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Kuhn

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[54] **CATHODE RAY DISPLAY TUBE WITH BLANKING GRID**

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[52] **U.S. Cl.** **313/86,** 313/83

[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

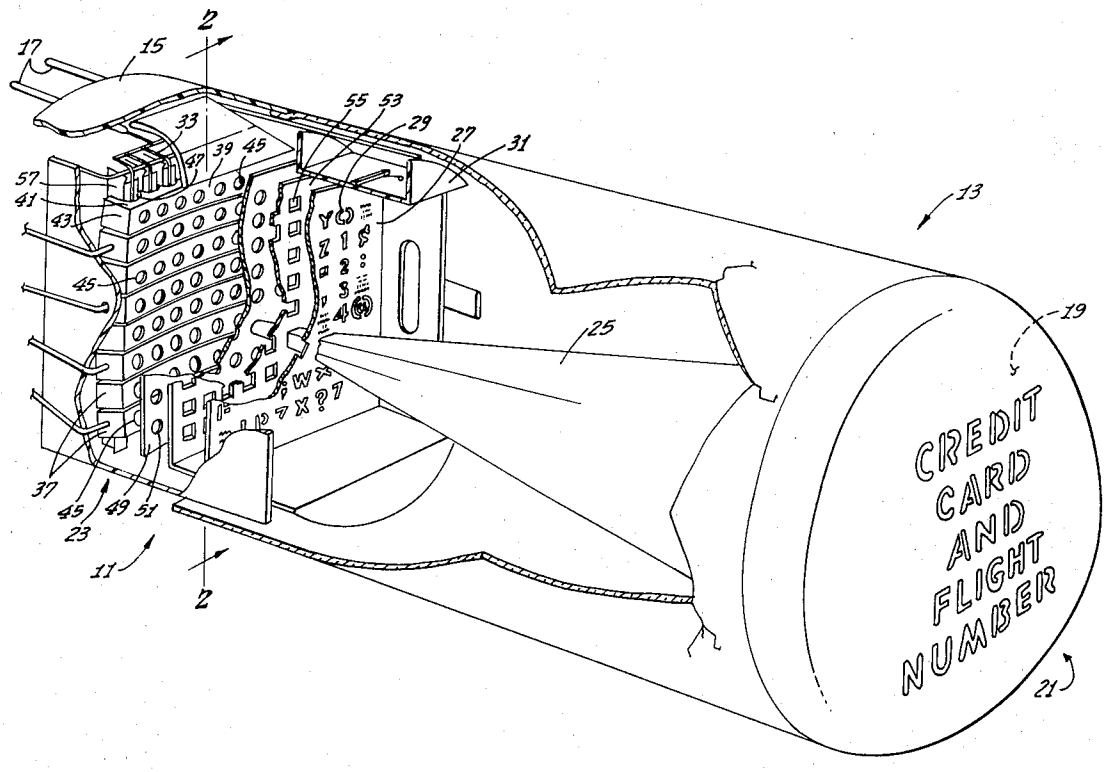
Attorney—Ellsworth R. Roston

[57] **ABSTRACT**

A display tube having a vacuum envelope with a fluorescent screen at one end thereof and a plurality of electron flood guns projecting a plurality of characters upon the screen from the other end of the display tube. The flood guns disposed in rows and columns and including a plurality of first means collectively energizable to provide a cloud of electrons for each one of the columns of the flood guns. A plurality of second means each associated with a respective row of the flood guns divides each of the clouds of electrons into a plurality of individual portions each associated with one of the flood guns. Third means accelerate each of the portions of the clouds of electrons into an individual stream of electrons to project one of the characters upon the screen. The second means can be selectively energized to inhibit the formation of the streams of electrons associated with a row of the flood guns.

A plurality of fourth means each associated with one of the first means are selectively energizable to inhibit the formation of the cloud of electrons by the associated energized first means. Thus the fourth means enable the columns of the flood guns to be individually inhibited and the second means enable rows of the flood guns to be individually inhibited so that a single character can be displayed.

19 Claims, 5 Drawing Figures



3 Sheets-Sheet 1

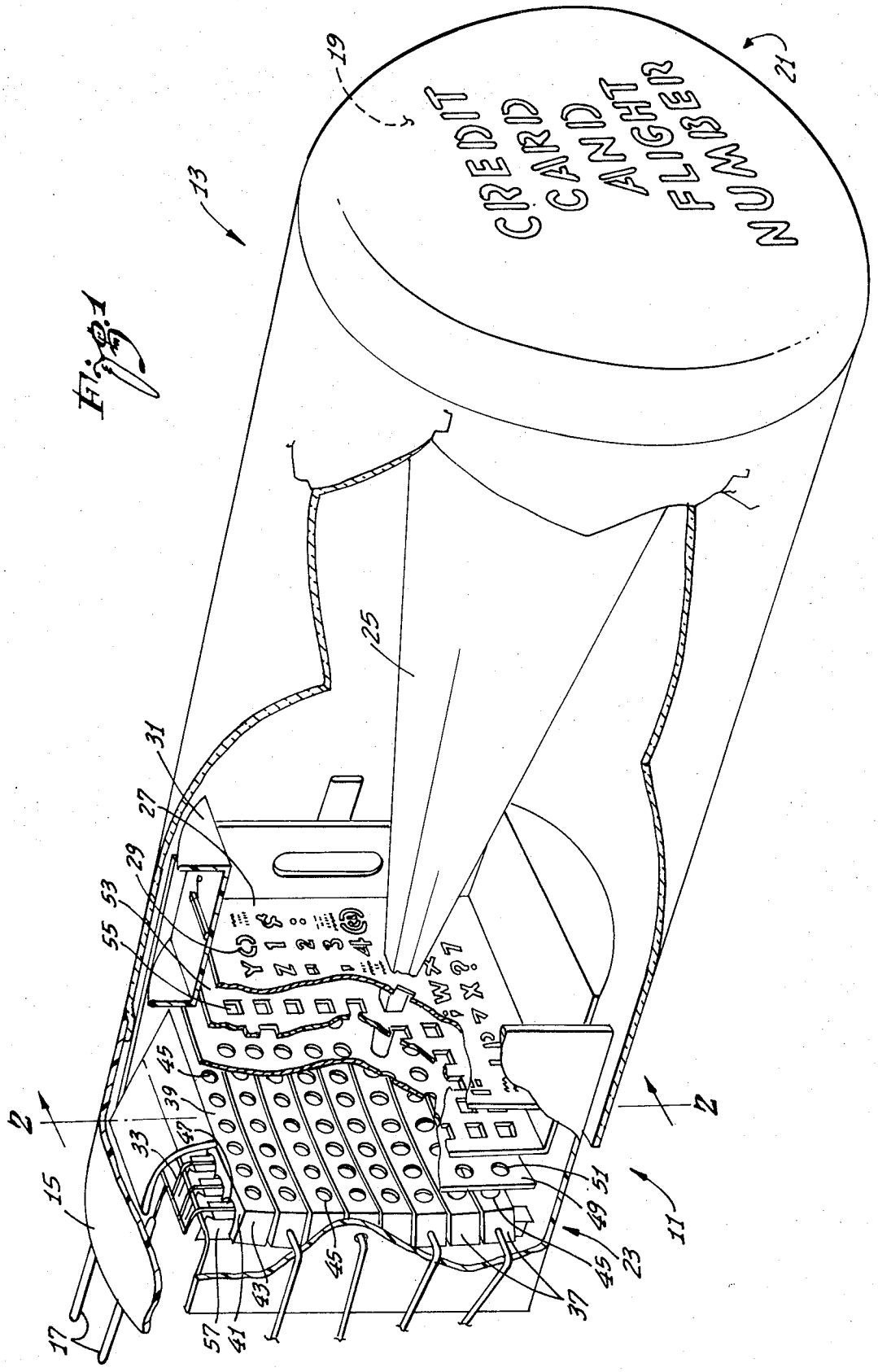


Fig. 1

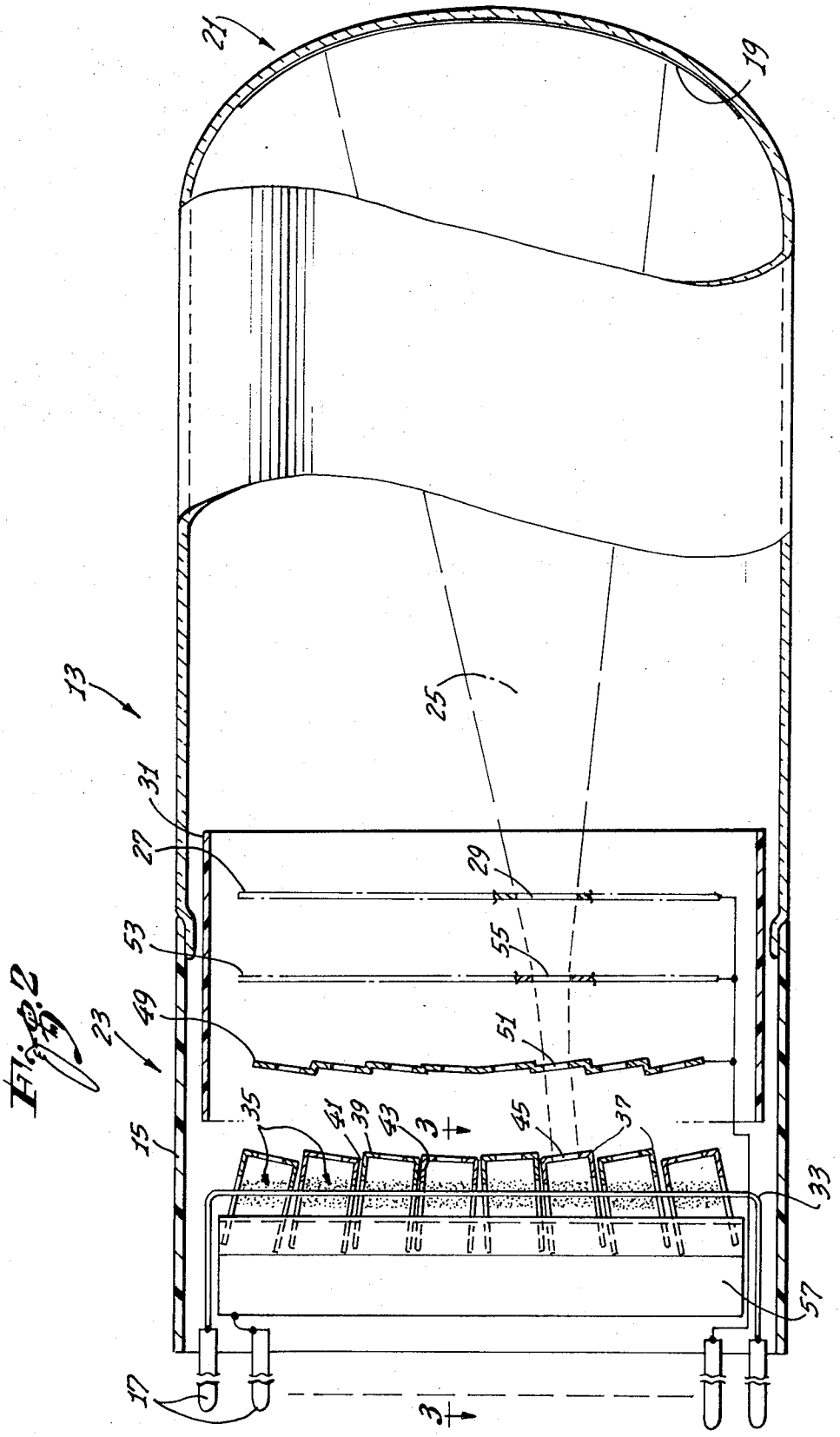


Fig. 2

Fig. 3

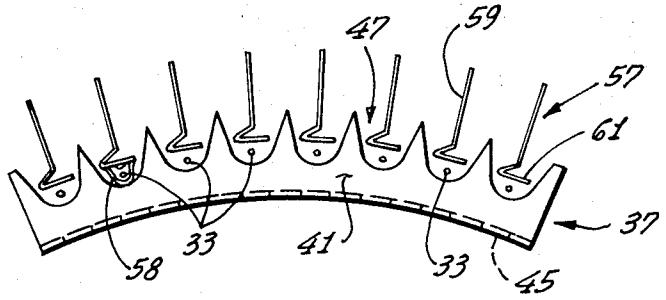


Fig. 4

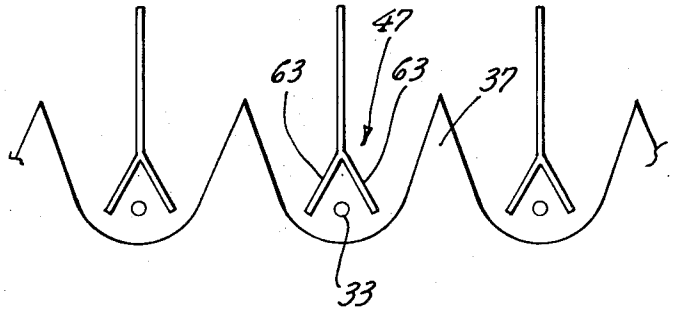
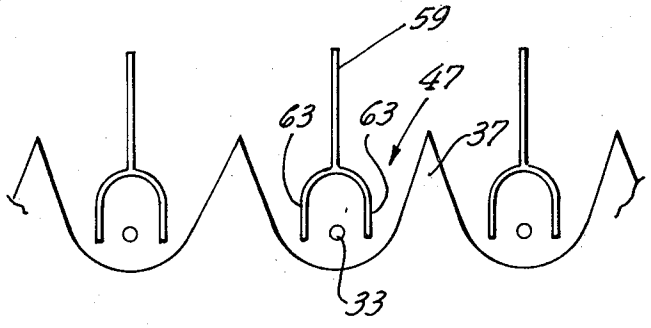


Fig. 5



CATHODE RAY DISPLAY TUBE WITH BLANKING GRID

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to display tubes having flood guns disposed in rows and columns and more specifically to means for selectively blanking individual ones of the columns of flood guns.

2. Description of the Prior Art

The prior art includes display tubes such as that disclosed and claimed in the copending application Ser. No. 239,535 filed by Donald G. Gumpertz on Mar. 30, 1972 and assigned of record to the assignee of record of the present application. That application discloses a display tube having a vacuum envelope with a fluorescent display screen at the forward end thereof and a plurality of electron flood guns at the rear end thereof. Each of the flood guns has characteristics for generating a stream of electrons which impinge upon the fluorescent screen. Disposed between the flood guns and the display screen is a character mask having a plurality of apertures therein each associated with an individual one of the streams of electrons and providing the associated stream of electrons with a cross section similar to the character to be displayed upon the fluorescent screen.

The flood guns are disposed in rows and columns at the rear of the tube. A plurality of filaments have characteristics for being selectively energized to provide a cloud of electrons for the associated column of flood guns. A plurality of grid control bars each associated with an individual row of the flood guns divide the clouds of electrons into portions so that each of the flood guns is associated with an individual portion of the clouds of electrons. An anode mask which is disposed between the grid control bars and the character mask is energizable to accelerate each of the portions of the clouds of electrons into an individual one of the streams of electrons.

The grid control bars are selectively energizable to inhibit the effect of the energized anode mask upon the portions of clouds of electrons associated with the energized grid control bars. Thus an individual one of the flood guns can be actuated by energizing a particular one of the filaments and energizing all but a particular one of the grid control bars.

Each of the filaments is connected through an associated switch to a source of potential. When the switch is closed, the associated filament is heated to a temperature such as 850° to provide a cloud of electrons for the associated column of the flood guns. In order to inhibit the column of flood guns, the associated filament switch can be opened to deenergize the filament so that the cloud of electrons is no longer provided. However, the energizing and deenergizing successively heats and cools the individual filaments, thereby substantially reducing their useful life.

A further deficiency in this means for inhibiting a column of the flood guns is related to the delay between the time that the individual filament switch is closed or opened and the time when the cloud of electrons is formed or deformed respectively. Ideally the character associated with an energized grid control bar will be displayed immediately upon the closing of the associated filament switch. Any delay associated with the formation of the associated cloud of electrons will subtract from this ideal situation.

The display tubes of the prior art are also not entirely satisfactory with respect to the configuration of the clouds of electrons. Since, in the interest of sharp character focus, it is desirable that the streams of electrons appear to emanate from a point source, and since the size of the clouds of electrons substantially determine the appearance of the electron source, the dimensions of the clouds of electrons has a considerable effect on the focus of the characters on the display screen. In the past, the clouds of electrons have been relatively large and, for this reason, the focus of the characters associated with the display tubes of the prior art has not been entirely satisfactory.

SUMMARY OF THE INVENTION

The invention as disclosed herein includes a vacuum envelope having a display screen at the forward end thereof and a plurality of electron flood guns at the rear end thereof. Each of the electron flood guns is associated with an individual one of a plurality of rows of grid control bars and an individual one of a plurality of columns of filaments. Each of the filaments is energizable to provide a cloud of electrons, portions of which are enclosed by each of the grid control bars. An anode mask which is disposed forwardly of the grid control bars is energizable to form each of the portions of the clouds of electrons into an individual one of a plurality of streams of electrons. Each of the streams of electrons is directed through a character mask which provides the associated stream of electrons with a cross section similar to the shape of a particular one of the characters.

A plurality of blanking grids are provided, each disposed in close proximity to an associated one of the filaments. Each of the blanking grids is energizable to inhibit the formation of the cloud of electrons by the associated energized filament. The blanking grids are disposed on the opposite side of the filaments relative to the disposition of the screen. The blanking grids are normally energized in a negative polarity so that the electrons of the energized filament are substantially prevented from forming a cloud of electrons about the associated energized filament. The blanking grids can also be positively energized in a manner that will augment the formation of the cloud of electrons in a restricted area about the associated filament. The blanking grids are operative, when positively energized, to restrict the width of the cloud of electrons. With the width of the cloud of electrons substantially reduced, each of the streams of electrons more nearly appears to emanate from a point source. This significantly improves the focus of the display tube.

Each of the grid control bars is selectively energizable to inhibit the formation of the streams of electrons associated with a row of the electron flood guns. Thus, by selectively energizing all but a particular one of the blanking grids with a negative potential and energizing the particular grid with the positive potential and energizing all but a particular one of the grid control bars, a single stream of electrons will be formed and the character associated with the single stream of electrons will be displayed upon the screen of the display tube.

Since the individual filaments need not be energized and deenergized to accomplish the switching of the individual electron flood guns, the filaments can be con-

tinuously energized so that they are not repeatedly heated and cooled. This has a significant effect in increasing the useful life of the filaments and hence the display tubes. Additionally, the clouds of electrons are more responsive to the selective energizing of the blanking grids than they are to the selective energizing of the filaments. This has the advantage of decreasing the delay between the time the blanking grid is energized and the time when the character is displayed on the screen. Furthermore, since the width and depth of the cloud of electrons is considerably decreased, the display tube has excellent characteristics for focusing the display and removing the presence of ghosts.

The disposition of a blanking grid on the opposite side of a continuously energized filament from a grid control bar has been disclosed above in reference to a matrix arrangement formed by a plurality of filaments and blanking grids disposed in columns, and a plurality of grid control bars disposed in rows. It will be appreciated, however, that the invention may also be used in a combination of a single filament, a single blanking grid and a single grid control bar having the same relationship as that described above.

These and other features of the invention will become more apparent with a detailed description of the preferred embodiment taken in conjunction with the associated drawings.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a fragmentary perspective view of a display tube including a plurality of blanking grids;

FIG. 2 is a side elevational view partially in section taken on line 2 — 2 of FIG. 1;

FIG. 3 is a plan view of the display tube taken on line 3 — 3 of FIG. 2 and showing one embodiment of the blanking grids;

FIG. 4 is a plan view of another embodiment of the blanking grids; and

FIG. 5 is a plan view of a further embodiment of the blanking grids.

DESCRIPTION OF PREFERRED EMBODIMENTS

A display tube shown generally at **11** in FIG. **1** includes an envelope designated generally by the reference numeral **13**. The envelope **13** can be formed from a transparent material such as glass and can be evacuated in accordance with methods old in the art. A header **15** is disposed to engage the rear of the envelope **13** and to provide the base of the display tube **11**. A multiplicity of pins **17** are fixed to the header **15** to provide electrical continuity between the interior and exterior surfaces of the envelope **13**. A plurality of fluorescent particles **19** having properties for illuminating when bombarded a stream of electrons are disposed on the interior surface of the envelope **13** to form a display screen **21** at the forward end thereof.

A plurality of electron flood guns shown generally at **23** are disposed at the rear of the display tube **11**. Each of the electron flood guns **23** is provided with characteristics for forming one of a plurality of streams of electrons **25** originating at the rear of the display tube **11** and terminating at the fluorescent particles **19**.

A character mask **27** is disposed between the electron flood guns **23** and the display screen **21**. The character mask **27** is provided with a plurality of apertures **29** individually shaped to provide an associated one of the streams of electrons **25** with a cross section similar to the shape of one of the characters to be displayed. Thus, by selectively energizing an individual one of the electron flood guns **23**, a desired one of the characters can be displayed upon the display screen **21**.

A shield **31** can be disposed to provide support for the character mask **27**. The shield **31** can be formed from a getter characteristics having chaaacteristics absorbing residual gases within the envelope **13**.

The electron flood guns **23** are disposed in a plurality of columns and a plurality of rows in a manner disclosed and claimed in the copending application, Ser. No. 239,535 filed by Donald G. Gumpertz on Mar. 30, 1972 and assigned of record to the assignee of record of the present application. Each of the columns of flood guns **23** is associated with one of a plurality of filaments **33**. In the preferred embodiment the filaments **33** are formed of tungsten wire having a diameter of approximately 0.001 inches. The filaments can be electrically connected in parallel and energized by a voltage such as 1.75 ± 0.15 volts a-c/d-c to heat the filaments **33** to a temperature such as 850°C. At this temperature one of a plurality of clouds of electrons **35** (shown best in FIG. **2**) will attempt to form about each of the filaments **33**.

Each of the rows of electron flood guns **23** is associated with one of a plurality of grid control bars **37**. Each of the grid control bars **37** comprises a box substantially longitudinal in configuration and having a forward side **39**, a topside **41** and a bottom side **43**. The grid control bars **37** can be open on the rearward side of the display tube **11**. Portions of the forward side **39** define a plurality of apertures **45** each disposed between an individual one of the filaments **33** and the display screen **21**. Portions of the top and bottom sides **41** and **43** of the grid control bars **37** define recesses **47**, each receiving an individual one of the filaments **33** so that the filaments **33** are disposed in close proximity to the apertures **45**. In this configuration, each of the grid control bars **37** encloses a portion of each of the clouds of electrons **35** and the individual protions are disposed nn proximity to an associated one of the apertures **45**.

An anode mask **49** is disposed between the grid control bars **37** and the character mask **27**. The anode mask **49** (shown best in FIG. **2**) has a shape similar to the collective configuration of the forward sides **39** of the grid control bars **37**. Portions of the anode mask **49** define a plurality of apertures **51** each associated with one of the flood guns **23** and aligned between an associated one of the apertures **45** and the display screen **21**. The anode mask **49** has characteristics for being energized by a potential such as 2,000 volts d-c to form a first electrical field extending through the apertures **45**. The first electrical field has properties for accelerating each of the portions of the clouds of electrons **35** through the associated apertures **45** to form one of the streams of electrons **25**.

The grid control bars **37** can be individually energized to either augment or inhibit the effect of the electrical field upon the portions of the clouds of electrons. For example, the grid control bars **37** can be energized by a negative voltage, such as −10 volts d-c, to form a second electrical field in proximity to the apertures **45**. The second electrical field is preferably of sufficient strength to prevent the first electrical field from extending through the particular apertures **45** to form the stream of electrons **25** associated therewith. Thus, by

selectively energizing the grid control bars 37, the rows of the flood guns can be selectively inhibited.

A rectangular mask 53 can be supported by the shield 31 between the anode mask 49 and the character mask 27 and can be provided with a plurality of rectangular apertures 55. Each of the rectangular apertures 55 is associated with an individual one of the apertures 45 and the apertures 51 to provide the associated stream of electrons 25 with a rectangular cross section. This is desirable so that adjacent ones of the apertures 29 are not flooded by an individual one of the streams of electrons. It is also desirable in insuring that characters having a sharp and clean appearance are displayed on the face of the screen 19. The rectangular mask 53 and the character mask 27 can be energized with a voltage such as that applied to the anode mask 49.

In the preferred embodiment, a plurality of blanking grids 57 are individually disposed in close proximity to an associated one of the filaments 33. The blanking grids 57 are disposed on the opposite sides of the filaments 33 relative to the grid control bars 37. Each of the blanking grids 57 can be energized through an individual one of the pins 17 on the header 15 so as to control the formation of the clouds of electrons 35 provided by the energized filaments 33. For example, the blanking grids 57 can be individually energized by a voltage such as −10 volts d-c to form an electrical field illustrated by the lines of force 58 shown in FIG. 3. When the blanking grids 57 are negatively energized, the lines of force 58 resist the tendency of the electrons, which would otherwise form one of the clouds of electrons 35, to stray from the energized associated filament 33. Thus, the associated cloud of electrons 35 is not available to be formed into the streams of electrons 49 by the anode mask 49.

It can be seen that the blanking grids 57 provide means for inhibiting the streams of electrons 25 associated with a particular column of the electron flood guns 23. In comparison, the grid control bars 37 provide means for inhibiting the streams of electrons 25 associated with a particular row of the electron flood guns 23. Thus, the blanking grids 57 and the grid control bars 37 can be selectively energized so that all but a particular one of the streams of electrons 25 can be inhibited and a single desired character can be displayed on the screen 21.

Each of the blanking grids 57 is substantially longitudinal in configuration and disposed in close proximity to an individual one of the filaments 33. In the preferred embodiment, the spacing between an individual one of the blanking grids 57 and its associated filament 33 is 0.004 inches. The blanking grids 57 can be provided with a cross section having a variety of configurations including a configuration such as the numeral 7 shown in FIG. 3. In this embodiment, each of the blanking grids 57 includes a first portion 59 extending in a first direction, and at least one second portion 61 extending in a second direction transverse to the first direction. In the preferred embodiment, the second portion 61 is disposed between the first portion 59 and the associated one of the filaments 33 and the first and second directions are substantially perpendicular. It is desirable that the first portions 59 each define a plane passing through the associated one of the filaments 33 to provide each of the blanking grids 57 with structural rigidity in the direction of the associated filament 33. This aids in the maintenance of the desired distance between the second portions 61 and the associated filament 33.

In another embodiment of the blanking grids 57, which is provided with a cross section substantially the shape of the letter Y, third portions 63 extend from each of the first portions 59 to a position between the associated filament 33 and the adjacent filament 33 on either side thereof. This configuration substantially reduces the cross talk associated with electrons straying from an adjacent filament 33 into proximity with the associated one of the filaments 33. The third portions 63 can be substantially planar in configuration as shown in FIG. 4 or they can have a cross section defining at least in part an arcuate path as shown in FIG. 5. Both of these embodiments are particularly effective in minimizing crosstalk between the filaments.

The energizing of the blanking grids 57 to inhibit a column of the flood guns 23 provides a significant advantage over the prior art. It will be noted that the filaments 33 remain energized, even if the associated column of the flood guns 23 is inhibited, so that the filaments 33 are not repeatedly heated and cooled. This feature of the present invention can extend the useful life of the tube 11 by as much as 2,000 times the useful life of the display tubes of the prior art.

The blanking grids 57 also can be positively energized by a voltage such as +2.5 volts d-c in which case the electrical lines of force 58 tend to pull the electrons from the energized associated filament 33. This not only enhances the formation of the associated one of the clouds of electrons 35 but also increases the electron concentration therein so that the character displayed upon the screen 21 is brighter. In this way, the blanking grids 57 are normally provided with a negative voltage to inhibit the flow of electrons from the associated filaments toward the grid control bars 37. When it is desired to provide such a flow of electrons for one of the filaments 33, the negative potential on the associated blanking grid 57 is removed or, preferably, a positive voltage is applied to the blanking grid 57.

It will be recalled that the tubes of the prior art have relied upon the heating and cooling of the filaments 33 to form and deform the associated clouds of electrons 35. The process of heating and cooling the filaments 33 has resulted in a significant delay, such as 200 millisecond, between the time that the filament was energized and the time when the characters appeared on the screen. The blanking grids 57 disclosed in this invention, however, do not rely upon heating and cooling but rather the creation of an electrical field about the associated filament 33. This takes place over a significantly shorter period of time such as 5 microseconds so that the display of the desired character occurs almost simultaneously with the energizing of the blanking grids 57. Furthermore, since the control of the filaments relies upon the switching of a voltage rather than a current, low cost integrated circuits can be used to selectively energize the blanking grids. The integrated circuits accommodate the binary code to provide the display tube with characteristics for accepting octal computer inputs.

With the blanking grids 57 positively energized, the electrons forming the cloud of electrons 35 tend to maintain a configuration substantially the shape of the positive lines of force 58. In other words, the electrons do not stray significantly but rather form a relatively narrow cloud of electrons 35 about the associated fila-

ment **35.** Since the clouds of electrons **35** have a narrower configuration, the source of each of the streams of electrons **25** more effectively approximates a point. This provides a significant advantage in increasing the focus of the characters upon the display screen **21.** The depth of the clouds of electrons **35** is also minimized by the positively energized blanking grids **57,** so that ghosts are substantially removed from the display screen **21.**

It will be appreciated that the combination of the filament **33,** the blanking grid **57,** and the grid control bar **37** may be used in a single tube, rather than in a matrix arrangement as described above, to control the formation of clouds of electrons and the movement of the electrons from the filament toward the grid control bar. The advantage of such an arrangement in a single tube is that the movement of the electrons can be positively controlled and the electrons can be focussed substantially in a point source before being directed toward a screen. This tends to sharpen the image on the screen and enhance the brightness of the image on the screen. As will be appreciated, these advantages are obtained by disposing the blanking grid **57** in proximity to the filament on the opposite side of the filament from the grid control bar **37** and controlling the relative polarity of the voltage applied to the blanking grid. The shaping of the blanking grid also tends to enhance these advantages.

While the present invention has been shown and described in what are conceived to be the most practical and preferred embodiment, 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;

means disposed interiorly of the envelope at one end of the envelope to provide a screen upon which the characters are displayed;

a plurality of first means disposed in columns at the end of the envelope opposite the screen, each having characteristics for being energized to provide a cloud of electrons in proximity to the associated one of the first means;

second means for accelerating the electrons in each of the clouds of electrons to form at least one stream of electrons between the first means and the screen, wherein each of the streams of electrons has properties for displaying a different one of the characters upon the screen;

a plurality of third means disposed on the far side of the first means relative to the screen and in columns in proximity to associated ones of the first means, the third means having characteristics for being selectively energized to inhibit the passage of the cloud of electrons from the associated first means; and

a plurality of fourth means disposed in rows between the fluorescent screen and the first means and in proximity to the first means for enclosing at least a portion of each of the clouds of electrons provided by the first means wherein each of the portions of the clouds of electrons produces one of the streams of electrons;

the fourth means having the characteristics for being selectively energized to inhibit the effect of the energized second means upon those portions of the clouds of electrons provided by the energized first means and enclosed by the energized fourth means; whereby

all but a particular one of the third means is energized so that the only cloud of free electrons provided is that associated with the particular third means, and all but a particular one of the fourth means is energized so that only the cloud of free electrons associated with the particular third means and the particular fourth means can be formed into a stream of electrons by the second means.

2. The display tube as recited in claim **1** wherein the fourth means comprise:

a plurality of grid control bars each disposed transverse to an associated one of the first means so that a portion of each of the clouds of electrons is formed within each of the grid control bars;

portions of each of the grid control bars defining one of a plurality of first apertures between each of the filaments and the display screen, each of the streams of electrons being directed through an associated one of the first apertures; and

fifth switching means for selectively energizing at least one of the grid control bars in the fourth means to inhibit the formation of the streams of electrons associated with the energized grid control bars.

3. The display tube as recited in claim **2** wherein the third means comprise:

a plurality of blanking grids each of which is disposed in proximity to an associated one of the first means, each of the blanking grids being energizable in a first polarity to inhibit the provision of the cloud of electrons by the associated first means so that the streams of electrons corresponding to the associated first means are not formed by the second means; and

each of the blanking grids being energizable in a second polarity to enhance the provision of the cloud of electrons by the associated first means.

4. The display tube as recited in claim **3** wherein each of the blanking grids is disposed relative to the associated one of the first means and is energizable in the second polarity to cause the streams of electrons provided by the second means to appear to emanate from a point source and wherein means are included for providing a controlled energizing of individual ones of the blanking grids in the second polarity at particular periods of time.

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

a filament included in each of the first means and having a longitudinal configuration wherein the filament is disposed in a plane substantially parallel to the screen; and

each of the blanking grids having a longitudinal configuration and disposed substantially parallel and in close proximity to a different one of the filaments.

6. The display tube as recited in claim **3** wherein the second means further comprises:

an anode mask having a substantially planar configuration and disposed substantially parallel to the screen, portions of the anode mask defining second

apertures a different one of which is disposed between each of the first apertures and the center of the screen;

the anode mask having characteristics for being energized to create a first electric field in proximity to the first apertures for accelerating the portion of the clouds of electrons passing through the associated first apertures in the particular grid control bar and the associated second aperture in the anode mask.

7. The display tube as recited in claim **6** wherein:

each of the grid control bars has characteristics for being energized to create a second electric field for opposing the transit of the electrons through the first apertures wherein the second electric field is stronger than the first electric field in proximity to the first apertures so that the portions of the clouds of electrons within the energized grid control bars are not formed into the streams of electrons by the anode mask.

8. A display tube having a plurality of electron flood guns at one end thereof for displaying a plurality of characters on a screen at the other end thereof, the electron flood guns comprising:

a plurality of first means each disposed in columns wherein each column of first means provides one of a plurality of clouds of electrons for at least one of the flood guns;

a plurality of second means disposed in rows between the first means and the screen, each of the rows of second means substantially enclosing a portion of each of the clouds of electrons provided by the first means;

third means disposed between the second means and the screen and having properties for being energized to accelerate each of the portions of the clouds of electrons to form one of a plurality of streams of electrons;

each of the rows of second means having characteristics for being energized to inhibit the formation of the streams of electrons associated with the energized row of second means;

a plurality of fourth means each disposed in close proximity to an individual one of the columns of first means and having characteristics for being selectively energized to inhibit the formation of the cloud of electrons by the associated first means; whereby

each of the electron flood guns is associated with one of the columns of the fourth means and one of the rows of second means so that a single stream of electrons is formed by energizing all but a particular column of the fourth means and all but a particular row of the second means.

9. The display tube as set forth in claim **8** wherein each of the second means comprises:

a forward surface having a plurality of first apertures therein, each of the first apertures aligned between an associated one of the filaments and the screen; and

a pair of side surfaces extending rearwardly from the edges of the forward surface, each side surface defining a plurality of second apertures wherein each of the first means extends through one of the second apertures in each of the side surfaces.

10. The display tube as set forth in claim **8** wherein each of the fourth means is disposed on the opposite side of the first means from the screen.

11. The display tube as set forth in claim **8** wherein each of the fourth means is energizable with a voltage of a first polarity to inhibit the formation of the cloud of electrons by the associated first means and is energizable with a voltage of a second polarity opposite to the first polarity to facilitate the formation of the cloud of electrons as a point source for movement to the screen.

12. The display tube recited in claim **11** wherein each of the fourth means comprises a longitudinal member extending substantially parallel to an individual one of the first means, the longitudinal member including a first portion defining a first plane including the associated filament where the first plane corresponds substantially to the direction in which the electrons move from the associated filament to the screen.

13. The display tube recited in claim **12** further including second portions in fixed relationship with the first portion and extending at least partially between the associated filament and one of the adjacent filaments.

14. The display tube recited in claim **13** wherein the longitudinal member has a cross section substantially the shape of the letter Y.

15. The display tube recited in claim **10** comprising:

a second portion on the fourth means in fixed relationship with the first portion and extending in a second plane transverse to the first plane between the first portion and the associated filament.

16. An electron tube comprising:

an envelope;

a filament disposed at one of the ends of the envelope and having properties for being continuously energized to form a cloud of electrons in close proximity to the filament;

first means spaced from the filament within the envelope and having characteristics for being energized to displace the cloud of electrons provided by the filament into a stream of electrons;

second means disposed on the side of the filament opposite to the first means and in close proximity to the filament, and having characteristics for being energized in a first polarity to inhibit the formation of the cloud of electrons by the filament; whereby

the stream of electrons is inhibited when the second means is energized in the first polarity.

17. The electron tube as recited in claim **16** further comprising:

a display screen disposed at the end of the envelope opposite to the filament for receiving the stream of electrons and in response thereto displaying a character similar to the shape of the cross section of the stream of electrons;

third means disposed between the first means and the display screen for providing the stream of electrons with a cross section in the shape of a particular character; whereby

the particular character is displayed upon the display screen.

18. The electron tube as set forth in claim **17** wherein the second means has characteristics for being energized in a second polarity to augment the formation of the cloud of electrons by the filament and to restrict the

size of the cloud of electrons so that the stream of electrons appears to emanate from a point source.

19. The electron tube defined in claim **18** further comprising:

fourth means disposed between the filament and the first means and having characteristics for being energized in a first polarity to inhibit to effect of the first means upon the cloud of electrons formed by the filament, and for being energized in a second polarity to enhance the effect of the first means upon the cloud of electrons formed by the filament.

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