

[54] **CATHODE RAY TUBE WITH REAR PROJECTION READOUT**

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[51] Int. Cl. .... **H01j 29/46**

[58] Field of Search .... **313/83, 84, 85, 86, 313/109.5**

[56] **References Cited**

**UNITED STATES PATENTS**

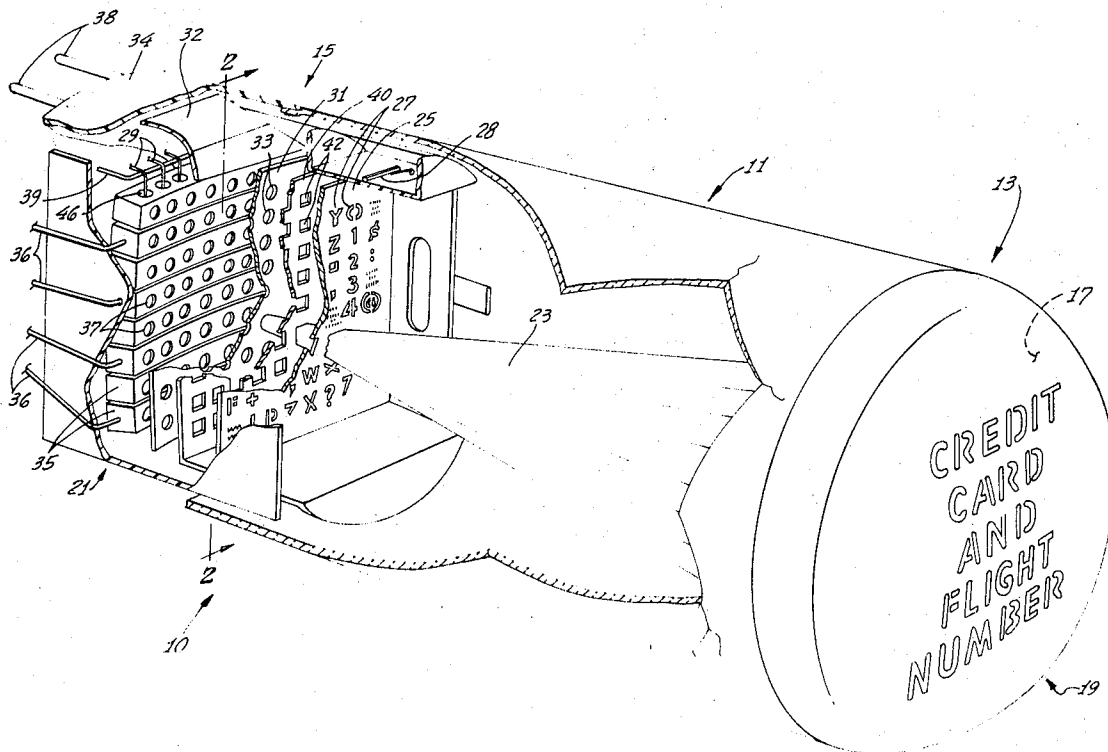
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Primary Examiner—John Kominski  
Attorney—Ellsworth R. Roston et al.

[57] **ABSTRACT**

A display tube for selectively providing a visual display of a plurality of characters, including a vacuum envelope with a display screen at one end thereof and a plurality of columns of first means providing a source of electrons at the other end thereof. An apertured mask disposed between the first means and the display screen energizable to accelerate the electrons into a different stream of electrons for each of the characters. A plurality of rows of grid control boxes disposed between the first means and the apertured mask each of the rows controlling a portion of the electrons provided by each of the columns of first means by inhibiting the effect of the apertured mask on the controlled portions. The rows of grid control boxes and columns of first means individually energizable so that a single stream of electrons is accelerated and a single one of the characters is displayed, wherein the number of characters displayable is equal to the product of the number of rows and the number of columns.

**15 Claims, 4 Drawing Figures**



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**SHEET 1 OF 3**

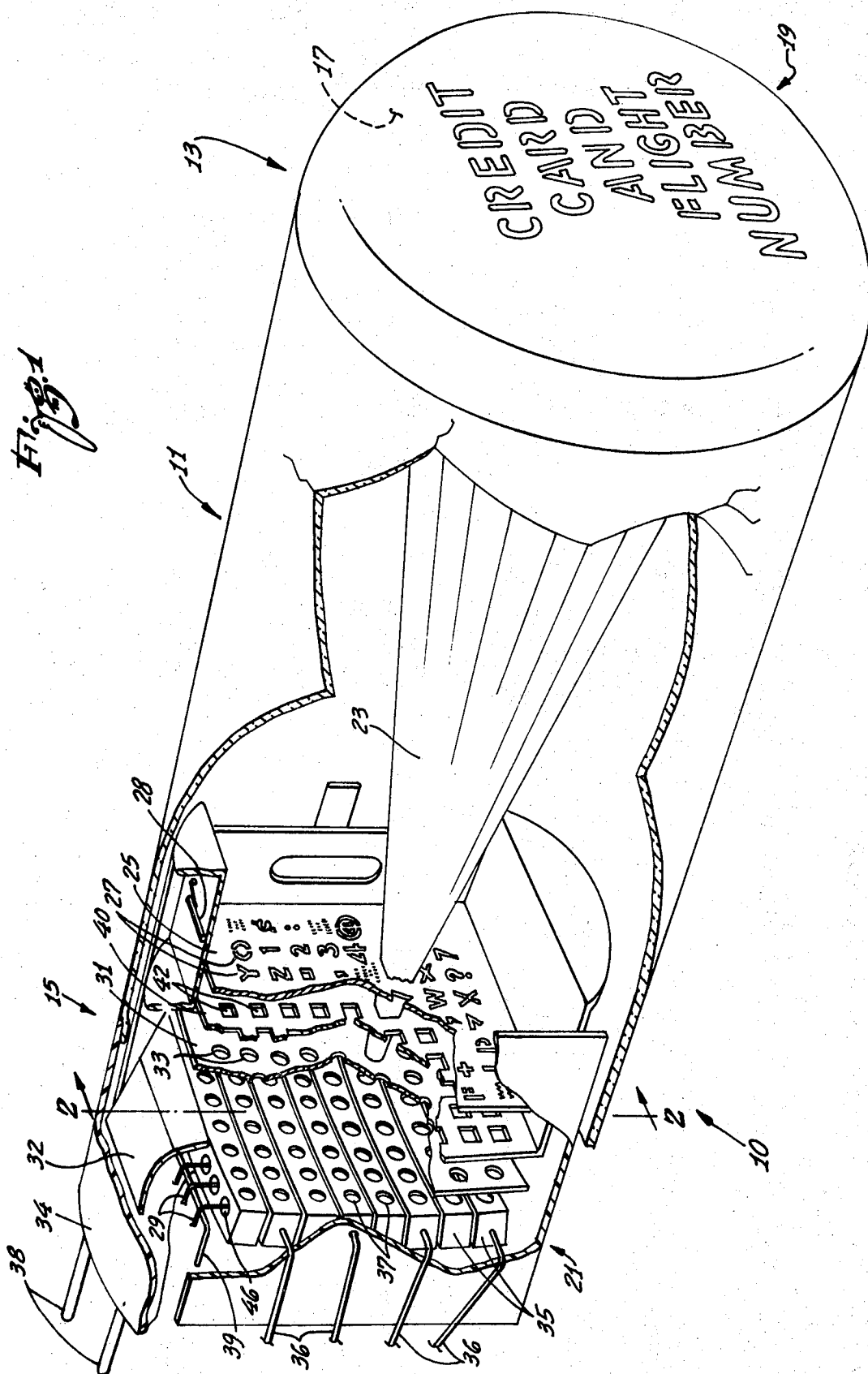


Fig. 2

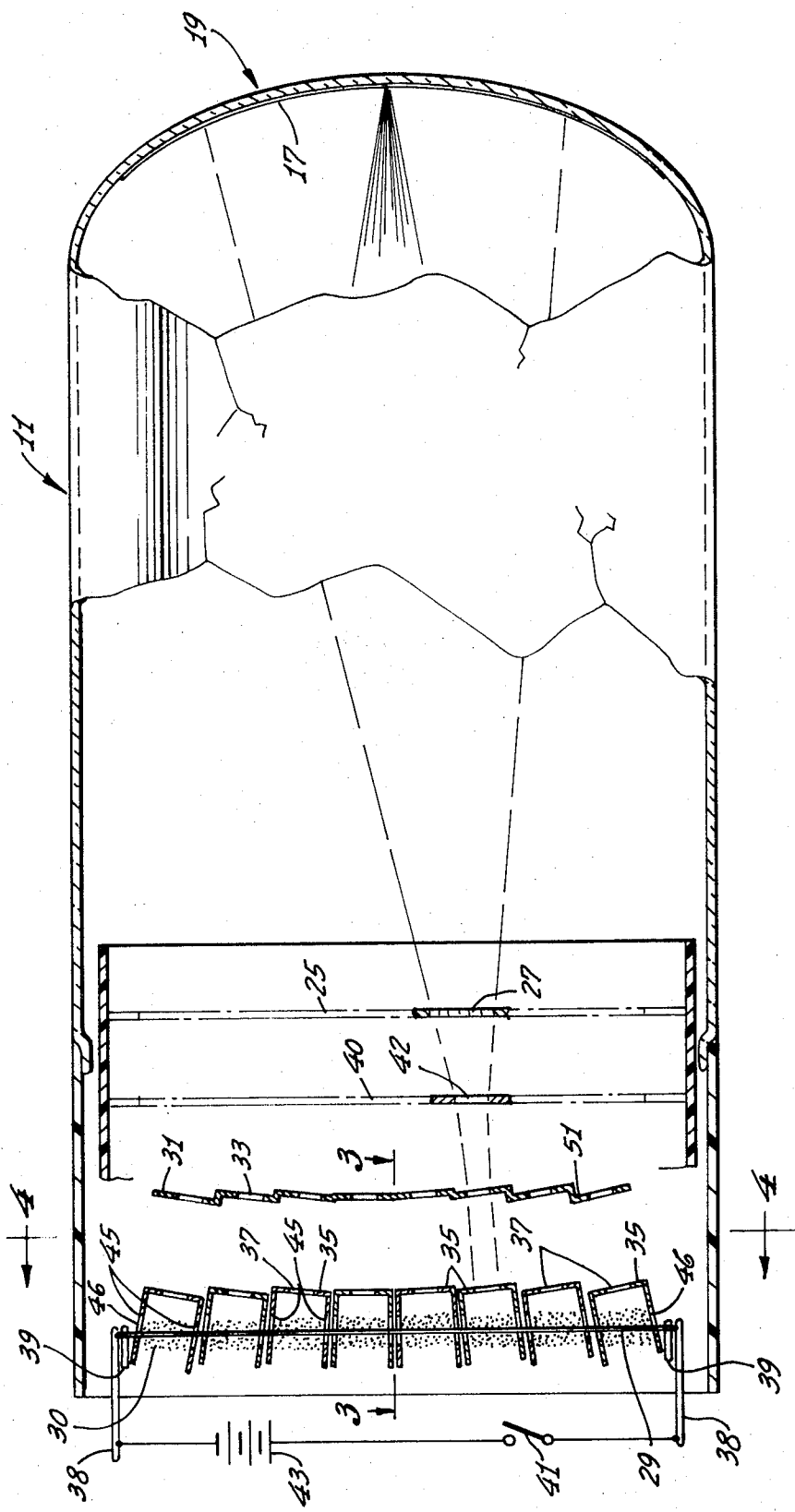


Fig. 3

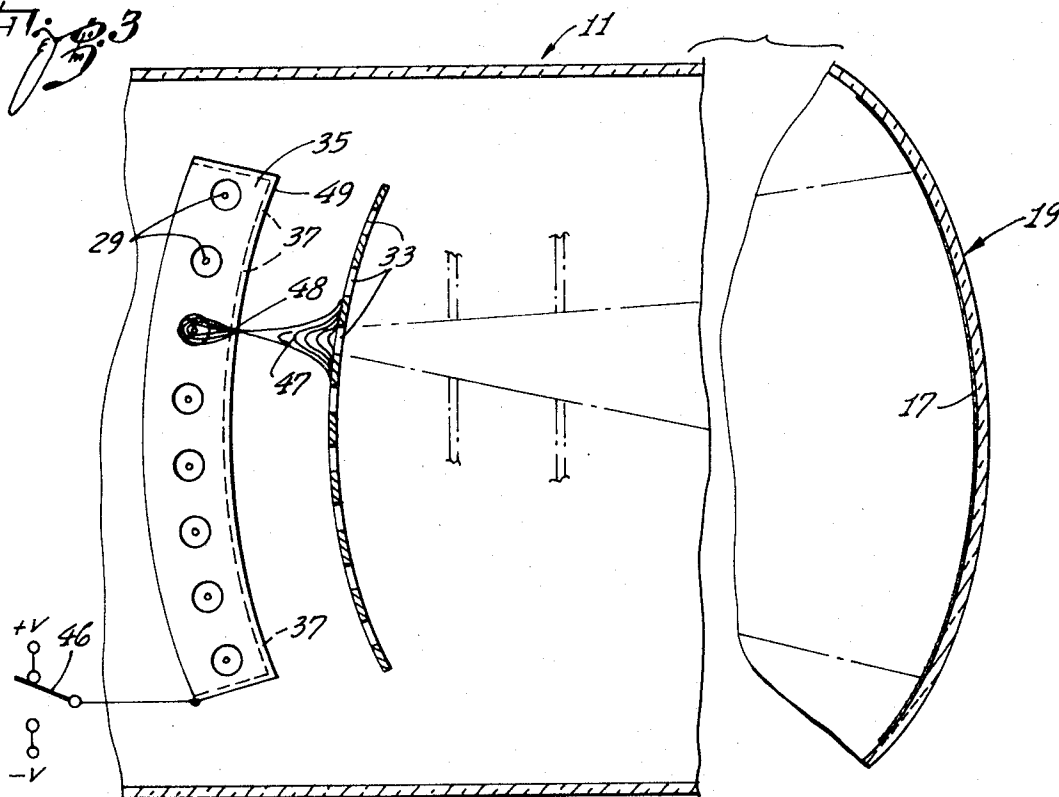
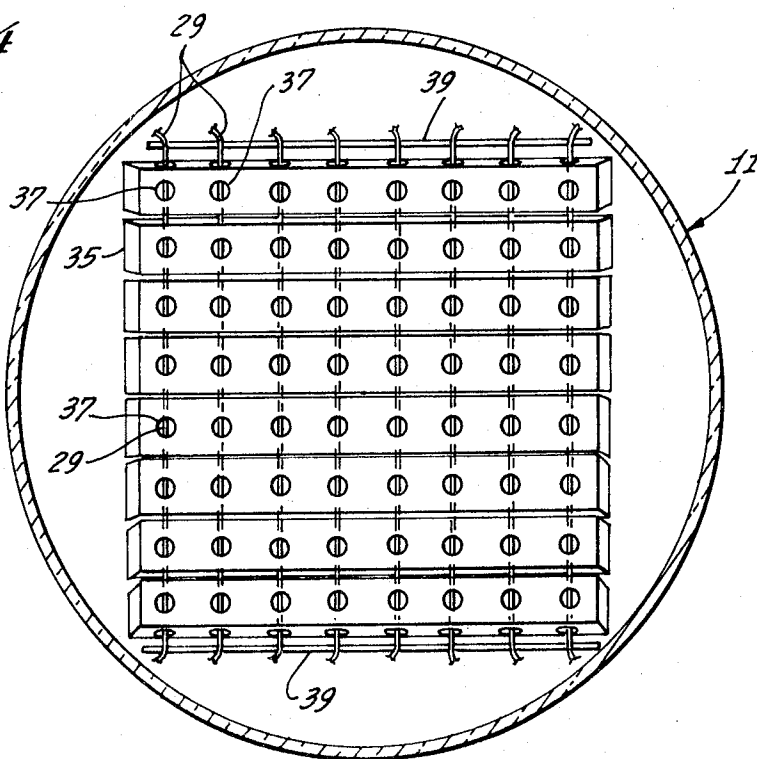


Fig. 4



# CATHODE RAY TUBE WITH REAR PROJECTION READOUT

## BACKGROUND OF THE INVENTION

### 1. Field of the Invention

This invention relates generally to display tubes and more specifically to means disposed in rows and columns and individually energizable to provide a visual display of one of a plurality of characters.

### 2. Background of the Invention

The prior art includes vacuum tubes having display screens at one end thereof excitable by electrons impinging thereon. At the opposite end of the tube a filament provides a source of electrons. A plurality of grid control boxes have been aligned in a single column with the filament extending through the column of boxes. This combination has enabled each of the grid control boxes to enclose a portion of the electrons provided by the associated filament.

An apertured mask has been disposed between the grid control boxes and the display screen, the mask having characteristics for being energized to displace and accelerate in a stream of electrons each of the portions of electrons associated with each of the grid control boxes. A character mask has been disposed between the apertured mask and the display screen to provide each of the streams of electrons with a cross section similar in shape to one of the characters to be displayed.

Each of the grid control boxes has been provided with an aperture through which the enclosed portion of the electrons passes to form one of the streams of electrons. The grid control boxes have been individually energizable to inhibit the effect of the energized aperture mask upon the portions of electrons enclosed by the energized grid control box and thereby to inhibit the formation of the associated stream of electrons.

A plurality of pins each connected to an individual one of the grid control boxes have extended from the header at the rear of the display tube to cooperate with a socket having portions thereof registerable with each of the pins. The fact that an individual pin has been used for each of the grid control boxes has been a major limitation in increasing the number of characters that could be displayed by an individual display tube. In part, this limitation has been a spatial limitation on the header and the tube socket.

In addition, an individual switch has been associated with each of the pins of the display tube so that each of the grid control boxes could be individually energized to inhibit all but a particular one of the grid control boxes so that the character associated with the particular grid control box would be displayed by the tube. This number of individual switches has been expensive to purchase and maintain and the amount of space required for the switches has been relatively large in comparison to the size of the display tubes. Furthermore, the individual switches have been cumbersome to operate.

It can be appreciated that since individual pins and switches have been associated with each of the grid control boxes, the limitations of space and expense have been major factors in limiting the number of characters displayable by the tubes of the prior art. In those situations where relatively few characters have been desired, the foregoing limitations have been minor and the tubes of the prior art have been satisfactory.

## SUMMARY OF THE INVENTION

The display tube disclosed herein includes a vacuum envelope having a display screen at one end thereof and a plurality of filaments arranged in columns at the opposite end thereof. Each of the filaments is energizable to provide a cloud of electrons which can be formed into a plurality of streams of electrons by an apertured mask disposed between the filaments and the display screen.

A plurality of grid control bars each include a plurality of apertures longitudinally spaced in a row on one side thereof. The grid control bars are stacked so that the apertures are disposed in rows and columns.

Each of the filaments passes through a portion of each of the grid control bars to associate with an individual column of the apertures. In this manner, each of the grid control bars encloses a portion of the cloud of electrons provided by each of the filaments. Thus, a particular one of the filaments cooperates with a particular one of the grid control bars to provide an individual portion of the cloud of electrons, which portion associated with one of the apertures in the particular grid control bar to form one of the streams of electrons.

The filaments are individually energizable so that the only cloud of electrons formed is that associated with the energized filament. Thus, only those apertures disposed in the column of apertures associated with the energized filament have characteristics for forming a stream of electrons.

Similarly, the grid control bars are individually energizable so that only those portions of the clouds of electrons which are enclosed in a deenergized grid control bar are capable of being formed into a stream of electrons. The apertured mask is energizable to form into a stream of electrons that portion of the cloud of electrons associated with the energized filament and the deenergized grid control bar. By individually energizing one of the filaments disposed in a column and deenergizing one of the grid control bars disposed in a row, only electrons at a particular position common to the individual row and the individual column are able to move towards the screen. These electrons are then formed into a stream and are shaped by an individual one of the characters on a character mask to produce a display of that individual character on the screen.

The advantages of this display tube are readily apparent. A single conductor attached to each of the grid control bars is sufficient to control the streams of electrons associated with a row of the apertures. Similarly, a single conductor attached to each of the filaments is sufficient to control the streams of electrons associated with a column of the apertures. Furthermore, a single switch and a single pin on the header of the tube is sufficient to actuate one of the conductors. Of ultimate importance is the fact that a number of characters equal to the product of the rows and columns of apertures can be individually controlled by a number of pins and switches substantially equal to the sums of the rows and columns of apertures. For example, 64 characters associated with 8 rows and 8 columns of apertures can be controlled by 17 conductors and pins, and 16 switches. Not only is the amount of panel space dedicated to the switches substantially decreased, but the number of characters displayable by a given size of tube header is substantially increased. With this increase in characters, a display tube can accommodate

a significant number of special characters in addition to a full alphanumeric presentation. In short, this display tube will provide an extremely high message density per square inch of panel space.

This and other features of the present invention will become more apparent with a detailed description of the preferred embodiments in combination with the associated drawings.

#### DESCRIPTION OF THE FIGURES

FIG. 1 is a fragmented perspective view of one embodiment of the display tube;

FIG. 2 is a side elevational view of the display tube taken on line 2 — 2 of FIG. 1;

FIG. 3 is a plan view of a portion of the display tube taken on line 3 — 3 of FIG. 2; and

FIG. 4 is a front elevational view of the display tube taken on line 4 — 4 of FIG. 2.

#### DESCRIPTION OF PREFERRED EMBODIMENTS

A display tube is shown generally at 10 in FIG. 1 wherein a vacuum envelope is designated generally by the reference numeral 11. The vacuum envelope 11 can be substantially tubular in configuration with a forward end and a rearward end shown generally at 13 and 15, respectively. The materials comprising the vacuum envelope 11 as well as the procedure for evacuating and sealing the envelope are in accordance with conventional vacuum tube construction practice. In the preferred embodiment, the vacuum envelope 11 is formed from a tube envelope T12ZD1 which is the largest cylindrical standard size in the tube industry. It will be appreciated, however, that the invention can be embodied in other sizes of tube envelopes.

A plurality of fluorescent particles 17 are disposed on the interior surface of the vacuum envelope 11 at the forward end 13 thereof. The fluorescent particles 17, which have characteristics for illuminating when bombarded by electrons, can be viewed externally of the vacuum envelope 11 to provide a display screen 19 at the forward end 13 of the envelope 11.

A plurality of electron flood guns shown generally at 21 are disposed at the rearward end 15 of the vacuum envelope 11. Each of the electron flood guns 21 has characteristics for being controlled to accelerate in the direction of the display screen 19 a stream of electrons, typified by the stream of electrons 23. A character mask 25, which is disposed between the flood guns 21 and the display screen 19, includes a plurality of apertures 27 each shaped in the form of a character and disposed in the path of a particular one of the streams of electrons 23. As a particular one of the streams of electrons 23 passes through its associated aperture 27, its cross section is altered so that the fluorescent particles 17 are bombarded in the shape of the associated aperture 27. In this manner, a desired one of the characters can be made visible on the display screen 19.

The electron flood guns 21 include a plurality of sources of electrons such as the filaments 29 which are aligned in columns at the rearward end 15 of the envelope 11. The filaments 29 are individually energizable to provide a cloud of electrons 30 (shown best in FIG. 2) for each of the filaments 29. A plurality of grid control bars 35 can provide means for dividing each of the clouds of electrons 30 into portions so that a different portion of electrons is provided for each of the electron flood guns 21. The grid control bars 35 can be spaced

from each other in rows transverse to the columns of the filaments with a plurality of apertures 37 individually spaced on each of the bars between an associated one of the filaments 29 and the display screen 19. Thus, each of the grid control bars 35 includes one of the apertures 37 for each of the filaments 29, so that the apertures 37 are disposed in rows corresponding to the rows of the grid control bars 35 and columns corresponding to the columns of the filaments 29.

Means for displacing at least one of the portions of the clouds of electrons from the grid control bars 35 comprises an anode mask 31 preferably disposed between the filaments 29 and the character mask 26. The anode mask 31 includes a plurality of apertures 33 through one of which each of the streams of electrons 23 passes. The anode mask 31 has properties for being energized at a potential such as 2,000 volts d-c to displace and accelerate into the streams of electrons 23 the electrons provided by the filaments 29. The amount of power consumed by the energized anode mask is in the order of 100 milliwatts.

Each of the grid control bars 35 has characteristics for being separately energized through one of a plurality of conductors 36 to inhibit the effect of the anode mask 31 on the portions of the clouds of electrons 30 enclosed by the energized grid control bars 35. When one of the grid control bars 35 is energized, it receives a voltage which neutralizes the voltage normally applied to the bar to inhibit the movement of electrons past the bar. Since the grid control bar is neutralized, the electrons are attracted toward the anode mask by the positive potential on the mask. In this way, by energizing only one filament 29 and one grid control bar at any one time, only the cloud of electrons at one position represented by the intersection of the filament and the bar is able to be attracted toward the screen 19 by the positive voltage on the anode mask 31. Thus, the separate energization of the filaments 29 and the grid control bars 35 enables the flood guns 21 to be individually actuated so that the display on the screen 19 can be limited to a single character. This single character is adjacent to the position at which the energized filament and the energized grid control bar have a common position in space.

Also shown in FIG. 1 is a getter shield 28 which is disposed at least in part forwardly of the character mask 25 to inhibit the transit of extraneous electrons from the rearward end 15 to the forward end 13 of the envelope 11. An end shield 32 is disposed over the ends of the filaments 29 to inhibit the effect of the energized anode mask 31 upon the electrons disposed outwardly of the rows of grid control bars 35. To further insure that the electrons provided by the filaments 29 pass forwardly only through the apertures 37, the spacing of the grid control bars 35 can be limited to a distance such as 0.010 inches.

It can be appreciated that if the distance between the character mask and the screen is minimized, the focus of the characters upon the screen will be improved. However, since the streams of electrons 23, which have a circular cross section after passing through the apertures 33, are each centered upon the display screen 19, the streams of electrons 23 tend to cross over at a particular distance from the grid control bars 35. It is desirable that the character mask 25 be disposed rearwardly of the point where the streams of electrons 23 tend to cross over so that a single stream of electrons

23 does not illuminate more than one of the apertures 27 in the character mask.

In the preferred embodiment, a rectangular mask 40 having a plurality of rectangular apertures 42 disposed therein is located between the anode mask 31 and the character mask 25. Each of the streams of electrons 23 passes through a different one of the apertures 42 so that the cross section of the streams of electrons is made substantially rectangular. In this manner, the point at which the streams of electrons 23 cross over is extended beyond the particular distance. This enables the character mask 25 to be located nearer the screen 19 and the form of the characters on the screen 13 is thereby improved.

The filaments 29 can comprise tungsten wire having a diameter of approximately 0.001 inches suspended between a pair of supports 39 at either end of the filaments 29. The filaments 29 can be individually connected through a plurality of filament switches, such as the switch 41, to a source of potential 43. When one of the switches 41 is closed, current will flow through and heat the associated one of the filaments 29. In the preferred embodiment, the source of potential 43 is maintained at a value of  $1.75 \pm 0.15$  volts a-c/d-c at which voltage the energized filament is heated to a temperature of approximately 850°C. This temperature has been found sufficient to provide the cloud of electrons 30 about each of the energized filaments 29.

The supports 39 can be formed from a material such as mica having a low heat conductivity and limited to a thickness such as 0.010 inches so that a minimum amount of heat passes from an energized filament 29 through its associated supports 39.

As shown in FIG. 2, each of the grid control bars can include portions 45 defining a pair of apertures 46 for receiving each of the filaments 29. Desirably the filaments 29 do not contact the portions 45 so that heat is not dissipated to the grid control bars 35 when the filaments are energized.

A plan view of an individual one of the grid control bars 35 is shown in FIG. 3. In the preferred embodiment, each of the grid control bars 35 has one of a plurality of forward edges 49 each provided with a radius of curvature substantially centered on the center of the display screen 19. Each of the filaments 29 is aligned with a respective one of the apertures 37 in the grid control bars 35 and an associated one of the apertures 33 in the anode mask 31. Preferably, the filaments 29 are equidistant from the center of the display screen 19.

As the anode mask 31 is energized, electrical lines of force 47 extend through the apertures 37 into the grid control bars 35 to withdraw along the lines of force 47 the electrons provided by the energized filaments 29. Unopposed, the electrical lines of force 47 tend to accelerate into one of the streams of electrons 23 each of the portions of the cloud of electrons 30 provided by the energized filaments 29. Thus, each of the portions of the cloud of electrons 30 is accelerated through an associated one of the apertures 37 in the grid control bars 35 and an associated one of the apertures 33 in the anode mask 31 to impinge upon the fluorescent particles 17.

Each of the grid control bars 35 can be deenergized, or individually energized through one of a plurality of switches 46 to either augment or inhibit the effect of the energized anode mask 31 upon the portions of the

clouds of electrons 43 enclosed by the energized grid control bars 35. For example, in an embodiment where the anode mask 31 is positively energized, a grid control bar 35 can be energized with a negative potential such as -6 volts d-c so that the electrical lines of force 47 provided by the energized anode mask 31 are inhibited from extending through the apertures 37 of the negatively energized grid control bars 35. Thus, even though the negatively energized grid control bars 35 may enclose portions of the clouds of electrons 30, the electrical lines of force 47 may not be capable of forming those portions into the stream of electrons 23.

In contradistinction, the grid control bars 35 can be individually energized with a positive potential such as +4 volts d-c so that the electrical lines of force 47 are reinforced in proximity to the apertures 37 to aid in formation of the streams of electrons 23. A positive potential on the grid control bars 35 will provide an additional advantage in improving the focus of the characters on the display screen 19. Since the electrons tend to travel along the lines of force 47 it is desirable to reduce the width of the lines of force 47 in proximity to the apertures 37 so that the streams of electrons 23 appear to emanate from a point source. With a positive potential on the grid control bars 35, the positive electrical lines of force 47 at the apertures 37 are reduced substantially to the configuration of a line 48. Thus, the streams of electrons 23 appear to emanate from a point source on the line 48 and the focus of the characters is considerably increased.

In order to provide each character displayed on the display screen 19 with a substantially uniform intensity, it is desirable that each of the streams of electrons 30 have a substantially uniform electron density and velocity when they impinge upon the fluorescent particles 17. In the preferred embodiment, at least two dimensions are of importance in accomplishing this result, the distance between the apertures 37 and the filaments 29 and the distance between the anode mask 31 and the aperture 37.

In the preferred embodiment the spacing of the filaments 29 and the associated apertures 37 is maintained at a uniform distance such as .075 inches. This uniform distance will aid in maintaining each of the clouds of electrons 30 an equal distance from the apertures 37. It would be possible to maintain this distance by aligning the forward edges 49 of the grid control bars 35 so that they substantially form an imaginary spherical surface having a radius centered on the center of the display screen 19. Thus, the grid control bars 35 progressively spaced from the centermost grid control bars 35 are progressively canted toward the center of the display screen 19 and displaced forwardly. In such a configuration, the filaments 29 could be supported at a plurality of locations to define an imaginary spherical surface concentric with the imaginary spherical surface formed by the grid control bars 35. This would maintain the desirable spacing between the apertures 37 and the associated filaments 29.

In a preferred embodiment, each of the filaments 29 is disposed in a linear configuration between only a pair of the supports 39. Thus, the filaments 29 substantially define an imaginary cylinder centered upon the center of the display screen 19. This embodiment providing for the linear disposition of the filaments 29 offers significant advantages. Not only is the number of supports 39 substantially reduced, but the amount of heat lost to

the supports 39 is also reduced. Since heat is related to power, the foregoing advantages are particularly appreciated in the low power consumption of the display tube. The filaments 29 typically consume only 1.3 watts of power.

It can be appreciated that if the forward edges 49 of the grid control bars 35 substantially define a sphere as in the previous embodiment, and the linear filaments substantially define a cylinder, as in the present embodiment, the distance between the apertures 37 and the filaments 29 will not be uniform. For this reason, after the grid control bars 35 are progressively canted toward the center of the display screen 19, each of them can be displaced rearwardly so that the apertures 37 are spaced the desired distance from the filaments 29. In this configuration, the apertures 37 are substantially disposed on an imaginary cylinder concentric with the imaginary cylinder upon which the filaments 29 are disposed.

The preferred distance between the anode mask 31 and the forward edges 49 of the grid control boxes 35 is 0.050 inches. This uniform dimension is desirable so that the electrical lines of force 47 extending through the apertures 37 will be of substantially equal intensity. In the preferred embodiment where the grid control boxes are progressively canted and displaced rearwardly, the anode mask 31 is provided with a configuration similar to the combined configuration of the forward edges 49 of the grid control boxes 35. Thus, the anode mask 31 is preferably a surface of revolution generated by revolving a zig-zag line such as the line 51 (shown in FIG. 2) about a radius equal to the distance between the anode mask 31 and the display screen 19. With the anode mask 31 and the forward edges 49 of the grid control bars 35 similarly configured, the apertures 37 in the grid control bars 35 and the associated apertures 33 in the anode mask 31 are disposed in substantially parallel surfaces which can be spaced the desired distance.

If the filaments 29 are uniformly heated and the anode mask 31 is uniformly energized, the maintenance of the foregoing dimension between the apertures 37, the filaments 29, and the anode mask 31 will provide the streams of electrons 30 with substantially constant electron density and acceleration.

A front elevational view of the grid control bars 35 is shown in FIG. 4. From this view it can be appreciated that each of the electron flood guns 21 is associated with an individual one of the apertures 37. It will also be noted that each of the apertures 37 is associated with a particular one of the filaments 29 and a particular one of the grid control bars.

In the preferred embodiment, for a particular one of the streams of electrons 30 to be formed, at least two conditions must be fulfilled. First, the associated one of the filaments 29 must be energized to form the associated one of the cloud of electrons 30 so that the particular stream of electrons 23 will have a source of electrons. Second, the associated one of the grid control bars 35 must be energized so that the electrical lines of force 47 provided by the energized anode mask 31 are not inhibited from extending through the associated apertures 37 to accelerate the particular portion of the cloud of electrons 30.

These two conditions provide the preferred embodiment with at least two means for inhibiting the formations of a particular one of the streams of electrons 23.

Of particular significance is the fact that the first condition is associated with the columns of the flood gun 21 and the second condition is associated with the rows of the flood guns 21. Thus, a single character can be displayed on the display screen 19 by inhibiting all but a particular one of the flood guns with either the first or second condition. Specifically, all but the associated one of the filaments 29 can be deenergized, and all but the associated one of the grid control bars 35 can be negatively energized. This can be accomplished with a minimum number of pins 38 on the header 34 of the tube and a minimum number of switches 41 and 46 on the panel, each substantially equal to the sum of the filaments 29 and the grid control bars 35.

Although vacuum tube sizes which are economically available are particularly adapted to receive eight grid control bars each containing eight apertures, it can be appreciated that a plurality of additional electron flood guns 21 can be added to the display tube 10 by the addition of a single filament 29 or a single grid control bar 35. In either case the number of electron flood guns 21 could be substantially increased with the addition of only a single pin 38 to the header 34 of the display tube. This is of particular advantage since the number of flood guns 21, and the number of associated characters which can be displayed by a display tube is no longer dependent upon the number of pins 38 which can be accommodated by the header 34 of the display tube. Since the number of switches 41 and 46 needed to individually actuate the electron flood guns 21 is substantially equal to the number of filaments 29 and grid control bars 35, the amount of panel space needed to accommodate the switches 41, 46 is also decreased. It can also be appreciated that since the number of characters capable of being displayed by a display tube is increased, the message density per square inch of panel space is also substantially increased. The foregoing advantages can be appreciated with a relatively low consumption of power.

While the present invention has been shown and described in what are conceived to be the most practical and preferred embodiments, it will be recognized by those skilled in the art that departures may be made therefrom within the scope of the invention as set forth in the following claims.

I claim:

1. A display tube for selectively providing a visual display of a plurality of characters, comprising:
  - an envelope having a display screen including fluorescent particles at one end thereof;
  - a plurality of first means each providing a source of electrons, the first means disposed within the envelope at the end thereof opposite the display screen and arranged in at least a pair of rows and a pair of columns transverse to the rows to direct the electrons toward the display screen;
  - second means disposed relative to the first means for forming into a stream of electrons the electrons provided by each of the first means, the second means accelerating the electrons in the direction of the display screen whereby the electrons impinge upon the fluorescent particles to illuminate the display screen;
  - third means providing each of the streams of electrons generated by the second means with a cross section which is similar to the shape of an individual one of the characters so that the display screen

is illuminated in the shape of the individual character;

fourth means included in the first means and having characteristics for selectively controlling the formation of the streams of electrons associated with a particular column of the first means;

fifth means included in the first means and having characteristics for selectively controlling the formation of the streams of electrons associated with a particular row of the first means; whereby a particular stream of electrons associated with the particular column and the particular row of the first means is generated by the second means so that the particular character associated with the particular stream of electrons is displayed by the second means so that the particular character associated with the particular stream of electrons is displayed by the display screen.

2. The display tube recited in claim 1, further comprising:

at least a pair of filaments included in the first means each of the filaments having characteristics for being energized to provide a source of electrons for at least one of the columns of the first means; and a plurality of first switching means included in the fourth means each of the first switching means in series with one of the filaments for selectively energizing the filament associated with the particular column of the first means.

3. The display tube as defined in claim 2 wherein the fifth means includes:

a plurality of control boxes electrically connected to form at least a pair of control bars, each control box having characteristics for substantially enclosing a portion of the electrons provided by an associated one of the filaments; and

second switching means electrically connected to one of the control boxes in each of the control bars for selectively energizing all but the control bar associated with the particular row of the first means.

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

an envelope having a display screen including fluorescent particles at one end thereof;

a plurality of filaments disposed in columns relative to the display screen to direct electrons to the display screen, each filament having characteristics for being energized to provide a source of electrons;

first means for selectively energizing a particular one of the filaments so that the particular filament is a source of electrons;

a plurality of second means disposed in rows relative to the filaments, each of the second means substantially controlling a different portion of the electrons provided by each of the energized filaments, each of the second means having for each of the portions of electrons controlled thereby an aperture disposed between the associated filament and the display screen;

third means for selectively energizing all but a particular one of the second means to control the passage of the electrons through the apertures in the energized second means in accordance with such selective energizings; and

fourth means disposed between the second means and the display screen and having characteristics

for being energized to displace from the first means in a stream of electrons the portion of electrons associated with the particular filament and the particular second means, the fourth means accelerating the electrons in the direction of the display screen and having characteristics to control the illumination of the fluorescent particles by the electrons passing through the second means in accordance with a particular one of the characters.

5. The display tube as recited in claim 4 further comprising:

the energized fourth means creating first lines of force disposed relative to the apertures of the particular second means to displace the portion of electrons associated with the particular filament;

the energized second means creating second lines of force having a polarity opposite that of the first lines of force and having at the apertures a magnitude greater than the magnitude of the first lines of force; whereby

the first lines of force are inhibited from passing through the apertures of the energized second means to displace the electron enclosed thereby.

6. A display tube as defined in claim 5 wherein the apertures are provided with a diameter sufficiently small to minimize the width of the first lines of force passing therethrough so that the free electrons in transit along the first line of force appear to emanate from a point.

7. A display tube as defined in claim 5 wherein the second means are aligned with the fourth means so that the centermost portions of the cross sections of the respective streams of electrons coincide with the center of the display screen and the outermost portions of their cross sections tend to cross over at a particular distance from the second means, the display tube further comprising sixth means disposed between the second means and the fourth means for maximizing the particular distance so that the distance between the fourth means and the display screen can be minimized to decrease the amplification of the particular character.

8. A display tube as recited in claim 7 wherein the sixth means comprises:

a mask having portions thereof defining a plurality of apertures therein through which each of the streams of electrons respectively passes, the apertures being substantially rectangular to shape the outermost portions of the streams of electrons so as to maximize the particular distance.

9. In combination for selectively providing a visual indication of a plurality of characters comprising:

an envelope having a display screen at a forward end thereof;

at least a pair of filaments disposed interiorly of the envelope at a rear end thereof and disposed relative to each other in a configuration corresponding to the configuration of the display screen, each of the filaments being energizable to form an individual cloud of electrons;

at least a pair of grid control bars each disposed in transverse relationship to the filaments and in a particular spacing relative to the filaments, and energizable to provide first characteristics for inhibiting the movement of a particular portion of the cloud of electrons from the associated energized filament and to provide second characteristics for

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facilitating the movement of the particular portion of the cloud of electrons from the associated energized filament;

a first mask having a plurality of first apertures disposed between the grid control bars and the display screen and in a particular spacing relative to the grid control bars, the first mask being energizable to create a first electrical field having first lines of force relative to at least a particular one of the filaments for accelerating in the direction of the display screen at least one stream of the electrons not inhibited by the grid control bars; whereby the accelerated electrons in each of the streams of electrons impinge upon the display screen to display at least one of the characters.

10. The combination as recited in claim 9, the filaments being longitudinal in configuration and substantially parallel to each other and the grid control bars being substantially arcuate in configuration.

11. The combination as recited in claim 10, each of the grid control bars being disposed between the filaments and the display screen and being individually energizable to provide second characteristics for reinforcing the first lines of force produced by the first mask on the clouds of electrons provided by the filaments.

12. The combination as recited in claim 9 further comprising:

a plurality of grid control bars elongated in configuration and disposed substantially parallel to the other grid control bars with portions of the grid control bars extending between the filaments and the first mask;

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each of the grid control bars enclosing a portion of the cloud of electrons formed by each of the energized filaments, and

the grid control bars being selectively energizable to create a second electrical field having second lines of force resisting the acceleration of the electrons by the first lines of force.

13. The combination as recited in claim 12 further comprising:

a plurality of partitions disposed within each of the grid control boxes to form a plurality of compartments each having an open side facing rearwardly of the screen and a side defining a second aperture facing toward the screen, each of the compartments substantially enclosing one of the portions of the clouds of electrons; whereby second lines of force inhibit the acceleration of the electrons through the second apertures.

14. The combination recited in claim 9 including: means for individually energizing the filaments; means for individually energizing the grid control bars to provide individual ones of the bars with the first characteristics at first particular times and with the second characteristics at second particular times different from the first particular times; and means for energizing the first mask to create the first electrical field.

15. The combination recited in claim 13 wherein the second apertures in one grid control boxes are equally spaced from the associated filament and are equally spaced from the first mask.

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