# United States Patent [19]

**Gumpertz**

[11] **3,793,551**

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[54] **DISPLAY TUBE**


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[52] **U.S. Cl.** ..... **313/70,** 313/109.5

[51] **Int. Cl.** ..... **H01j 29/70,** H01j 31/16

[58] **Field of Search**.....313/109.5, 86 KM; 315/29, 315/21 CH



[56] **References Cited**

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|---|---|---|---|
| 2,591,981 | 4/1952 | Overbeek et al. | 315/29 X |
| 3,432,710 | 3/1969 | Gumpertz | 315/109.5 X |
| 3,537,097 | 10/1970 | Gumpertz | 313/70 X |



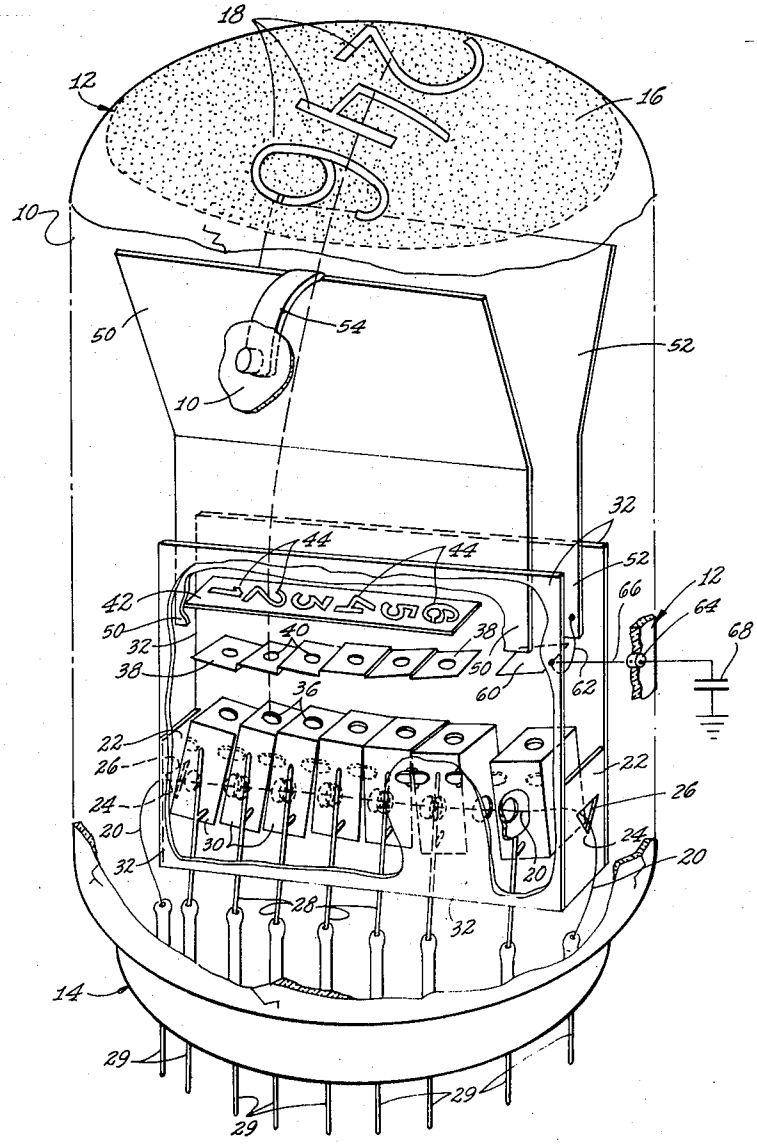
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[57] **ABSTRACT**

In the present invention, a display tube for displaying a plurality of characters including a plurality of individual electron beam sources that are provided within the tube envelope. Each of the sources is mechanically directed toward a common point on a fluorescent display screen. A mask having a number of shaped apertures, wherein each aperture is associated with a different source, is interposed between the sources and the display screen. A pair of deflection means for deflecting the electron beam away from a common point on the display screen is located between the mask and the screen. A control means is provided interior to the tube for sequentially changing the voltage on a particular one of the deflection means so that the display of the plurality of characters will be displayed substantially an equal distance apart from each other on the fluorescent display screen.


**19 Claims, 3 Drawing Figures**



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SHEET 1 OF 2

Fig. 1

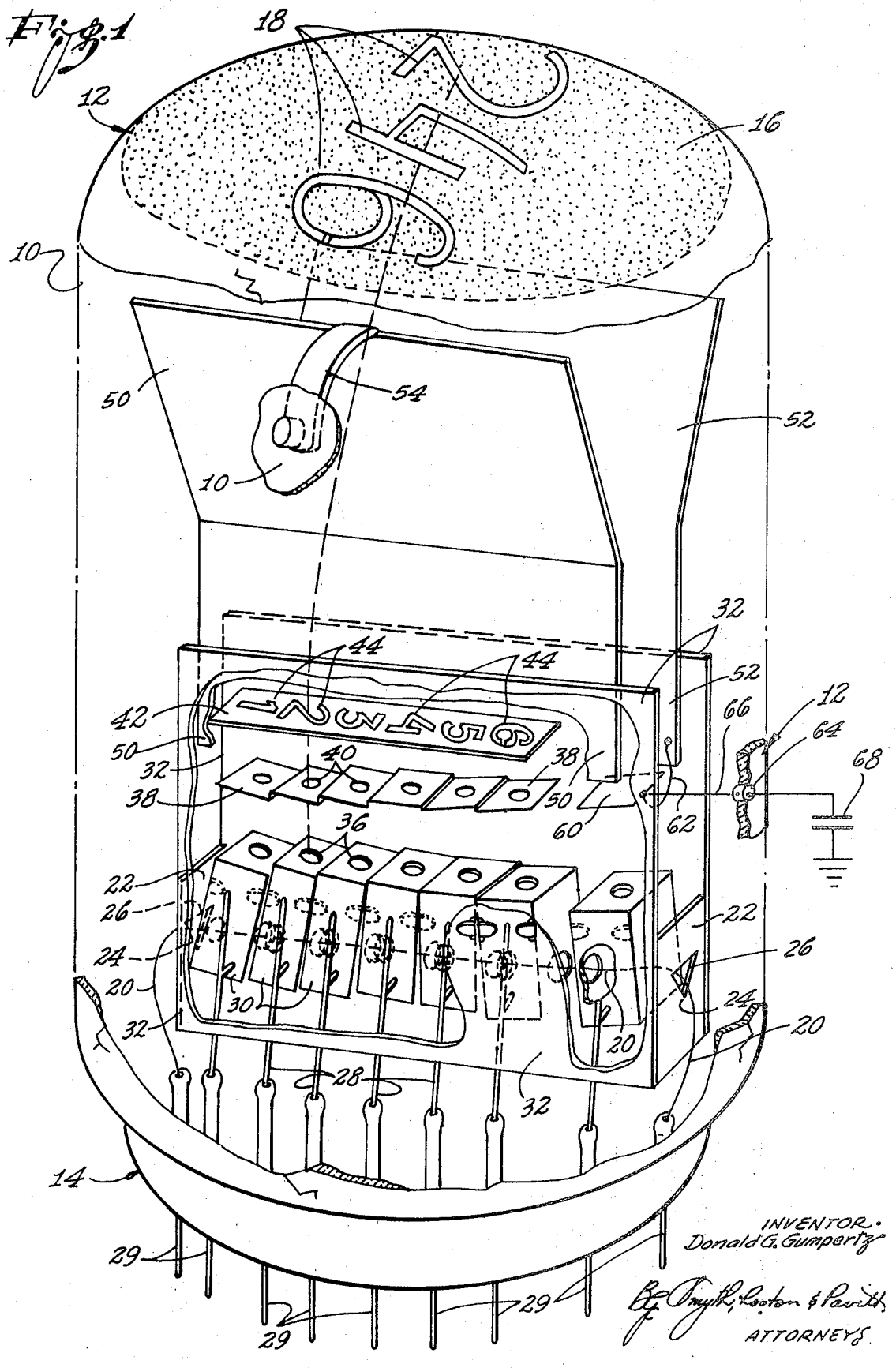


Fig. 2

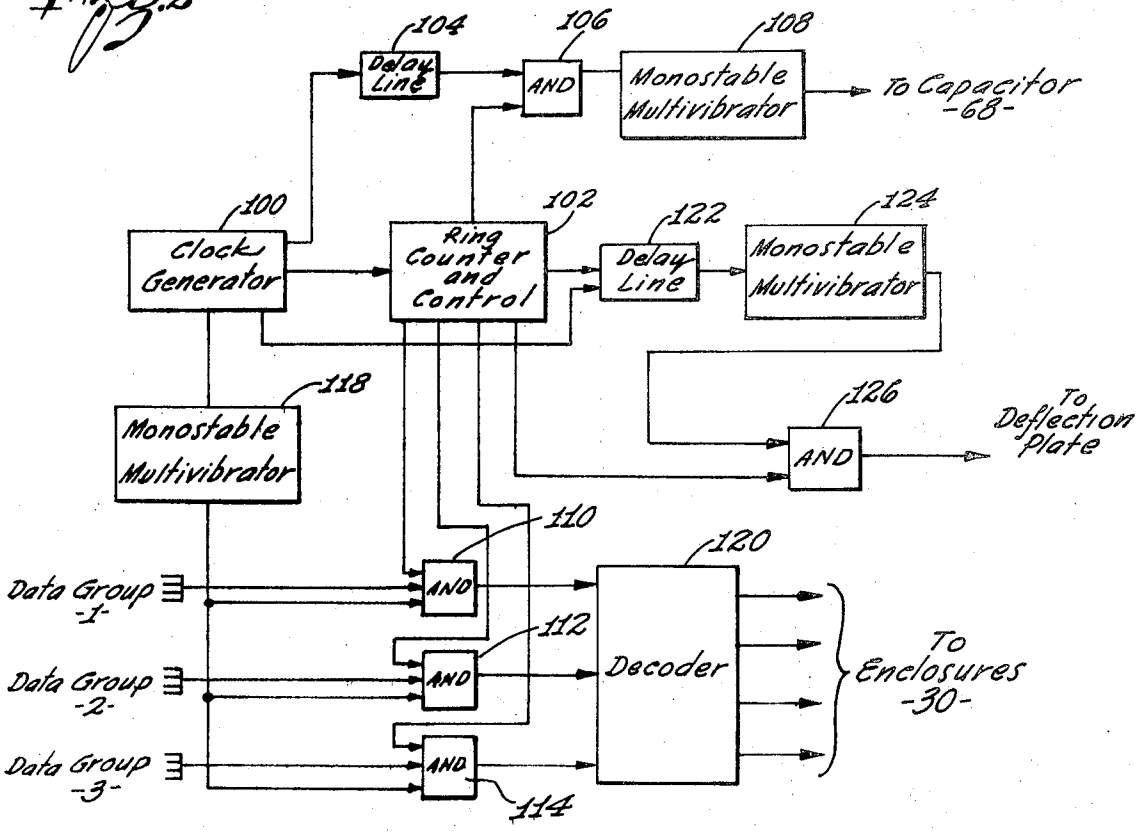
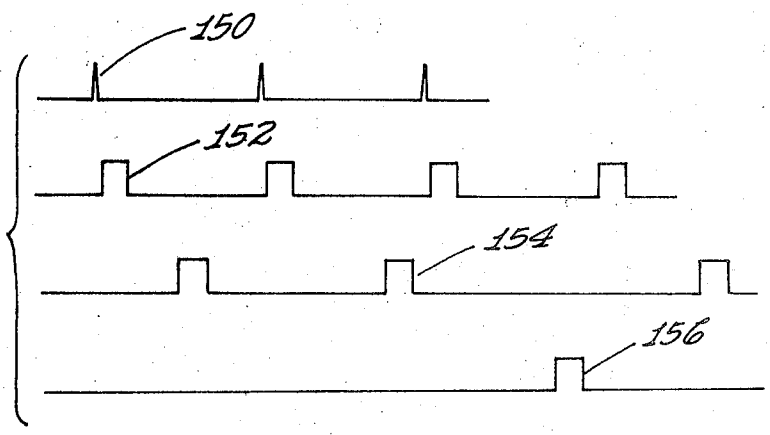



Fig. 3




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ATTORNEYS

# DISPLAY TUBE

## BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates in general to a display tube and more particularly to a display tube capable of providing simultaneous display of a plurality of characters on a tube display screen.

2. Description of the Prior Arts

In certain applications, it is desirable to have a display tube for conveniently converting information in the form of electrical signals to a visible, readable form. For example, such units may be employed to display the output of digital computer devices, electronic counters, and registers. The display units may be used in large multiples to make up electrically controlled annunciator panels, flight and arrival departure tables, scoreboards, etc.

In the prior arts, a cathode ray display tube has been used that has a plurality of individual electron sources or guns located in position within the tube envelope such that each of the sources is mechanically aimed along converging axes which meet at a common point on the fluorescent display screen at the end of the tube opposite the location of the sources. Interdisposed between the sources and the display screen is a character forming mask having a plurality of apertures therein, each of the apertures having the outline of a different one of the plurality of characters to be presented on the display screen. The number of characters in the selection corresponds to the number of electron guns provided within the tube. The mask is positioned between the guns and the display screen and the apertures are located in the mask so that each aperture is located on a different one of the source screen axes whereby energization of a particular source produces a display of a particular associated character on the display screen. The location of the mask and the size of the character forming aperture are chosen such that a stream of electrons from this selected source illuminates an aperture, forming the stream into a specific outline. The stream expands in transit toward the screen such that the image projected thereon is centered and substantially fills the screen.

Such a display tube is described in U.S. Pat. No. 3,432,710 titled, "Display Tube Having Character Masks with Electron Gun Individual to Each Character", in the name of Donald G. Gumpertz, filed June 8, 1967, and issued Mar. 11, 1969. The above-described display tube only provides for a single readout for a particular character at any one instant of time; however, where a multi-character readout is desired, a number of cathode ray display tubes of the type illustrated above is required corresponding to the maximum number of possible characters to be simultaneously displayed. By connecting suitable driving circuitry to the various tubes, a pre-selected one of the plurality of sources in each of the tubes is energized at any one time to produce the desired multi-character readout. The cost and space required to use a separate tube for the display of each digit makes it desirable to have a single display tube capable of providing a multi-character readout.

A cathode ray display tube has been used in the prior art that will produce a multi-character readout in one tube and comprises a vacuum tube display device for



selectively presenting at least one of a selection of patterns on a screen. The display device includes an evacuated envelope having a display screen on one end, with the screen having a fluorescent coating on the interior thereof. A plurality of electron sources are located within the envelope wherein each source includes electrode means for directing a diverging stream of electrons toward the screen along the line extending from the source and passing to a common point on the screen. A means for selectively operating each of the electron sources to release a stream of electrons from a first one of said sources is connected to each one of the electrode means. A mask is provided which is located between the electron source and the screen and which is provided with openings therein in the form of selection of patterns to be displayed. Each of the openings in the mask is aligned on a different one of the lines between the electron sources and the common point such that each source illuminates only the opening in the mask associated with the source. The display tube further includes a means for accelerating the released stream of electrons toward the mask and screen and is located between the electron sources and the mask. An electron stream deflection means is provided with the tube that is located intermediate with the geoemtric planes defined by the mask and the display screen for deflecting the stream of electrons away from the screen axis such that when the deflection means is energized the character projected by the device on the screen is centered on a point removed from the common point on the screen.

With the above-described prior art, a means is required external to the tube to drive the deflection means so that the characters displayed on the screen will be deflected a particular distance. The tube and the means external to the tube are disclosed and claimed in Patent application Ser. No. 695,012 filed by applicant on Jan. 2, 1968, for a Cathode Ray Display Tube. Consequently, it is desirable to have a control means interior to the tube so that the deflection means can be easily controlled from within the tube.

## SUMMARY OF THE INVENTION

The present invention provides a display tube for displaying a plurality of characters and includes a glass envelope having a fluorescent display screen on one end thereof. A plurality of enclosures are disposed along a filament within the glass envelope adjacent to the display screen. Each of the plurality of enclosures has an enclosure aperture therein for providing a stream of electrons toward the display screen. An electrode for accelerating the individual stream of electrons toward the display is located between the plurality of enclosures and the mask. The electrode has a plurality of electrode apertures that are in alignment with the enclosure apertures so that the streams of electrons can pass therethrough. A mask having a plurality of shaped apertures in the shape of characters to be displayed is located between the plurality of enclosures and the fluorescent display screen. Each of the plurality of shaped apertures is in alignment with a particular stream of electrons for providing an individual shaped stream of electrons to the fluorescent display screen.

A first deflection plate and a second deflection plate are disposed within the envelope that provide an electric field to the individual shaped streams of electrons for deflecting the shaped streams to a particular posi-

tion on the display screen in response to the electric field. A control plate interior to the envelope and in alignment with a particular one of the plurality of enclosures is sequentially impinged by a stream of electrons for changing the voltage applied to the first and second deflection plate. The changes in voltage applied to the deflection plates causes a corresponding change in the electric field to change the position that a character will be displayed. Means are provided for impinging a stream of electrons on the control plate to progressively change the voltage between the deflection plates every time that an electron stream is directed to the display screen.

Other objects, features and advantages of the present invention will become more readily apparent with reference to the following detailed description, taken in conjunction with the accompanying drawings, in which:

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective elevation view in partial section of a character display in accordance with the prsent invention.

FIG. **2** is a block diagram of typical electrical circuitry associated with the display tube of the FIG. **1** to accomplish the purposes of the invention.

FIG. **3** is a timing diagram of electrical signals produced at strategic terminals in the circuitry shown in FIG. **2.**

Referring now to the drawings wherein like reference characters designate like or corresponding parts, there is shown in FIG. **1** a perspective elevation view in partial section of a display tube of the present invention including an evacuated tubular glass envelope **10** having a first end **12** and a second end **14.** A display screen **16** including a thin phosphor layer is provided on the first end **12** of the glass envelope **10.** The display screen **16** provides a screen for viewing a plurality of characters **18** exterior to the tube. When the display screen **16** is impinged with a stream of electrons in the shape of at least one of the plurality of characters **18,** the display screen **16** emits light in the form of a luminance in the shape of the impinging stream of electrons.

A directly heated filament **20** having a particular length is suspended between a pair of supports **22** substantially parallel to the display screen **16** for providing a source of electrons. The filament **20** is supported within an apex **24** of a triangular aperture **26** in each of a pair of supports **22.** The filament **20** is connected between at least two of a plurality of leads **28** and to one of a plurality of pins **29** provided in the second end **14** of the glass envelope **10.** The filament **20** is made of a suitable resistance wire or wire ribbon of the type that will produce the emission of electrons upon the application of a suitable electric current.

Disposed along the length of the filament **20** is a plurality of enclosures **30** that operate as a first cathode for providing streams of electrons in response to an applied voltage. Each of the plurality of enclosures **30** is aligned between the pair of supports **32** to provide the stream of electrons toward a fixed point substantially in the center of the display screen **16.** Each of the plurality of enclosures **30** is further aligned along the length of the filament **30** so that the center of the enclosure aperture **36** is substantially the same distance from the filament **20.** Alignment of each of the enclosure apertures **36** equidistant from the filament **20** has the advantage that substantially the same voltage potential is developed between each of the plurality of enclosures **30** and the filament **20** when a voltage of the same amplitude is applied thereto.

Consequently, by applying the same voltage potential between each of the shaped apertures **36** and the filament **20,** each of the streams of electrons will have substantially the same electron density and velocity.

An electrode **38** or second anode having a plurality of electrode apertures **40** therein is in alignment with the plurality of enclosures **30** so that each of the electrode apertures **40** is in alignment with one of the enclosure apertures **36.** The streams of electrons provided by the plurality of enclosure **30** pass through the electrode apertures **40** in the electrode **38** and toward the display screen **16.** The electrode **38** has a shape in conformity with the shape of the plurality of enclosures **30** adjacent thereto. The area of the electrode **38** surrounding each of the plurality of electrode apertures **40** is substantially parallel to the area surrounding the corresponding enclosure aperture **36.** When a positive voltage with respect to the voltage applied to the plurality of enclosures **30** is applied to the electrode **38,** the electrode **38** will accelerate the flow of the individual streams of electrons being provided. Consequently, the individual streams of electron flow from the filament **20** through the enclosure apertures **36** in the plurality of enclosures **30,** through the electrode apertures **40** in the electrode **38** toward the display screen **16** and the first end **12** of the display tube. The electrode **38** is supported between the pair of supports **32** and can be electrically connected to one of the plurality of tube pins **29** via one of the plurality of leads **28.**

A beam shaping mask **42** is interposed in the path of the streams of electrons provided by the plurality of enclosures **30** and supported between the pair of supports **32.** The beam shaping mask **42** has a plurality of shaped apertures **44** therein that are in the shape of the plurality of characters to be displayed on the display screen. The beam shaping mask **42** illustrated in FIG. **1** has six shaped apertures **44** in the shape of the numbers "**1**" to "**6**". However, it should be apparent that any shape can be used for the shaped apertures **44,** such as letters, symbols, etc. and that any number of apertures may be provided, provided that a number of guns corresponding to the number of apertures is also provided.

Each of the plurality of shaped apertures **44** is in alignment with one of the electrode apertures **40** and the corresponding enclosure aperture **38** in one of the plurality of enclosures **30.** The individual streams of electrons provided by the plurality of enclosures **30** passes through the electrode apertures **40** and to the shaped apertures **44** in the beam shaping mask **42.** Some of the individual streams of electrons pass through the shaped apertures **44** and form a shaped stream of electrons having a shape in the shape of the particular character. The shaped stream of electrons passes onto the display screen **16** and impinges the display screen **16,** causing the illumination of a character in the shape of the streams of electrons on the display screen **16.**

A first deflection plate **50** and a second deflection plate **52** are connected to the pair of supports **32** and in parallel relationship with each other. The first deflection plate **50** is further connected to the envelope **10** by means of a tab **54** so that a voltage may be externally applied to the first deflection plate **50.** Although

the first deflection plate **50** is illustrated as connected to the glass envelope **10** by the tab **54**, it could be connected externally to the glass envelope **10** by one of the plurality of pins **29** or other suitable means. The first deflection plate **50** and the second deflection plate **52** provide an electric field there between when a deflection voltage is applied thereto. The electric field operates to deflect the streams of electrons from their straight line path to the display screen **16**. For example, if the second deflection plate **52** is more positive than the first deflection plate **50**, the streams of electrons will be drawn or deflected toward the second deflection plate **52**. If the second plate **52** is made less positive than the first deflection plate **50**, the streams of electrons are deflected toward the first deflection plate **50**. Accordingly, the streams of electrons are deflected toward the deflection plate **50** or **52** that has the more positive voltage applied thereto.

The deflection voltage can be produced by applying a constant voltage to one of the deflection plates **50** or **52** and by applying a variable step voltage to the other one of the deflection plates **40** and **42**. For example, a constant voltage, such as a voltage of 1,000 volts, can be applied to the first deflection plate **50** and variable voltage to the second deflection plate **52**, such as a voltage variable between 1,100 volts and 900 volts.

Consequently, by stepwise decreasing the voltage applied to the second deflection plate **52** from a more positive voltage than the voltage applied to the first deflection plate **50** to a more negative voltage than the voltage applied to the first deflection plate **50**, individual streams of electrons or characters can be sequentially deflected and represented as a series of characters on the display screen **16**. The quantity of characters that can be presented is dependent only upon the size of the display screen **16** and by the number of step changes in voltage to the second deflection plate **52**, and the number of enclosures within the display tube.

A control plate **60** is supported between the pair of supports **32** and is electrically coupled to the second deflection plate **52** by a lead **62**. The control plate **60** is further connected to a terminal **64** by means of the lead **66**. The control plate **60** is disposed above a particular one of the plurality of enclosures **30** so that the stream of electrons provided by the particular one of the enclosure **30** will impinge the control plate **60**. A capacitor **68** is connected between the terminal by a ground potential. Therefore, voltage can be stored in the capacitor **68** and applied to the deflection plate **52** by applying a step pulse to the terminal **64**. The voltage is stored on the capacitor **68** by impinging the control plate **60** with the stream of electrons provided by the corresponding one of the plurality of enclosures **30**. The amount of discharge of the voltage on the capacitor will correspond to the length of time that the stream of electrons impinges the control plate **60**. Although the capacitor **68** is shown external to the glass envelope **10**, the capacitor **68** could be readily constructed within the envelope **10**, between the terminal **64** and one of the plurality of tube pins **29**. Consequently a positive voltage can be applied to the second deflection plate **52** which can be stepwise sequentially decreased in amplitude by applying a sequence of streams of electrons to the control plate **60**.

Referring now to the operation of the display tube in more detail, to sequentially display a plurality of characters on the display screen **16**, such as the numbers "**246**" illustrated in FIG. **2**, the filament **20** is maintained at ground potential or at some constant dc voltage for providing a continuous source of electrons. Prior to displaying the first number "**2**", a negative or low voltage with respect to the filament **20** is applied to all of the plurality of enclosures **30**. A low amplitude or negative voltage on the plurality of enclosures **30** prevents the emission of any streams of electrons therefrom. Also, a reset signal or a positive voltage is applied to the second deflection plate **52** at the terminal **64** that is more positive than a continuously positive voltage applied to the first deflection plate **50**. For example, if the first deflection plate **50** is maintained at a positive 1,000 volts, the reset signal can have an amplitude of 1,100 volts. The reset signal charges the capacitor **68** to the positive voltage amplitude of the reset signal. Since there is no return path to ground from the second deflection plate **52**, the voltage developed on the second deflection plate **52** and the capacitor **68** will remain substantially constant until an external source of energy is applied thereto. Therefore, the second deflection plate **52** is more positive than the first deflection plate, such as 100 volts more positive.

To display the first character **18**, for example, the number "**2**", a positive voltage with respect to the filament **20** is applied to the particular one of the plurality of enclosures **30** in alignment with the shaped aperture **30** having a shape of the number "**2**". Where the particular one of the plurality of enclosures **30** is biased positive with respect to the filament **20**, a stream of electrons flows through the corresponding enclosure aperture **32** toward a point at the center of the display screen **16**. The stream of electrons passes through the corresponding electrode aperture **42** through a shaped aperture **30**, in the shape of the integer "**2**", in the beam shaping mask **42** and forms a shaped stream of electrons in the shape of the number "**2**". As the shaped stream of electrons passes through the electric field developed between the first deflection plate **50** and the second deflection plate **52**, it is deflected in the direction of the second deflection plate **52**. The shaped stream of electrons impinges the display screen **16**, causing an illumination of the number "**2**" on the display screen **16** at the end of the tube closest to the deflection plate **52**.

To display the second character **18**, the number "**4**", on the display screen **16**, the enclosures **30** corresponding to the number "**2**" is biased negative again so that all of the plurality of enclosures are again biased negative with respect to the filament **20**. Consequently, no streams of electrons are applied to the display screen **16**. Subsequently, the particular one of the plurality of enclosures **30** in alignment with the discharge plate **60** is biased positive to provide a stream of electrons to the discharge plate **50**. The provided stream of electrons impinge the discharge plate **60** causing the capacitor **58** and hence the discharge plate **60** to be partially discharged by a particular value. Discharging the discharge plate **60** causes a corresponding discharge of the second deflection plate **52** so that a desired new potential is produced. The amount of discharge is dependent upon the length of time that the stream of electrons impinges on the discharge plate **60**. When the desired potential has been developed on the second deflection plate **52**, the corresponding enclosure **30** is biased negative, causing a cessation of the stream of electrons to the discharge plate **60**.

Subsequently, the particular one of the plurality of enclosures **30** corresponding to the second character **18**, or the number "**4**", is biased positive to provide a stream of electrons to the display screen **16** as previously described. It should be noted that any character, including the character such as the integer "**2**" previously displayed can be displayed as the second character. The second character displayed on the display screen **16** will be displaced from the position that the first character was displayed due to the change in the voltage potential between the first deflection plate **50** and the second deflection plate **52**. The amount of displacement is proportional to the voltage change. Consequently, if it is desired to display three characters on the display screen **16**, and the potential on the second deflection plate **52** is varied between 1,100 volts and 900 volts, the deflection voltage would be stepwise decreased in 100 volt steps.

The above described operations for displaying the first two characters, "**2**" and "**4**", is repeated to display any subsequent characters, such as the number "**6**". As many characters can be displayed as it is desired to display on the display screen **16**, within the limits of the size of particular display screen **16** and the number of enclosures **30**. It will be appreciated that the display screen **16** may include a phosphor with characteristics of retaining images on the screen for an extended period of time so that a plurality of characters, such as the number "**246**", will be simultaneously displayed on the surface of the screen.

Referring now to FIG. **2** and FIG. **3**, FIG. **2** is a block diagram of a typical electrical circuitry associated with the display tube of FIG. **1**. FIG. **3** is a timing diagram of electrical voltages associated with the block diagram of FIG. **2**. In FIG. **2**, there is shown a clock **100** that provides a series of accurately timed pulses for synchronization of the electrical operations of the electrical circuitry. The timing pulses have a frequency related to a frequency at which the plurality of characters **18** (illustrated in FIG. **1**) are displayed on the display screen **16** (FIG. **1**).

A ring counter and control **102** is coupled to receive the clock signals from the clock generator **100** and to provide a count on a cyclic basis to a particular value, such as the value "**3**" for the example shown in FIG. **1**. Every time that the counter reaches the particular count such as the count of "**3**", it introduces a pulse to an "and" network **106**. This causes a clock pulse from the generator **100** to pass through the "and" network **106** after the clock pulse has been delayed for a particular period of time by a delay line **104**. The delayed clock pulse passing through the "and" network **106** triggers a monostable multi-vibrator **108**. The resultant pulse from the multivibrator **108** constitutes a reset pulse which is applied to the second deflection plate **52** to provide a voltage having an amplitude equal to the maximum voltage to be applied to the second deflection plate **52**. For example, as described above, the maximum voltage applied to the second deflection plate **52** can be 1,100 volts as compared to a voltage of **900** volts which is constantly being applied to the first deflection plate **50**. In this way, the stream of electrons passing through one of the apertures **44** in the plate **42** is deflected to a position on the screen **16** closest to the deflection plate **52**.

The ring counter **102** is connected to indicate the count at each instant on a recycling basis. For example, in the example in FIG. **1**, the ring counter provides progressive indications of the successive digits "**1**", "**2**" and "**3**" on a cyclic basis in accordance with the introduction of progressive clock signals to the ring counter. Separate lines are provided for indicating the count "**1**" to an "and" network **110**, the count "**2**" to an "and" network **112** and the count "**3**" to an "and" network **114**.

Each of the "and" networks **110**, **112** and **114** also receives the signals from a monostable multivibrator **118**, which is triggered by the clock signals from the clock generator **100**. The monostable multivibrator **118** may be constructed to provide a slight delay before it becomes triggered but this delay is less than that provided by the line **104**. The "and" network **110** is further connected to an input designated as "Data Group **1**", which represents the indiction, such as the integer "**2**" in the example of FIG. **1**, to be provided on the screen **16** at the first position. The "and" network **112** is connected to an input designated as "Data Group **2**", which represents the indications, such as the integer "**4**" in the example of FIG. **1**, to be provided on the screen **16** at the second position. Similarly, the "and" network **114** is connected to an input designated as "Data Group **3**", which represents the indication, such as the integer "**6**" in the example of FIG. **1**, to be provided on the screen **16** at the third position. Actually, the indications such as those from the "Data Group **1**", "Data Group **2**" and "Data Group **3**" may be a plurality of indications on a plurality of lines, which indications digitally represent in binary form integers such as the decimal integers "**2**", "**4**" and "**6**" in the example shown in FIG. **1**.

When the counter **102** has an indication of "**1**" in each count cycle, it activates the "and" network **110** for a period of time after the clock pulse from the generator **100**. This period of time is dependent upon the time length of the pulse provided by the monostable multivibrator **118**. This causes the binary indications from "Data Group **1**" to pass through the "and" network **110** to a decoder **120**. The decoder **120** decodes the digital indications from "Data Group **1**" and activates a particular one of the enclosures **30** dependent upon the digital indications from "Data Group **1**". This corresponds to the integer "**2**" in the example shown in FIG. **1**.

Similarly, the "and" network **112** becomes activated upon a digital count of "**2**" in the counter **102** and upon the introduction of a pulse from the multivibrator **118**. When the "and" network **112** becomes activated, it passes to the decoder **120** the digital indications from "Data Group **2**" such that a particular one of the enclosures **30** becomes energized. In the example of FIG. **1**, the enclosure **30** providing an indication of the integer "**4**" becomes energized.

When the count from the counter **102** provides an indication of a count of "**3**", and "and" network **114** becomes energized upon the introduction of a pulse from the multivibrator **118**. When the "and" network **114** becomes activated, it passes to the decoder **120** the signals from "Data Group **3**". In this way, one of the enclosures **30** becomes energized in accordance with the digital indications provided by "Data Group **3**". In the example shown in FIG. **1**, the enclosure **30** providing an indication of the integer "**6**" becomes energized when the "and" network **114** becomes activated.

Everytime that a clock pulse is produced by the clock generator **100**, it is delayed by a delay line **122** for a particular period of time. This particular period of time is greater than the length of the pulses produced by the multivibrator **118** but less than the period of time between two successive clock pulses and approximately the period of time provided by the delay line **104.** The delayed clock signals from the line **122** are then introduced to a monostable multivibrator **124** which produces a pulse for a greater period of time than the length of the clock pulse. The pulses from the multivibrator **124** pass through an "and" network **126** which is also connected to the counter **102** to pass all of the pulses from the multivibrator **124** except for those which occur when a reset pulse is being introduced to the capacitor **68.** The pulses passing through the "and" network **126** are then introduced to the capacitor **68** in FIG. **1** to bleed a particular amount of charge from the capacitor. By bleeding a particular amount of charge from the capacitor **68,** the electron stream passing to the screen **16** in FIG. **1** becomes deflected to an individual one of the positions on the screen, such as the positions represented by the numerals "**2**", "**4**" and "**6**" in FIG. **1.**

The clock pulses from the generator **100** are illustrated at **150** in FIG. **3.** The signals produced by the monostable multivibrator **118** in FIG. **2** are illustrated at **152** in FIG. **3.** The signals produced by the monostable multivibrator **124** are illustrated at **154** in FIG. **3** and the signals produced by the monostable multivibrator **108** are illustrated at **156** in FIG. **3.** As will be seen, the pulses **152** are produced slightly after the clock pulses **150** to activate the particular enclosures **130** for the indication of the successive digits on the screen **16.** The pulses **154** are produced after the pulses **152** to shift the position of indication on the screen **16** for each successive integer. However, one of the pulses **154** is not produced when an integer is being indicated in the last position on the screen **16.** Instead, one of the pulses **156** is produced to reset the indication on the screen **16** to the first position so that a new cycle can be initiated.

Although this application has been disclosed and illustrated with reference to particular applications, the principles involved are susceptible of numerous other applications which will be apparent to persons skilled in the art. For example, the invention may be used with other types of display tubes than those described above in which a separate electron gun is provided for each individual character to be displayed. The invention is, therefore, to be limited only as indicated by the scope of the appended claims.

I claim:

**1.** A display tube for selectively providing a visual display of a plurality of characters, comprising:

an envelope having a fluorescent coating display screen on one end,

first means disposed within the envelope for providing selected streams of electrons, the first means being coupled to receive control signals for selectively providing individual ones of the selected streams of electrons in response to the received control signal;

a mask disposed within the envelope between the display screen on the envelope and the first means, the mask having a plurality of displaced apertures in the form of selected characters to be displayed on the display screen, individual ones of the plurality of displaced apertures being in alignment with individual ones of the selected streams of electrons;

deflection means disposed between the display screen and mask, the deflection means being responsive to a multi-amplitude voltage signal for selectively deflecting the selected streams of electrons in a particular direction in accordance with the particular level of the multi-amplitude voltage signal; and

control means disposed within the envelope in alignment with at least one of the selected streams of electrons, the control means being coupled electrically to the deflection means for selectively changing the amplitude voltage levels in response to the stream of electrons for causing selected characters to be displaced simultaneously at different positions on the display screen.

**2.** The display tube of claim **1** wherein the deflection means includes at least one electrode.

**3.** The display tube of claim **1** wherein the deflection means is a pair of electrodes disposed within the tube on opposite sides of the display tube for deflecting the stream of electrons in a direction substantially parallel to the plane passing through the electrodes.

**4.** A display tube for selectively providing an visual display of a plurality of characters, comprising:

an envelope having a fluorescent coating display screen on one end,

a plurality of electron sources located within the envelope opposite the display screen for providing a plurality of electron streams, each of the sources being coupled to receive control signals for selectively providing electron streams in response to the received control signal;

a mask disposed within the envelope between the display screen on the envelope and the plurality of electron sources, the mask having a plurality of displaced apertures in the form of selected characters to be displayed on the display screen, individual ones of the plurality of displaced apertures being in alignment with individual ones of the plurality of electron sources;

deflection means disposed between the display screen and the mask, the deflection means being responsive to a multiamplitude voltage signal for selectively deflecting the electron streams in a particular direction in accordance with the particular level of the multi-amplitude voltage signal; and

control means disposed within the envelope in alignment with at least one of the selected streams of electrons, the control means being coupled electrically to the deflection means for selectively changing the amplitude voltage levels in response to the stream of electrons for causing selected characters to be displaced simultaneously at different positions on the display screen.

**5.** The display tube of claim **4** and further including means for storing electrical energy, the means for storing electrical energy being coupled electrically to the control means to receive a set signal having a particular amplitude and to receive the electrons impinging on the control means to vary the particular amplitude of the signal stored by the means for storing electrical energy.

**6.** The display tube of claim **5** wherein the means for storing is a capacitor.

7. A display tube for selectively providing a visual display of a plurality of characters, comprising:
an envelope having a fluorescent coating display screen on one end,
first means disposed within the screen for providing selected streams of electrons toward the display screen, the first means being coupled to receive control signals for selectively providing individual ones of the selected streams of electrons in response to the received control signal;
a mask disposed within the screen between the display screen on the envelope and the first means, the mask having a plurality of displaced apertures in the form of selected characters to be displaced on the display screen, individual ones of the plurality of displaced apertures being in alignment with individual ones of the selected streams of electrons to shape the individual stream of electrons;
deflection means disposed between the display screen and the mask, the deflection means being responsive to a voltage signal for selectively deflecting the selected streams of electrons in a particular direction in accordance with the particular level of the voltage signal;
control means disposed within the screen in alignment with at least one of the selected streams of electrons to receive the selected stream of electrons;
means for storing electrical energy, the storing means being coupled to the control means and to the deflection means to introduce the voltage on the storing means to the deflection means and to receive the energy passing to the control means for varying the voltage across the storing means and the voltage introduced to the deflection means,
means coupled to the storing means to introduce periodically a set signal to the storing means for providing a voltage signal having a particular amplitude related to the amplitude of the set signal; and
means for obtaining an alternate direction of streams of electrons toward the mask and toward the control means to obtain a display of individual characters in displaced relationship to the display screen.

8. In combination for selectively providing a visual display of a plurality of characters,
an envelope having a fluorescent coating display screen on one end,
first means disposed within the envelope for directing streams of electrons in individual shapes toward the screen to provide a display of individual characters on the screen,
second means disposed within the envelope and responsive to progressive voltages for selectively deflecting the streams of electrons to progressive positions on the screen in accordance with the introduction of the progressive voltages to the second means, and
means disposed within the envelope and operatively coupled to the second means and responsive to the formation of successive streams of electrons in the individual shapes for obtaining the production of the progressive voltages for introduction to the second means in accordance with the formation of such successive streams of electrons.

9. The combination set forth in claim 8, wherein,
the second means include a pair of deflection plates disposed within the envelope between the display screen and the first means and wherein the progressive deflection of the individual streams of electrons to the different positions on the screen is dependent upon the voltage difference between the pair of deflection plates.

10. In combination for selectively providing a visual display of a plurality of characters,
an envelope,
first means disposed within the envelope for directing toward a particular position in the envelope individual streams of electrons having characteristics representative of individual characters,
second means disposed within the envelope in displaced relationship to the first means and responsive to particular voltages for deflecting the individual streams of electrons from the particular position in accordance with the characteristics of the particular voltages,
the envelope being constructed to provide visual indications of the characters represented by the individual streams of electrodes at the position at which the individual streams of electrons reach the envelope,
third means disposed within the envelope for producing second streams of electrons for a particular period of time after each direction of an individual stream of electrons by the first means, and
fourth means disposed within the envelope and responsive to each stream of electrons from the third means and progressively coupled to the second means for progressively changing the voltages applied to the second means in accordance with the production of each such stream of electrons.

11. The combination set forth in claim 10, including
first circuit means operatively coupled to the first means for obtaining a sequential production by the first means of the individual streams of electrons with characteristics representative of individual characters, and
second circuit means operatively coupled to the third means and responsive to each production of the individual streams of electrons by the first means for obtaining the production of the second stream of electrons by the third means.

12. The combination set forth in claim 11, including,
third circuit means for operating upon the first circuit means to obtain the production of each individual stream of electrons by the first means only after the production of the second stream of electrons by the third means, and
fourth circuit means for operating upon the second circuit means to obtain the production of the second stream of electrons by the third means only after the production of each individual stream of electrons by the first means.

13. In combination for selectively providing a visual display of a plurality of characters,
an envelope having a display screen constructed at one end to respond to streams of electrons to provide a visual display dependent upon the shape of the electron streams;
first means disposed within the envelope for directing individual streams of electrons in individual shapes toward the screen to obtain a visual display of individual characters on the display screen,
second means disposed within the envelope for deflecting the individual streams of electrons in ac-

cordance with progressive voltages applied to the second means,

third means disposed within the envelope and responsive to each formation of an individual stream of electrons for obtaining the production of a progressive voltage for introduction to the second means, and

circuit means operatively coupled to the first and third means for alternately obtaining successive productions of individual streams of electrons in representation of successive characters and for alternately obtaining the production of the progressive voltages in accordance with the successive productions of the individual streams of electrons.

**14.** The combination set forth in claim **13**, wherein the second means include

a pair of spaced plates disposed within the envelope and the third means include an electrode disposed within the the envelope for receiving streams of electrons and a capacitor reponsive to the streams of electrons received by the electrode and having a variable charge in accordance with such reception of electrons by the electrode for providing the progressive voltage for introduction to the second means.

**15.** In combination for selectively providing a visual display of a plurality of characters,

an envelope having a display face constructed to display individual characters in accordance with the shape of individual streams of electrons directed toward the display face,

first means within the envelope for individually directing toward a first position in the envelope individual streams of electrons shaped to simulate individual characters,

second means within the envelope, the second means being responsive to an applied voltage for deflecting the individual streams of electrons to individual positions on the screen in accordance with the characteristics of such applied voltage,

third means operatively coupled to the second means and having a variable charge for applying a voltage to the second means in accordance with the variable charge to control the deflection of the individual stream of electrons,

fourth means disposed within the envelope for providing additional streams of electrons,

fifth means operatively coupled to the third means and disposed within the envelope to receive the additional stream of electrons from the fourth means and to vary the charge in the third means in accordance with such streams, and

sixth means operatively coupled to the first and fourth means for alternately obtaining a flow of the individual streams of electrons and the additional streams of electrons.

**16.** The combination set forth in claim **15**, including,

seventh means operatively coupled to the third means and responsive to each display of the individual characters in particular positions on the display face of the envelope for charging the third means to a particular value for initiating a new display of the individual characters in the particular positions on the display face of the envelope.

**17.** The combination set forth in claim **16** wherein,

the first means includes a plurality of electron guns each energized to indicate an individual character and the first means further includes a mask having a plurality of apertures each associated with an individual one of the electron guns in the plurality and each having an individual shape to pass the stream of electrons from its associated gun in an individual configuration to the display face of the envelope.

**18.** The combination set forth in claim **16** wherein

the third means includes a capacitor and wherein

the fourth means is operative to change the charge of the capacitor by a particular amount every time that an individual stream of electrons is directed by the first means toward the display face of the envelope.

**19.** The combination set forth in claim **13** wherein

the first means includes a plurality of electron guns each energized to indicate an individual character and the first means further includes a mask having a plurality of apertures each associated with an individual one of the electron guns in the plurality of each having an individual shape to pass the stream of electrons from its associated gun in an individual configuration to the display face of the envelope.

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