

Description

The invention relates to a fluorescent display apparatus consisting of a plurality of display elements arranged in a common vacuum chamber, each display element containing a cathode for emitting thermoelectrons, an arrangement of control electrodes for controlling the flow of the emitted thermoelectrons, and a fluorescent display portion coated with fluorescent material and emitting light upon being bombarded by the thermoelectrons.

Large-screen displays are in use for displaying progress and result of sports events in such places as an outdoor stadium. A fluorescent display apparatus utilized in such a large-screen display is constructed of a large number of monochromatic illuminating tubes arranged in a matrix. FIG. 1 is a schematic diagram showing an internal arrangement of a prior art monochromatic illuminating tube.

The interior of the glass tube 1 is in a vacuum with air inside the tube evacuated through an exhaust hole 2. As a heater 3 heats up a cathode 4 surrounding the heater 3, thermoelectrons are emitted from the cathode 4. The thermoelectrons emitted from the cathode 4 is controlled in their flow by three types of grids 5, 6, 7 and allowed to bombard a fluorescent display screen 1a coated with fluorescent material. The fluorescent display screen 1a is applied with a high voltage and the part of the fluorescent display screen 1a bombarded by the thermoelectrons emits light. The grid 5 controls the quantity of the thermoelectrons emitted from the cathode 4, the grid 6 controls the diameter of the beam of the emitted thermoelectrons, and the grid 7 accelerates the emitted thermoelectrons. While potential for the grids 6, 7 is fixed, potential for the grid 5 is controlled, and thereby the quantity of the emitted thermoelectrons is controlled and the brightness of the fluorescent display screen 1a is regulated.

FIGS. 2 and 3 show a fluorescent display apparatus integrating a number of such monochromatic illuminating tubes therewith. On the apparatus, there are disposed the fluorescent display portions 8 of three primary colors, i.e., red (R), green (G), and blue (B) colors, suitably spaced apart in vertical and horizontal directions so as to be regularly distributed. Thus, with the potential of the grid 5 of each of the monochromatic illuminating tubes controlled, each of the fluorescent display portions 8 are controlled in their brightness and thereby a display is given with a desired color tone.

As a means to improve the resolution of such an apparatus provided with a number of monochromatic illuminating tubes, it is known from JP-A-64/995 to use an illuminating tube which is pro-

vided with a plurality of fluorescent display portions. However, since such an apparatus is of the structure that the cathode and grids must be provided for each of the fluorescent display portions, there are problems with it that the number of the component parts of the fluorescent display apparatus becomes larger, the internal structure becomes complex, and the power consumption becomes larger.

From EP-B1-217 003 a fluorescent display tube is known which is similar to the tube as shown in Fig. 3, but which is additionally provided with column selection back electrodes below the discrete cathodes, and row selection control grids provided with apertures and being placed between the cathodes and fluorescent display portions. With these column selection back electrodes and row selection control grids it is possible to control the matrix of fluorescent display elements, but each of these fluorescent display elements contains a separate cathode which has to be separately heated.

It is an object of the present invention to provide a fluorescent display apparatus having a simpler internal structure and consuming less heating power for the cathodes.

According to the present invention, a fluorescent display apparatus as defined above is characterized in that said fluorescent display portions are arranged in a matrix of rows and columns to form a display screen; that said cathodes are of elongated form oriented in the direction of the row or column and supported on a substrate to oppose said display screen, the cathodes being arranged in an array of rows and columns, in which each cathode is provided for two of said fluorescent display portions; and that said arrangement of electrodes for controlling the flow of the emitted thermoelectrons are made up of a first control electrode in a planar form disposed between said display screen and said cathodes and having openings made therein corresponding to said fluorescent display portions of said display screen, second control electrodes disposed on the substrate near said cathodes and arranged in an array of rows and columns, in which each thereof corresponds to one of said cathodes and third control electrodes disposed on the substrate on two sides of said second control electrodes in the direction of the column, in which two thereof correspond to one of said cathodes.

Preferable embodiments are defined in the dependent claims.

The invention will now be described in connection with the drawings.

FIG. 1 is a schematic diagram showing internal structure of a prior art monochromatic illuminating tube;

FIG. 2 is a top view of a prior art fluorescent display apparatus;

FIG. 3 is a side view in section of the same;

FIG. 4 is an exploded view in perspective showing component parts of an embodiment of the present invention;

FIG. 5 is a plan view showing electrode structure;

FIG. 6 is a timing chart schematically showing timing of signals;

FIG. 7 is a schematic plan view showing a display portion;

FIGS. 8 and 9 are schematic diagrams showing state of potential in the vicinity of cathodes;

FIG. 10 is a plan view showing electrode structure of another embodiment of the present invention;

FIG. 11 is an exploded view in perspective showing component parts of still other embodiment of the present invention; and

FIG. 12 is a plan view showing electrode structure of the embodiment of FIG. 11.

FIG. 4 is an exploded view in perspective showing component parts of an embodiment of a fluorescent display apparatus according to the present invention. Referring to the figure, 1a denotes a display portion in a planar form having 16 fluorescent display portions 8, 1b denotes a frame member constituting the side walls of the fluorescent display apparatus, 14 denotes a planar electrode as a first control electrode having 16 openings 15 made therein, and 1c denotes a substrate with cathodes 4, second and third control electrodes 10, 12, wiring conductors as signal lines 11, 13 therefor formed thereon. The fluorescent display apparatus is assembled by having the planar electrode 14 disposed in the space surrounded by the frame member 1b, attaching the display portion 1a to one side of the frame member 1b, and attaching the substrate 1c to the other side of the frame member 1b.

The display portion 1a has 16 fluorescent display portions 8 arranged in a matrix (four rows by four columns) and coated with fluorescent material. Each fluorescent display portion 8 is applied with a high voltage and emits light when bombarded by thermoelectrons. The planar electrode 14 is provided with 16 openings 15 made therein, arranged in a matrix (four rows by four columns), at the positions corresponding to their respective fluorescent display portions 8.

FIG. 5 is a plan view showing the electrode arrangement on the substrate 1c, in which the horizontal direction corresponds to the direction of the row and the vertical direction corresponds to the direction of the column. In the center of the substrate 1c, there is formed an exhaust hole 2 as the passage for evacuating air from the interior of

the fluorescent display apparatus. There are provided eight directly heated, elongated cathodes 4 disposed slightly separated from the surface of the substrate 1c. As each cathode 4 is heated by electric current passed therethrough, thermoelectrons are emitted from the cathode 4. At the portions on the surface of the substrate 1c below each of the cathodes 4, there are formed eight data electrodes 10 in an array of two rows by four columns as second control electrodes for controlling the emission of the thermoelectrons from the cathodes 4. Each data electrode 10 controls the emission of the thermoelectrons from each of the corresponding cathodes 4 by being applied with a positive or negative potential relative to the potential of the cathode 4. On the surface of the substrate 1c and at both sides of each of the data electrodes 10 in the direction of the column, there are formed 16 scanning electrodes 12 as third control electrodes arranged in a matrix of four rows by four columns for controlling the progression of the thermoelectrons emitted from the cathode 4. The data electrode 10 has a smaller surface area than the scanning electrode 12. The eight data electrodes 10 are grouped in four columns, each column being connected to a respective wiring conductor 11 as column signal line. The 16 scanning electrodes 12 are grouped in four rows, each row being connected to a respective wiring conductor 13 as row signal line crossing the wiring conductors 11 at right angles. The wiring conductors 11 and the wiring conductors 13 are electrically isolated from another by means of an insulating layer so as not to contact each other through. And, these data electrodes 10, scanning electrodes 12, wiring conductors 11, and wiring conductors 13 are printed on the surface of the substrate 1c.

Below will be described the operation of the apparatus. Referring to FIG. 5, S_1 , S_2 , S_3 , and S_4 denote scanning signals to be applied, respectively, to four scanning electrodes 12 each in the direction of the row, while D_1 , D_2 , D_3 and D_4 denote data signals to be applied, respectively, to four data electrodes 10 each in the direction of the column. FIG. 6 is for showing time of application of these signals $S_1 - S_4$ and $D_1 - D_4$. And, FIG. 7 is for showing the arrangement of the fluorescent display portions 8 formed in a matrix on the display portion 1a, wherein the fluorescent display portions 8 are controlled in their emission of light by the control of the signals $S_1 - S_4$ and $D_1 - D_4$.

The operation for controlling the emission of light will be described below.

ON (positive) or OFF (negative) state of each of the data electrodes 10 and ON (positive) or OFF (negative) state of each of the scanning electrodes 12 are controlled by the timing of application of the

data signals and the scanning signals. With regard to the ON or OFF state of the scanning electrode 12 and the ON or OFF state of the data electrode 10, there are four cases: the case where both the scanning electrode 12 and the data electrode 10 are in the ON state, where the scanning electrode 12 is in the ON state and the data electrode 10 is in the OFF state, where the scanning electrode 12 is in the OFF state and the data electrode 10 is in the ON state, and where both the scanning electrode 12 and the data electrode 10 are in the OFF state. The condition of emission of light by the fluorescent display portion 8 in each case will be described below. FIGS. 8 and 9 are schematic diagrams showing states of potential in these four cases.

① Where both the scanning electrode 12 and the data electrode 10 are in the ON state:

The electric field in the vicinity of the heated cathode 4 becomes positive on account of the electric field of the data electrode 10 and the scanning electrode 12 and hence thermoelectrons are emitted. The emitted thermoelectrons are deflected by the electric field of the scanning electrode 12 and accelerated by the planar electrode 14 to advance to the corresponding fluorescent display portion 8 and bombard it. Then, the thermoelectrons coming into contact with the fluorescent material causes the fluorescent display portion 8 to emit light (FIG. 8 ①).

② where the scanning electrode 12 is in the ON state and the data electrode 10 is in the OFF state:

Since the data electrode 10 is formed closer to the cathode 4, the electric field of the data electrode 10 affects the cathode 4 more strongly. Hence, in this case, the electric field in the vicinity of the cathode 4 becomes negative so that the emission of the thermoelectrons from the cathode 4 is restrained and the fluorescent display portion 8 does not emit light (FIG. 9 ②).

③ where the scanning electrode 12 is in the OFF state and the data electrode 10 is in the ON state:

Although the data electrode 10 is positive, both the scanning electrodes 12 formed on both sides of the data electrode 10 are negative, and moreover, the scanning electrode 12 is larger in surface area than the data electrode 10, and hence the electric field in the vicinity of the cathode 4 becomes negative so that the emission of the thermoelectrons from the cathode 4 is restrained and the fluorescent display portion 8 does not emit light (FIG. 8 ③).

④ where both the scanning electrode 12 and the data electrode 10 are in the OFF state:

The electric field in the vicinity of the cathode 4 becomes negative so that the emission of

the thermoelectrons from the cathode 4 is restrained and the fluorescent display portion 8 does not emit light (FIG. 9 ④).

In the described manner, the emission of light by each of the fluorescent display portions 8 is controlled at will by combination of the potential of the data electrode 10 and the scanning electrode 12. Since, here, the potential of the data electrode 10 and the scanning electrode 12 is controlled by the data signals $D_1 - D_4$ and the scanning signals $S_1 - S_4$, it is enabled to have each of the fluorescent display portions 8 emitting light or not at will by the control of these signals.

The relationship in concrete terms between the control of signals and the control of light emission in each of the fluorescent display portions 8 will now be described according to Fig. 7. First, when the scanning signal S_1 is ON, fluorescent display portions $P_{11} - P_{14}$ are selected, and according to ON/OFF states of the data signals $D_1 - D_4$, the corresponding fluorescent display portions 8 are chosen whether or not to emit light. Then, upon turning ON of the signal S_2 , the fluorescent display portions $P_{21} - P_{24}$ are selected and, according to ON/OFF states of the data signals $D_1 - D_4$, similarly to the above, the corresponding fluorescent display portions 8 are chosen whether or not to emit light. Upon turning ON of the signals S_3, S_4 , similarly to the above, corresponding fluorescent display portions 8 according to ON/OFF states of the data signals $D_1 - D_4$ are chosen whether or not to emit light. Thus, by the application of the timing signals as shown in FIG. 6, the conditions of the fluorescent display portions 8 whether or not to emit light can be controlled at will.

By the construction and the control of the fluorescent display apparatus described above, the number of the cathodes can decrease by half and the power consumption can also be made smaller as compared with the prior art fluorescent display apparatus.

FIG. 10 is another embodiment of the present invention wherein the cathodes are arranged in the column direction. Thus arrangement, as the cathode length is longer than that in Fig. 4 wherein the cathodes are arranged in the row direction, the emission efficiency of the thermoelectrons is better and the power consumption can furthermore decrease.

FIGS. 11 and 12 show another embodiment of the fluorescent display apparatus of the present invention having display portions which are arranged in four rows by four columns.

FIG. 11 is an exploded view showing the electrode arrangement on the substrate 1c, in which the horizontal direction corresponds to the direction of the row and the vertical direction corresponds to the direction of the column. In the center of the

substrate 1c, there is formed an exhaust hole 2 as the passage for evacuating air from the interior of the fluorescent display apparatus. There are provided four directly heated, elongated cathodes 4 disposed slightly separated from the surface of the substrate 1c. As each cathode 4 is heated by electric current passed therethrough, thermoelectrons are emitted from the cathode 4. At the portions on the surface of the substrate 1c below each of the cathodes 4, there are formed eight data electrodes 10 as second control electrodes for controlling the emission of the thermoelectrons from the cathodes 4 in an array of two rows by four columns. Each data electrode 10 controls the emission of the thermoelectrons from each of the corresponding cathodes 4 by being applied with a positive or negative potential relative to the potential of the cathode 4. On the surface of the substrate 1c and at both sides of each of the data electrodes 10 in the direction of the column, there are formed eight double scanning electrodes 12 as third control electrodes for controlling the progression of the thermoelectrons emitted from the cathode 4 arranged in a matrix of four rows by two double columns. The data electrode 10 has smaller surface area than the scanning electrode 12. The eight data electrodes 10 are grouped in four columns, each being connected to a respective wiring conductor 11. The eight scanning electrodes 12 are grouped in four rows, each row being connected to a respective wiring conductor 13 crossing the wiring conductors 11 at right angles. The wiring conductors 11 and the wiring conductors 13 are electrically isolated from another by means of an insulating layer so as not to contact each other. And, these data electrodes 10, scanning electrodes 12, wiring conductors 11, and wiring conductors 13 are printed on the surface of the substrate 1c.

The operation of the fluorescent display apparatus thus constructed is the same as that of FIG. 4. By the above construction of the fluorescent display apparatus, the number of cathodes can decrease to a quarter and the power consumption can also be made smaller as compared with the prior art fluorescent display apparatus.

According to the present invention, the control electrodes are arranged in a matrix, light emitting conditions of the fluorescent display portions 8 are controlled for each row by the scanning signal, and the light emitting conditions of the fluorescent display portions 8 for each column are controlled by the data signal, and therefore, the peripheral circuits for the control electrodes can be made smaller in number as compared with the prior art fluorescent display apparatus wherein the fluorescent display portions 8 are individually controlled for emitting light.

Further, the data electrodes, scanning electrodes, and wiring conductors for these electrodes are formed on the same surface by printing, and hence the internal structure can be made simpler.

Although the present embodiment was described above as to its case where four rows by four columns, but these are not limitative. Even if more numbers of row and column are used, similar arrangements as above can of course be realized.

According to the present invention as described above in detail, cathodes in a elongated form are used, and besides, a single cathode is arranged to be commonly used for two or four, or further more fluorescent display portions, and hence the power consumption can be kept lower.

Further, since the number of peripheral circuits of the control electrodes is reduced on account of the arrangement that emission of light by the fluorescent display portions arranged in a matrix is controlled for each row and each column, the effect is obtained that the internal structure of the fluorescent display apparatus can be made simpler.

Claims

1. A fluorescent display apparatus consisting of a plurality of display elements arranged in a common vacuum chamber, each display element containing a cathode (4) for emitting thermoelectrons, an arrangement of control electrodes (14, 10, 12) for controlling the flow of the emitted thermoelectrons, and a fluorescent display portion (8) coated with fluorescent material and emitting light upon being bombarded by the thermoelectrons; characterized in that said fluorescent display portions (8) are arranged in a matrix of rows and columns to form a display screen (1a); that said cathodes (4) are of elongated form oriented in the direction of the row or column and supported on a substrate (1c) to oppose said display screen (1a), the cathodes (4) being arranged in an array of rows and columns, in which each cathode (4) is provided for two of said fluorescent display portions (8); and that said arrangement of electrodes (14, 10, 12) for controlling the flow of the emitted thermoelectrons is made up of
 - a first control electrode (14) in planar form disposed between said display screen (1a) and said cathodes (4) and having openings (15) made therein corresponding to said fluorescent display portions (8) of said display screen (1a),
 - second control electrodes (10) disposed on the substrate (1c) near said cathodes (4) and arranged in an array of rows and



substrate 1c, there is formed an exhaust hole 2 as the passage for evacuating air from the interior of the fluorescent display apparatus. There are provided four directly heated, elongated cathodes 4 disposed slightly separated from the surface of the substrate 1c. As each cathode 4 is heated by electric current passed therethrough, thermoelectrons are emitted from the cathode 4. At the portions on the surface of the substrate 1c below each of the cathodes 4, there are formed eight data electrodes 10 as second control electrodes for controlling the emission of the thermoelectrons from the cathodes 4 in an array of two rows by four columns. Each data electrode 10 controls the emission of the thermoelectrons from each of the corresponding cathodes 4 by being applied with a positive or negative potential relative to the potential of the cathode 4. On the surface of the substrate 1c and at both sides of each of the data electrodes 10 in the direction of the column, there are formed eight double scanning electrodes 12 as third control electrodes for controlling the progression of the thermoelectrons emitted from the cathode 4 arranged in a matrix of four rows by two double columns. The data electrode 10 has smaller surface area than the scanning electrode 12. The eight data electrodes 10 are grouped in four columns, each being connected to a respective wiring conductor 11. The eight scanning electrodes 12 are grouped in four rows, each row being connected to a respective wiring conductor 13 crossing the wiring conductors 11 at right angles. The wiring conductors 11 and the wiring conductors 13 are electrically isolated from another by means of an insulating layer so as not to contact each other. And, these data electrodes 10, scanning electrodes 12, wiring conductors 11, and wiring conductors 13 are printed on the surface of the substrate 1c.

The operation of the fluorescent display apparatus thus constructed is the same as that of FIG. 4. By the above construction of the fluorescent display apparatus, the number of cathodes can decrease to a quarter and the power consumption can also be made smaller as compared with the prior art fluorescent display apparatus.

According to the present invention, the control electrodes are arranged in a matrix, light emitting conditions of the fluorescent display portions 8 are controlled for each row by the scanning signal, and the light emitting conditions of the fluorescent display portions 8 for each column are controlled by the data signal, and therefore, the peripheral circuits for the control electrodes can be made smaller in number as compared with the prior art fluorescent display apparatus wherein the fluorescent display portions 8 are individually controlled for emitting light.

Further, the data electrodes, scanning electrodes, and wiring conductors for these electrodes are formed on the same surface by printing, and hence the internal structure can be made simpler.

Although the present embodiment was described above as to its case where four rows by four columns, but these are not limitative. Even if more numbers of row and column are used, similar arrangements as above can of course be realized.

According to the present invention as described above in detail, cathodes in a elongated form are used, and besides, a single cathode is arranged to be commonly used for two or four, or further more fluorescent display portions, and hence the power consumption can be kept lower.

Further, since the number of peripheral circuits of the control electrodes is reduced on account of the arrangement that emission of light by the fluorescent display portions arranged in a matrix is controlled for each row and each column, the effect is obtained that the internal structure of the fluorescent display apparatus can be made simpler.

Claims

1. A fluorescent display apparatus consisting of a plurality of display elements arranged in a common vacuum chamber, each display element containing a cathode (4) for emitting thermoelectrons, an arrangement of control electrodes (14, 10, 12) for controlling the flow of the emitted thermoelectrons, and a fluorescent display portion (8) coated with fluorescent material and emitting light upon being bombarded by the thermoelectrons; characterized in that said fluorescent display portions (8) are arranged in a matrix of rows and columns to form a display screen (1a); that said cathodes (4) are of elongated form oriented in the direction of the row or column and supported on a substrate (1c) to oppose said display screen (1a), the cathodes (4) being arranged in an array of rows and columns, in which each cathode (4) is provided for two of said fluorescent display portions (8); and that said arrangement of electrodes (14, 10, 12) for controlling the flow of the emitted thermoelectrons is made up of
 - a first control electrode (14) in planar form disposed between said display screen (1a) and said cathodes (4) and having openings (15) made therein corresponding to said fluorescent display portions (8) of said display screen (1a),
 - second control electrodes (10) disposed on the substrate (1c) near said cathodes (4) and arranged in an array of rows and



columns, in which each thereof corresponds to one of said cathodes (4), and
 - third control electrodes (12) disposed on the substrate (1c) on two sides of said second control electrodes (10) in the direction of the column, in which two thereof correspond to one of said cathodes (4).

2. Display apparatus according to claim 1, wherein at least two of the third control electrodes (12) of the same row are combined with another in each row.
3. Display apparatus according to claim 1 or 2, wherein said second and third control electrodes (10, 12) and wiring conductors (11, 13) are all formed on the same surface of the substrate (1c) by printing.
4. Display apparatus according to any of claims 1 to 3, wherein the second control electrodes (10) of each column are connected to column signal lines (11), while the third control electrodes (12) of each row are connected to row signal lines (13) crossing said column signal lines (11) at right angles.
5. Display apparatus according to any of claims 1 to 4, wherein the cathodes (4) are supported on the substrate (1c) between the second control electrodes (10) and the first control electrode (14).

Patentansprüche

1. Fluoreszenz-Anzeigevorrichtung mit einer Mehrzahl von Anzeigeelementen, die in einer gemeinsamen Vakuumkammer angeordnet sind, wobei jedes Anzeigeelement eine Kathode (4) zum Ermitteln von Thermoelektronen, eine Anordnung von Steuerelektroden (14, 10, 12) zur Steuerung des Thermoelektronenflusses und einen Fluoreszenz-Anzeigeabschnitt (8) aufweist, der mit fluoreszierendem Material beschichtet ist und beim Auftreffen von Thermoelektronen aufleuchtet; dadurch gekennzeichnet, daß die Fluoreszenz-Anzeigeabschnitte (8) in einer Matrix von Zeilen und Spalten angeordnet sind, um einen Anzeigeschirm (1a) zu bilden; daß die Kathoden (4) in langgestreckter Form ausgebildet, in Richtung der Zeilen oder Spalten ausgerichtet und gegenüber dem Anzeigeschirm (1a) auf einem Substrat (1c) gehalten sind, wobei die Kathoden (4) in einer Anordnung von Zeilen und Spalten angeordnet sind und jede Kathode (4) zwei Fluoreszenz-Anzei-

geabschnitten (8) zugeordnet ist; und daß die Anordnung von Steuerelektroden (14, 10, 12) zur Steuerung des Thermoelektronenflusses folgende Steuerelektroden aufweist:

- eine erste Steuerelektrode (14) in planarer Form, die zwischen dem Anzeigeschirm (1a) und den Kathoden (4) angeordnet ist und mit Öffnungen (15) versehen ist, die mit den Fluoreszenz-Anzeigeabschnitten (8) auf dem Anzeigeschirm (1a) korrespondieren,
- zweite Steuerelektroden (10), die auf dem Substrat (1c) in der Nähe der Kathoden (4) in einer Anordnung von Zeilen und Spalten angeordnet sind, wobei jede der zweiten Steuerelektroden einer der Kathoden (4) zugeordnet ist, und
- dritte Steuerelektroden (12), die auf dem Substrat zu beiden Seiten der zweiten Steuerelektroden (10) in Zeilenrichtung angeordnet sind, wobei zwei dieser dritten Steuerelektroden einer der Kathoden (4) zugeordnet sind.

2. Anzeigevorrichtung nach Anspruch 1, dadurch gekennzeichnet, daß mindestens zwei der dritten Steuerelektroden (12) derselben Zeile miteinander in der Zeile kombiniert sind.

3. Anzeigevorrichtung nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß die zweiten und dritten Steuerelektroden (10, 12) sowie die Anschlußdrähte (11, 13) alle auf derselben Fläche des Substrats (1c) durch Aufdrucken aufgebracht sind.

4. Anzeigevorrichtung nach einem der Ansprüche 1 bis 3, dadurch gekennzeichnet, daß die zweiten Steuerelektroden (10) jeder Spalte mit Spaltensignalleitungen (11) und die dritten Steuerelektroden (12) jeder Zeile mit Zeilensignalleitungen (13) verbunden sind, wobei sich die Zeilensignalleitungen und die Spaltensignalleitungen einander im rechten Winkel kreuzen.

5. Anzeigevorrichtung nach einem der Ansprüche 1 bis 4, dadurch gekennzeichnet, daß die Kathoden (4) auf dem Substrat (1c) zwischen den zweiten Steuerelektroden (10) und der ersten Steuerelektrode (14) gehalten sind.

Revendications

1. Appareil d'affichage fluorescent se composant d'une multiplicité d'éléments d'affichage disposés dans une chambre à vide commune, cha-



que élément d'affichage renfermant une cathode (4) ayant pour fonction d'émettre des électrons thermiques, une disposition d'électrodes de commande (14, 10, 12) ayant pour fonction de commander le flux des électrons thermiques émis, et une partie d'affichage fluorescent (8) revêtue d'une matière fluorescente et émettant de la lumière lorsqu'elle est bombardée par les électrons thermiques;

caractérisé en ce que lesdites parties d'affichage fluorescent (8) sont disposées suivant une matrice de rangées et de colonnes pour former un écran d'affichage (1a); en ce que lesdites cathodes (4) sont de forme allongée, orientées dans la direction de la rangée ou de la colonne et supportées sur un substrat (1c) de manière à se trouver en face dudit écran d'affichage (1a), les cathodes (4) étant disposées suivant un ensemble de rangées et de colonnes dans lequel chaque cathode (4) est prévue pour deux desdites parties d'affichage fluorescent (8); et en ce que ladite disposition d'électrodes (14, 10, 12) ayant pour fonction de commander le flux des électrons thermiques émis se compose:

- d'une première électrode de commande (14) de forme plane disposée entre ledit écran d'affichage (1a) et lesdites cathodes (4) et dans laquelle sont pratiquées des ouvertures (15) qui correspondent auxdites parties d'affichage fluorescent (8) dudit écran d'affichage (1a),
- de secondes électrodes de commande (10) placées sur le substrat (1c) à proximité desdites cathodes (4) et disposées suivant un ensemble de rangées et de colonnes, chacune desdites électrodes correspondant à l'une desdites cathodes (4), et
- de troisièmes électrodes de commande (12) disposées sur le substrat (1c) de part et d'autre desdites secondes électrodes de commande (10) dans la direction de la colonne, deux desdites électrodes correspondant à l'une desdites cathodes (4).

2. Appareil d'affichage selon la revendication 1, dans lequel au moins deux des troisièmes électrodes de commande (12) d'une même rangée sont combinées l'une avec l'autre dans chaque rangée.

3. Appareil d'affichage selon la revendication 1 ou 2, dans lequel lesdites secondes et troisièmes électrodes de commande (10, 12) et des fils conducteurs (11, 13) sont tous formés sur la même surface du substrat (1c) par impres-

sion.

4. Appareil d'affichage selon l'une quelconque des revendications 1 à 3, dans lequel les secondes électrodes de commande (10) de chaque colonne sont reliées à des lignes de signaux de colonnes (11), tandis que les troisièmes électrodes de commande (12) de chaque rangée sont reliées à des lignes de signaux de rangées (13) traversant lesdites lignes de signaux de colonnes (11) à angle droit.

5. Appareil d'affichage selon l'une quelconque des revendications 1 à 4, dans lequel les cathodes (4) sont supportées sur le substrat (1c) entre les secondes électrodes de commande (10) et la première électrode de commande (14).