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(54) **ELECTROLUMINESCENT DISPLAY DEVICE**

ELEKTROLUMINESZIERENDE ANZEIGEVORRICHTUNG

DISPOSITIF ELECTROLUMINESCENT D'AFFICHAGE

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WO-A-01/73738 **US-B1- 6 188 375**

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Description

[0001] The invention relates to electroluminescent display devices, for example using organic LED devices such as polymer LEDs.

[0002] Matrix display devices employing electroluminescent, light-emitting, display elements are well known. The display elements may comprise organic thin film electroluminescent elements, for example using polymer materials, or else light emitting diodes (LEDs) using traditional III-V semiconductor compounds. Recent developments in organic electroluminescent materials, particularly polymer materials, have demonstrated their ability to be used practically for video display devices. These materials typically comprise one or more layers of a semiconducting conjugated polymer sandwiched between a pair of electrodes, one of which is transparent and the other of which is of a material suitable for injecting holes or electrons into the polymer layer.

[0003] The polymer material can be fabricated using a CVD process, or simply by a spin coating technique using a solution of a soluble conjugated polymer. Organic electroluminescent materials exhibit diode-like I-V properties, so that they are capable of providing both a display function and a switching function, and can therefore be used in passive type displays. Alternatively, these materials may be used for active matrix display devices, with each pixel comprising a display element and a switching device for controlling the current through the display element.

[0004] Display devices of this type have current-addressed display elements, so that a conventional, analogue drive scheme involves supplying a controllable current to the display element. It is known to provide a current source transistor as part of the pixel configuration, with the gate voltage supplied to the current source transistor determining the current through the display element. A storage capacitor holds the gate voltage after the addressing phase. However, different transistor characteristics across the substrate give rise to different relationships between the gate voltage and the source-drain current, and artefacts in the displayed image result.

[0005] Digital drive schemes have also been proposed. In such schemes, the LED device is effectively driven to two possible voltage levels. This reduces the power consumption in the pixel circuit, because a transistor is no longer required to operate in the linear region as a current source. Instead, all transistors can be fully on or fully off, which reduces power consumption. Such a drive scheme is less sensitive to transistor characteristic variations for the same reason. This approach only gives two possible pixel outputs. However, grey scale pixel outputs can be achieved by a number of methods.

[0006] In one approach, pixels can be grouped to form larger pixels. Pixels within the group can be addressed independently, so that a grey scale is produced which is a function of the number of pixels within the group activated. In the following description, this will be referred to as the area ratio method. A drawback of this approach is the reduced resolution of the display and the increased pixel complexity.

[0007] In an alternative approach, pixels can be turned on and off more quickly than the frame rate, so that a grey scale is implemented as function of the duty cycle with which the pixel is turned on. In the following description, this will be referred to as the time ratio method. For example, a frame period may be divided into sub-frame periods in the ratio 1:2:4 (giving 8 evenly spaced grey scale values). This increases the required driving capability (or else requires a reduction in the frame rate), and therefore increases the cost of the display.

[0008] WO 01/73738 discloses an electroluminescent display arrangement in which each pixel is divided into (four) sub-pixels. Each sub-pixel is provided with a different supply voltage, so that each sub-pixel has different brightness. A grey scale can thus be produced from binary control of each sub-pixel.

[0009] US 6 188 375 discloses an electroluminescent display arrangement in which a duty cycle control scheme is used to provide a grey scale output, by switching off a drive transistor at a time which is dependent on the pixel data. This approach also uses driving of the display element with ac pulses.

[0010] The invention is set forth in attached claims 1 and 8.

[0011] This device enables a digital drive scheme to be implemented, in which the EL display element is either supplied with a constant supply voltage or is turned off. This enables a low power drive circuit to be implemented, which also does not suffer from variations in switching device characteristics over the display substrate. The provision of a plurality of different supply voltages enables a grey scale to be implemented without requiring time or area ratio systems to be employed. Alternatively, the device of the invention can allow time or area ratio techniques to be improved.

[0012] Preferably, the switching device comprises a thin film transistor coupled between supply voltage lines and the EL display element, the transistor being driven substantially fully on or off by the pixel drive signal. This is one pixel design for providing the digital drive scheme.

[0013] There may be three supply voltage lines, for example with the voltages on the three supply voltage being in the ratio 1:2:4. Whilst this only provides three different grey levels, these three supply voltage levels can be used in conjunction with time or area ratio techniques to increase the number of grey scales without further penalties (in resolution or in speed).

[0014] In another embodiment, one of the plurality of supply voltages may be such that the EL display element is off. This may be desired when combining the multiple supply voltage feature with an area ratio technique. In particular, a plurality of groups of pixels may be defined, with all pixels in a group sharing a common pixel drive signal conductor. Thus, a group of pixels is effectively a single sub-pixellated pixel, which is driven by a single

pixel drive signal. However, a supply voltage can be selected independently for each pixel within the group. In this way, the number of grey scales which can be provided by the sub-pixellation is increased.

[0015] The display device of the invention may be used in a portable device, such as a mobile phone.

[0016] In this method, a digital drive scheme is implemented, because a first drive signal either turns the pixel on or off, and does not need to encode brightness level information. However, the power supply level within the pixel is used to create a grey scale.

[0017] A second drive signal is preferably supplied to the pixel for selecting the one of the plurality of supply voltage levels. In this way, the power can be selected for each pixel. Alternatively, all pixels may be driven to different powers in turn, so that a time ratio method is implemented.

[0018] The first drive signal is preferably supplied to an address transistor of the pixel and causes a drive transistor of the pixel to be turned on or off, thereby operating the pixel in a digital mode. The second drive signal is preferably supplied to a power line selection circuit.

[0019] This method may be combined with a conventional area ratio method. Thus, a shared first drive signal can be supplied to a group of pixels, and wherein individual second drive signals are supplied to the pixels in the group. The group of pixels is effectively a single master pixel, and the individual pixels of the group are then effectively sub-pixels. So that all sub-pixels of the group can be addressed by a signal drive signal (even though some sub-pixels may need to be turned on and others turned off at any point in time), one of the plurality of supply voltages levels is preferably for turning the pixel off. In this way, a sub-pixel can be turned off even though the master pixel group is addressed. This reduces the number of conductors required to drive the sub-pixels.

[0020] The method may additionally (or alternatively) be combined with a time ratio method. Thus, all pixels of the display may be addressed in a frame, and wherein each frame comprises a number of sub-frames. Different supply voltage levels can then be selected for different sub-frames. This enables the conventional binary scale of sub-frame times (for example 1:2:4) to be altered, in particular to avoid the need for a very short first sub-frame. For example, the sub-frames may be of equal duration.

[0021] When the method of the invention is combined with the time ratio method, this can be achieved without any change to a conventional pixel design, and all hardware changes can be in the driving circuitry, to ensure that a different supply voltage is generated for the different pixel sub-frames.

[0022] Embodiments of display devices in accordance with the invention will now be described, by way of example, with reference to the accompanying drawings, in which:-

Figure 1 shows an EL display device according to the invention;

Figure 2 is a simplified schematic diagram of a known pixel circuit for current-addressing an EL display pixel;

Figure 3 shows a first example of pixel circuit according to the invention;

Figure 4 shows how the pixel circuit of the invention can be used in combination with an area ratio grey scale drive scheme;

Figure 5 shows a simplification to Figure 4; and

Figure 6 shows a mobile telephone using the display of the invention.

[0023] Referring to Figure 1, an active matrix addressed electroluminescent display device comprises a panel having a row and column matrix array of regularly-spaced pixels, denoted by the blocks 1 and comprising electroluminescent display elements 2 together with associated switching means, located at the intersections between crossing sets of row (selection) and column (data) address conductors 4 and 6. Only a few pixels are shown in the Figure for simplicity. In practice there may be several hundred rows and columns of pixels. The pixels 1 are addressed via the sets of row and column address conductors by a peripheral drive circuit comprising a row, scanning, driver circuit 8 and a column, data, driver circuit 9 connected to the ends of the respective sets of conductors.

[0024] The electroluminescent display element 2 comprises an organic light emitting diode, represented here as a diode element (LED) and comprising a pair of electrodes between which one or more active layers of organic electroluminescent material is sandwiched. The display elements of the array are carried together with the associated active matrix circuitry on one side of an insulating support. Either the cathodes or the anodes of the display elements are formed of transparent conductive material. The support is of transparent material such as glass and the electrodes of the display elements 2 closest to the substrate may consist of a transparent conductive material such as ITO so that light generated by the electroluminescent layer is transmitted through these electrodes and the support so as to be visible to a viewer at the other side of the support. Typically, the thickness of the organic electroluminescent material layer is between 100 nm and 200nm. Typical examples of suitable organic electroluminescent materials which can be used for the elements 2 are known and described in EP-A-0 717446. Conjugated polymer materials as described in WO96/36959 can also be used.

[0025] Figure 2 shows in simplified schematic form a known pixel and drive circuitry arrangement. Each pixel 1 comprises the EL display element 2 and associated driver circuitry. The driver circuitry has an address transistor 16 which is turned on by a row address pulse on the row conductor 4. When the address transistor 16 is turned on, a voltage on the column conductor 6 can pass to the remainder of the pixel. In particular, the address

transistor 16 supplies the column conductor voltage to a current source 20, which comprises a drive transistor 22 and a storage capacitor 24. The column voltage is provided to the gate of the drive transistor 22, and the gate is held at this voltage by the storage capacitor 24 even after the row address pulse has ended.

[0026] In order to drive the pixel digitally, the possible gate voltages on the drive transistor 22 in combination with the voltage on the power rail 26 supplying the current source 20 are selected such that the transistor is fully turned on or off. When fully turned on, there is almost no voltage drop across the drive transistor 22, and the voltage on the supply rail 26 is effectively provided on the display element 2. The voltage on the column conductor 6 is used to select one of two possible drive voltages for the display element 2. In order to address the drive transistor fully on or fully off, gate voltages of either 0V or 10V may for example be applied across the capacitor.

[0027] In accordance with the invention, a number of different voltages can be provided on the power rail 26. The power rail voltage can then be used to vary the brightness of the LED. This enables the low power consumption of a fully turned on or off drive transistor to be maintained as well as the independence of the brightness on the driving TFT characteristics.

[0028] Figure 3 shows one possible implementation of the pixel circuit to obtain the operation described above. The pixel circuit of the invention is shown as an improvement to the known pixel design of Figure 2, and the same reference numbers are used to denote the same components.

[0029] The pixel circuit of the invention has a group 30 of voltage supply lines, for example three as shown in Figure 3. The voltage from a selected one of the lines 30 is switched by the drive transistor 22 to the EL display element 2. A digital drive scheme is implemented, in that the drive transistor is driven fully on or off, but a number of different output levels, corresponding to the number of voltage lines 30, can be selected. Thus, a grey scale can be implemented without requiring time or area ratio systems to be employed. Alternatively, the device of the invention can allow time or area ratio techniques to be improved, as will be discussed below. The voltages on the supply lines 30 can easily be generated very accurately with hardware external to the main display device substrate.

[0030] In order to select one of the supply voltage lines 30, each pixel has a multiplexer 32 (or other power line selection circuit) which is controlled using a control line 34.

[0031] The multiplexer 32 can be implemented in a number of ways. The simplest method is to use a simple array of transistor switches in parallel between the power lines and the drive transistor, with one switch associated with each of the power lines 30. This requires a control line for each transistor (so that one is turned on and the others are turned off), which is realistic for a small number of power lines.

[0032] The number of select lines can be reduced by using different types of transistor for different power lines. For example, the power lines can be in pairs, with a n-type transistor coupling one of the lines to the drive transistor and a p-type transistor coupling the other of the lines to the drive transistor. For example, a single select line can then control power lines 30 in which there are two power lines.

[0033] In one example, the voltages on three supply voltage lines are in the ratio 1:2:4. This provides three different grey levels, without requiring area or time ratio techniques. However, the multiple voltage level pixel of the invention is preferably combined with time or area ratio techniques, to provide an increase in the number of grey scales without further penalties (in resolution or in speed).

[0034] Figure 4 shows three pixels 1, each provided with a multiplexer circuit 32 controlled by a respective second drive signal line 34. The three pixels comprise sub-pixels of a larger pixel, so that the combined output can define grey levels (in conventional manner). However, the combination of the multiple voltage levels with the three sub-pixel design increases the number of grey levels from 3 to 11 (if the ratio of the voltages on the supply lines is 1:2:4, as combined voltages of 1-10 and 12 can be obtained). If a different ratio on the voltage supply lines is used, even more grey levels can be achieved.

[0035] In the example of Figure 4, each sub-pixel is provided with the two pixel drive lines 6,34, so that each sub-pixel effectively has four levels (off and the three voltage levels).

[0036] In the example of Figure 5, one of the plurality of supply voltages may be such that the EL display element is off, for example zero Volts. Figure 5 again shows three sub-pixels of a larger pixel. In this example, all pixels in the group share a common pixel drive signal conductor 6, so that all sub-pixels are turned on or off together. However, a supply voltage can be selected independently for each pixel within the group, so that each pixel has a second drive signal conductor 34. This reduces the number of column conductors, although it does reduce the number of levels of each sub-pixel to three (off and the two other voltage levels).

[0037] The invention may also be combined with a time ratio method. Thus, all pixels of the display may be addressed in a number of sub-frames which together make up a frame. The time ratio method conventionally uses sub-frame periods in the ratio 1:2:4 to gain the maximum number of evenly spaced grey levels. The invention can be used to avoid the very short first sub-frame period and the very long last sub-frame period. In particular, different supply voltage levels can be selected for different sub-frames. For example, the sub-frames may be of equal duration, and then by stepping the power supply voltages in the same ratio of 1:2:4, the same grey scale resolution can be achieved, but avoiding the short first sub-frame. By increasing the length of the first sub-frame, it is less susceptible to timing errors which cause errors with low

brightness values, which are most obvious to the viewer.

[0038] The time ratio and area ratio schemes may both be combined, to produced many more grey scales. In a preferred design, three (or more) sub-pixels would operate with three (or more) sub-frames of equal length, with the power rail stepped to give light output power per sub-frame in the ratio 1:2:4.

[0039] In one version, the power for all three sub-pixels of all pixels can be switched together. This does not have the flexibility of individually switching sub-pixels. However, it has the advantage that the system can be implemented entirely in the driving hardware and so does not require a specific pixel circuit. In a comparative example, a conventional pixel circuit can be used, and the voltage supply line for the entire display is driven to the desired voltage for the particular sub-frame at that time. Thus, the selected supply voltage is supplied to the pixels of the display by a driver circuit external to the array of pixels.

[0040] The display device of the invention may be used in a portable device, such as a mobile phone. Figure 6 shows a mobile telephone 40 incorporating a display 42 of the invention.

[0041] The pixel circuits described above are only examples of possible pixel structures which can be improved by the invention. In particular, any pixel design for providing a fixed voltage to the EL display element can be improved using the teaching of the invention, either by incorporating a selection circuit into the pixel or else by modifying the external circuitry for providing the supply voltage to the pixels. Other possible pixel configurations will be known to those skilled in the art, and the invention can provide benefits in many different such configurations.

[0042] Specific examples have been given above with three voltage levels. However, one preferred embodiment is to use only two voltage levels. Although the examples above incorporate selective switching of power lines at a pixel level, it may be preferred in many case to maintain a simple pixel layout, and to provide power supply lines which are switched by circuits off the display, for example as described above in connection with a time ratio scheme. For example, the frame period could be divided into two equal sub-frames and the power line set at different values for each.

[0043] From reading the present disclosure, other modifications will be apparent to persons skilled in the art. Such modifications may involve other features which are already known in the field of matrix electroluminescent displays and component parts thereof and which may be used instead of or in addition to features already described herein.

Claims

1. An electroluminescent (EL) display device comprising an array of display pixels (1), each display pixel comprising an EL display element (2) and a pixel driving circuit, wherein the driving circuit comprises a switching device (22) for selectively switching a supply voltage (26) to the EL display element (2) or else substantially isolating the display element (2) from the supply voltage, in response to a pixel drive signal (6), and each pixel comprises a first pixel drive signal conductor (6) for operating the switching device (22),
characterised in that:

   each pixel comprises a multiplexer (32) for selecting the supply voltage line from a plurality of supply voltage lines (30) to enable the supply voltage (26) from the selected supply voltage line to be switched to the EL display element (2) depending on the pixel drive signal for the display element; and
   each pixel comprises second pixel drive signal conductor (34) for controlling the multiplexer to select the one of the plurality of supply voltage lines (30).

2. A display device as claimed in claim 1, wherein the switching device (22) comprises a thin film transistor coupled between supply voltage lines (30) and the EL display element (2), the transistor being driven substantially fully on or off by the pixel drive signal.

3. A display device as claimed in any preceding claim, wherein there are three supply voltage lines (30).

4. A display device as claimed in claim 3, wherein the voltages on the three supply voltage lines (30) are substantially in the ratio 1:2:4.

5. A display device as claimed in any claim 1 or 2, wherein one of the plurality of supply voltages is such that the EL display element is off.

6. A display device as claimed in claim 5, wherein a plurality of groups of pixels are defined, wherein all pixels in each group share a common first pixel drive signal conductor (6), but wherein a supply voltage can be selected independently for each pixel within the group.

7. A portable electronic device (40) comprising a display device as claimed in any preceding claim.

8. A method of driving an electroluminescent (EL) display device comprising an array of pixels (1), each pixel comprising an electroluminescent (EL) display element (2), a first pixel drive signal conductor and a drive circuit, wherein the drive circuit comprises a switching device (22) the method comprising, for each pixel of the display, supplying a first drive signal from the first pixel drive signal conductor (6) to the

switching device of the pixel for selectively switching the switching device of the pixel on or off so that a supply voltage is switched to the EL display (2) element or else is substantially isolated from the EL display element,
characterised in that the method further comprises:

providing a second drive signal from a second pixel drive signal conductor (34) to the pixel thereby to select the supply voltage level from one of a plurality of supply voltage lines (30) using a power line selection circuit (32) in the form of a pixel multiplexer.

9. A method as claimed in claim 8, wherein the second drive signal is supplied to the power line selection circuit (32) of the pixel.

10. A method as claimed in claim 8 or 9, wherein the first drive signal is supplied to an address transistor (16) of the pixel and causes a drive transistor (22) of the pixel to be turned on or off.

11. A method as claimed in claim 8 or 9, wherein a shared first drive signal from the first pixel drive signal conductor (6) is supplied to a group of pixels, and wherein individual second drive signals from the second pixel drive signal conductor (34) are supplied to the pixels in the group.

12. A method as claimed in claim 11, wherein one of the plurality of supply voltages levels is for turning the pixel off.

13. A method as claimed in any one of claims 8 to 12, wherein all pixels of the display are addressed in a frame, and wherein each frame comprises a number of sub-frames.

14. A method as claimed in claim 13, wherein different supply voltage levels are selected for different sub-frames.

15. A method as claimed in claim 14, wherein the sub-frames are of equal duration.

16. A method as claimed in any one of claims 13 to 15, wherein the number of sub-frames is three.

Patentansprüche

1. Elektrolumineszierende Anzeigevorrichtung (EL), umfassend eine Anordnung mit Anzeigebildpunkten (1), wobei jeder Anzeigebildpunkt ein EL Anzeigeelement (2) und einen Bildpunktsteuerkreis umfasst, wobei der Steuerkreis eine Schaltungsvorrichtung (22) zur wahlweisen Schaltung einer Versorgungsspannung (26) zum EL Anzeigeelement (2) umfasst oder auf andere Weise das Anzeigeelement (2) von der Versorgungsspannung wesentlich trennt als Antwort auf ein Bildpunktsteuersignal (6), und jeder Bildpunkt eine erste Bildpunkt-Steuersignalleitung (6) zum Betrieb der Schaltungsvorrichtung (22) umfasst,
dadurch gekennzeichnet dass,
jeder Bildpunkt einen Multiplexer (32) zur Auswahl der Versorgungsspannungsleitung aus einer Vielzahl von Versorgungsspannungsleitungen (30) umfasst, um die Versorgungsspannung (26) von der ausgewählten Versorgungsspannungsleitung, die zum elektrolumineszierenden Anzeigeelement (2) geschaltet ist, in Abhängigkeit von dem Bildpunktsteuersignal für das Anzeigeelement, anzulegen; und
jeder Bildpunkt eine zweite Bildpunkt-Steuersignalleitung (34) zur Kontrolle des Multiplexers umfasst, um eine der Vielzahl von Versorgungsspannungsleitungen (30) auszuwählen.

2. Anzeigevorrichtung nach Anspruch 1, wobei die Schaltungsvorrichtung (22) einen Dünnschicht-Transistor, der zwischen die Versorgungsspannungsleitungen (30) und dem EL Anzeigeelement (2) angekoppelt ist, umfasst, wobei der Transistor im Wesentlichen vollständig durch das Bildpunktsteuersignal an- oder ausgeschaltet wird.

3. Anzeigevorrichtung nach einem der vorhergehenden Ansprüche, wobei drei Versorgungsspannungsleitungen (30) vorhanden sind.

4. Anzeigevorrichtung nach Anspruch 3, wobei die Spannungen der drei Versorgungsspannungsleitungen (30) ein Verhältnis von im Wesentlichen 1:2:4 aufweisen.

5. Anzeigevorrichtung nach Anspruch 1 oder 2, wobei eine der Vielzahl von Versorgungsspannungen so ist, dass das EL Anzeigeelement (2) ausgeschaltet ist.

6. Anzeigevorrichtung nach Anspruch 5, wobei eine Vielzahl von Gruppen aus Bildpunkten festgelegt ist, wobei alle Bildpunkte in jeder Gruppe eine gemeinsame erste Bildpunkt-Steuersignalleitung (6) teilen, wobei aber eine Versorgungsspannung für jeden Bildpunkt innerhalb der Gruppe unabhängig ausgewählt werden kann.

7. Tragbare elektronische Vorrichtung (40), umfassend eine Anzeigevorrichtung nach einem der vorhergehenden Ansprüche.

8. Verfahren zur Steuerung einer elektrolumineszie-

renden (EL) Anzeigevorrichtung (EL), welche eine Anordnung mit Anzeigebildpunkten (1) umfasst, wobei jeder Anzeigebildpunkt ein EL Anzeigeelement (2), eine erste Bildpunkt-Steuersignalleitung und einen Steuerkreis umfasst, wobei der Steuerkreis eine Schaltungsvorrichtung (22) umfasst,
das Verfahren umfassend, für jeden Bildpunkt der Anzeige,
Bereitstellen eines ersten Steuersignals von der ersten Bildpunkt-Steuersignalleitung (6) an die Schaltungsvorrichtung des Bildpunktes für das wahlweise Ein- oder Ausschalten der Schaltungsvorrichtung des Bildpunktes, so dass eine Versorgungsspannung zum EL Anzeigeelement (2) geschaltet ist oder auf andere Weise von dem EL Anzeigeelement (2) wesentlich getrennt ist,
dadurch gekennzeichnet, dass das Verfahren ferner umfasst:

Bereitstellen eines zweiten Steuersignals (34) von einer zweiten Bildpunkt-Steuersignalleitung zum Bildpunkt, wodurch die Höhe der einen Versorgungsspannung aus einer Vielzahl von Versorgungsspannungsleitungen (30) ausgewählt wird, indem ein Stromleitungsauswahlkreis (32) in Form eines Bildpunkt-Multiplexers verwendet wird.

9. Verfahren nach Anspruch 8, wobei das zweite Steuersignal an den Stromleitungsauswahlkreis (32) des Bildpunktes bereitgestellt wird.

10. Verfahren nach einem der Ansprüche 8 oder 9, wobei das erste Steuersignal an einen Adressierungstransistor (16) des Bildpunktes bereitgestellt wird und bewirkt, dass ein Steuerungstransistor (22) des Bildpunktes an- oder ausgeschaltet wird.

11. Verfahren nach einem der Ansprüche 8 oder 9, wobei ein gemeinsames erstes Steuersignal von der ersten Bildpunkt-Steuersignalleitung (6) an eine Gruppe von Bildpunkten bereitgestellt wird, und wobei einzelne zweite Steuersignale von der zweiten Bildpunkt-Steuersignalleitung (34) an die Bildpunkte in der Gruppe bereitgestellt werden.

12. Verfahren nach Anspruch 11, wobei eine der Vielzahl der Versorgungsspannungshöhen für das Abschalten des Bildpunktes vorgesehen ist.

13. Verfahren nach einem der Ansprüche 8 bis 12, wobei alle Bildpunkte der Anzeige in einem Datenübertragungsblock adressiert sind und wobei jeder Datenübertragungsblock eine Anzahl von Unterdatenübertragungsblöcken umfasst.

14. Verfahren nach Anspruch 13, wobei unterschiedliche Versorgungsspannungshöhen für unterschiedliche Unterdatenübertragungsblöcke ausgewählt werden.

15. Verfahren nach Anspruch 14, wobei die Unterdatenübertragungsblöcke von gleicher Dauer sind.

16. Verfahren nach einem der Ansprüche 13 bis 15, wobei die Anzahl der Unterdatenübertragungsblöcke drei ist.

Revendications

1. Dispositif d'affichage électroluminescent (EL) comprenant un réseau de pixels d'affichage (1), chaque pixel d'affichage comprenant un élément d'affichage EL (2) et un circuit de commande de pixel, dans lequel le circuit de commande comprend un dispositif de commutation (22) afin de commuter de manière sélective une tension d'alimentation (26) vers l'élément d'affichage EL (2) ou bien d'isoler sensiblement l'élément d'affichage (2) de la tension d'alimentation, en réponse à un signal de commande de pixel (6), et chaque pixel comprend un premier conducteur de signal de commande de pixel (6) destiné à mettre en service le dispositif de commutation (22),
caractérisé en ce que :

chaque pixel comprend un multiplexeur (32) destiné à sélectionner la ligne de tension d'alimentation à partir d'une pluralité de lignes de tension d'alimentation (30) de manière à permettre à la tension d'alimentation (26) provenant de la ligne de tension d'alimentation sélectionnée, d'être commutée vers l'élément d'affichage EL (2) selon le signal de commande de pixel de l'élément d'affichage ; et
chaque pixel comprend un second conducteur de signal de commande de pixel (34), commandant le multiplexeur de manière à sélectionner celle de la pluralité de lignes de tension d'alimentation (30).

2. Dispositif d'affichage selon la revendication 1, dans lequel le dispositif de commutation (22) comprend un transistor à couches minces couplé entre les lignes de tension d'alimentation (30) et l'élément d'affichage EL (2), le transistor étant sensiblement entièrement passant ou bloqué par le signal de commande de pixel.

3. Dispositif d'affichage selon l'une quelconque des revendications précédentes, dans lequel il y a trois lignes de tension d'alimentation (30).

4. Dispositif d'affichage selon la revendication 3, dans lequel les tensions présentes sur les trois lignes de tension d'alimentation (30) se trouvent sensiblement

dans un rapport 1:2:4.

5. Dispositif d'affichage selon l'une quelconque des revendications 1 ou 2, dans lequel une tension parmi la pluralité de tensions d'alimentation est telle que l'élément d'affichage EL est éteint.

6. Dispositif d'affichage selon la revendication 5, dans lequel une pluralité de groupes de pixels sont définis, dans lequel tous les pixels de chaque groupe partagent un premier conducteur commun de signal de commande de pixel (6), mais dans lequel une tension d'alimentation peut être sélectionnée indépendamment de chaque pixel à l'intérieur du groupe.

7. Dispositif électronique portable (40) comprenant un dispositif d'affichage selon l'une quelconque des revendications précédentes.

8. Procédé de commande d'un dispositif d'affichage électroluminescent (EL) comprenant un réseau de pixels (1), chaque pixel comprenant un élément d'affichage électroluminescent (EL) (2), un premier conducteur de signal de commande de pixel et un circuit de commande, où le circuit de commande comprend un dispositif de commutation (22), le procédé comprenant, pour chaque pixel de l'affichage, la fourniture d'un premier signal de commande à partir du premier conducteur de signal de commande de pixel (6) au dispositif de commutation du pixel afin de commuter de manière sélective le dispositif de commutation du pixel en service ou hors service de telle sorte qu'une tension d'alimentation soit commutée vers l'élément de l'affichage EL (2) ou bien qu'elle soit sensiblement isolée de l'élément d'affichage EL, **caractérisé en ce que** le procédé comprend en outre :

la fourniture d'un second signal de commande à partir d'un second conducteur de signal de commande de pixel (34) au pixel de manière à sélectionner de ce fait le niveau de tension d'alimentation à partir d'une ligne parmi la pluralité de lignes de tension d'alimentation (30) à l'aide d'un circuit de sélection de ligne électrique (32) sous la forme d'un multiplexeur de pixels.

9. Procédé selon la revendication 8, dans lequel le second signal de commande est fourni au circuit de sélection de ligne d'alimentation (32) du pixel.

10. Procédé selon la revendication 8 ou 9, dans lequel le premier signal de commande est fourni à un transistor d'adressage (16) du pixel et provoque la mise en service ou hors service d'un transistor de commande (22) du pixel.

11. Procédé selon la revendication 8 ou 9, dans lequel un premier signal de commande partagé provenant du premier conducteur de signal de commande de pixel (6) est fourni à un groupe de pixels, et dans lequel des seconds signaux de commande individuels provenant du second conducteur de signal de commande de pixel (34), sont fournis aux pixels du groupe.

12. Procédé selon la revendication 11, dans lequel un niveau parmi la pluralité de niveaux de tensions d' alimentation est destiné à mettre hors service le pixel.

13. Procédé selon l'une quelconque des revendications 8 à 12, dans lequel tous les pixels de l'affichage sont adressés dans une image, et dans lequel chaque image comprend un certain nombre de sous-images.

14. Procédé selon la revendication 13, dans lequel différents niveaux de tension d'alimentation sont sélectionnés pour différentes sous-images.

15. Procédé selon la revendication 14, dans lequel les sous-images sont de durée égale.

16. Procédé selon l'une quelconque des revendications 13 à 15, dans lequel le nombre de sous-images est égal à trois.

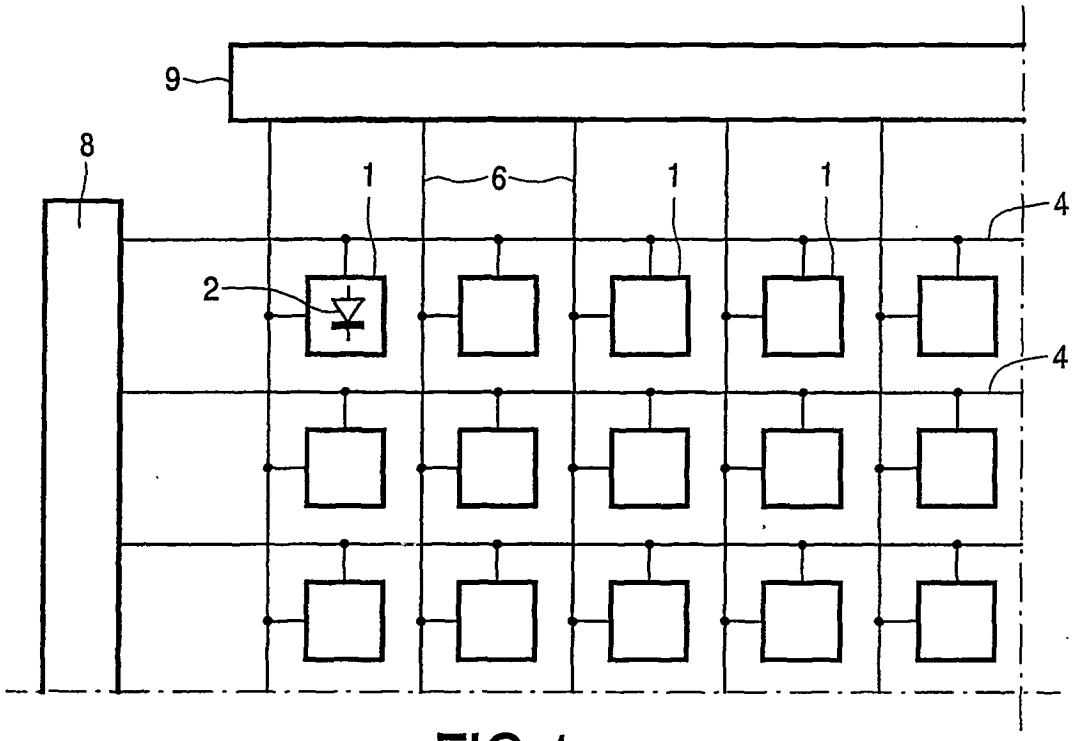

FIG.1

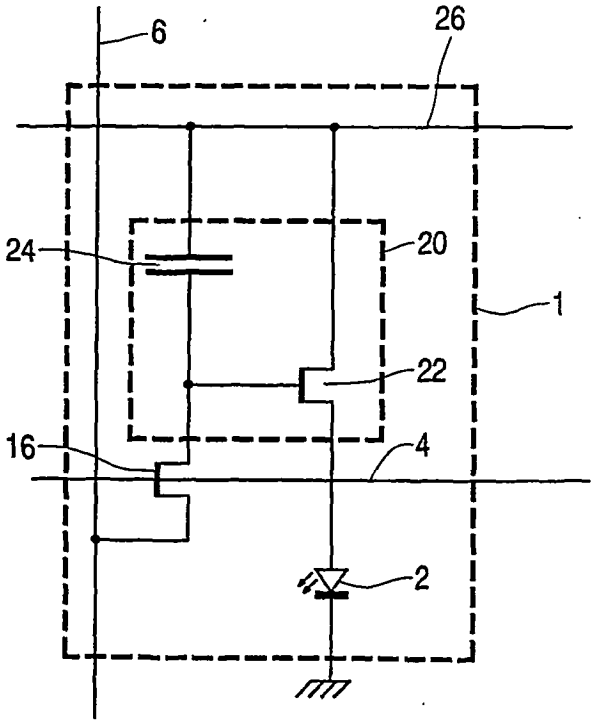

FIG.2

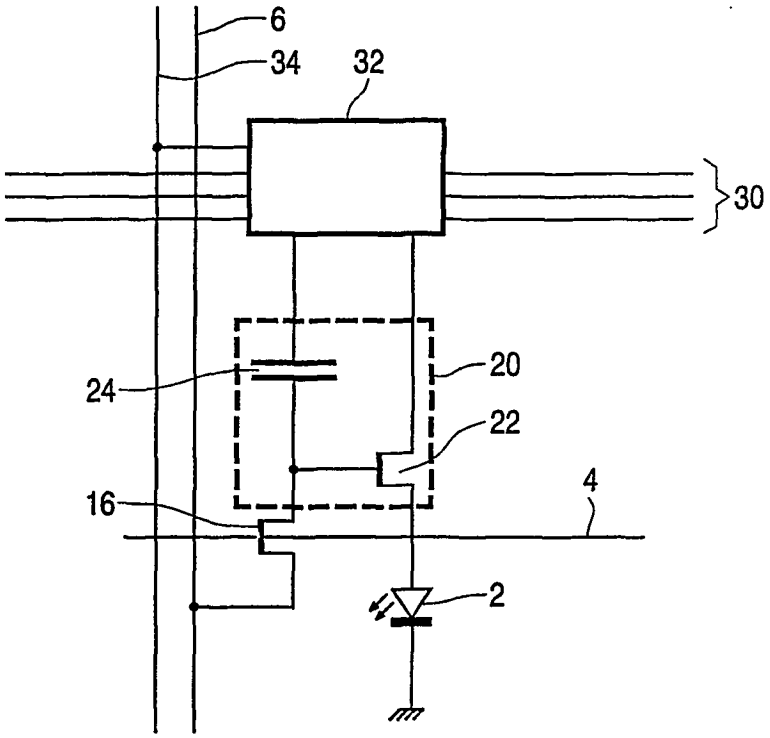

FIG.3

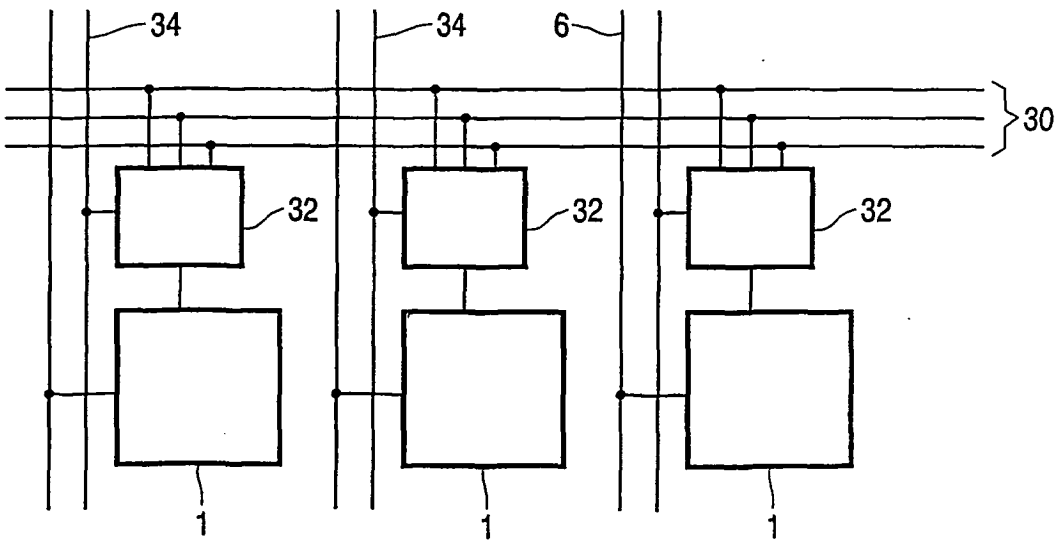

FIG.4

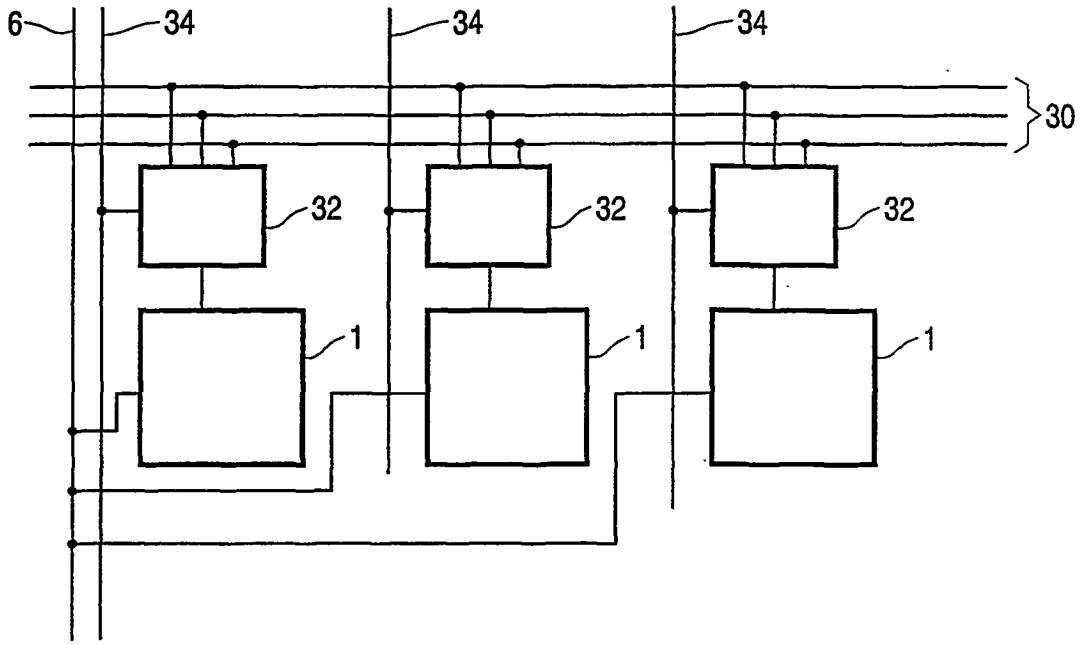

FIG.5

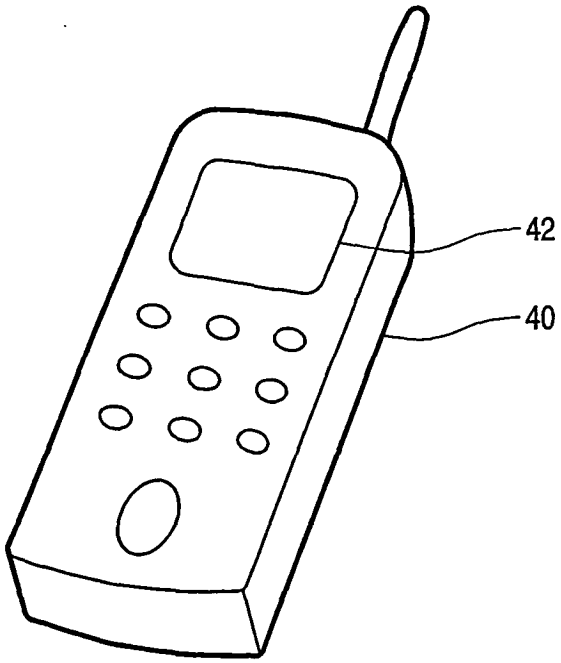

FIG.6

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- WO 0173738 A **[0008]**
- US 6188375 B **[0009]**
- EP 0717446 A **[0024]**
- WO 9636959 A **[0024]**

专利名称(译)	电致发光显示装置		
公开(公告)号	EP1461797B1	公开(公告)日	2008-08-27
申请号	EP2002785742	申请日	2002-11-21
[标]申请(专利权)人(译)	皇家飞利浦电子股份有限公司		
申请(专利权)人(译)	皇家飞利浦电子N.V.		
当前申请(专利权)人(译)	TPO DISPLAYS CORP.		
[标]发明人	CHILDS MARK J		
发明人	CHILDS, MARK, J.		
IPC分类号	G09G3/32 H01L51/50 G09G3/20 G09G3/30 H04N5/70		
CPC分类号	G09G3/3258 G09G3/2011 G09G3/2022 G09G3/2074 G09G3/2077 G09G3/2081 G09G2300/0804 G09G2300/0828 G09G2300/0842		
优先权	2001030176 2001-12-18 GB		
其他公开文献	EP1461797A1		
外部链接	Espacenet		

摘要(译)

一种电致发光（EL）显示装置，包括显示像素阵列，每个显示像素包括EL显示元件和驱动电路。数字像素驱动信号确定像素是打开还是关闭，并且多个电源电压中选定的一个切换到EL显示元件。该装置使得能够实现数字驱动方案，但是提供多个不同的电源电压使得能够实现灰度级而不需要采用时间或面积比系统。或者，本发明的装置可以允许改进时间或面积比技术。

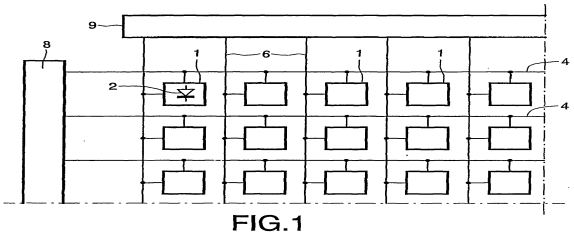

FIG.1

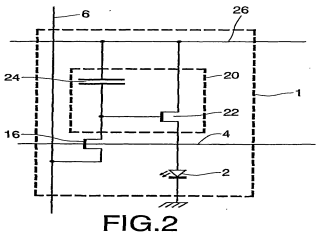

FIG.2