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(54) **Video display device and operating method therefore**

Videoanzeigevorrichtung und Betriebsverfahren dafür

Dispositif d'affichage vidéo et son procédé de fonctionnement

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(73) Proprietor: **Thomson Licensing**
92130 Issy-les-Moulineaux (FR)

(72) Inventors:
- **Gagnot, Dominique**
  38500 Charavines (FR)
- **Le Roy, Philippe**
  35830 Betton (FR)
- **Martin, Pierrick**
  35230 Bourgbarre (FR)

(74) Representative: **Lindemann, Robert**
Deutsche Thomson OHG
European Patent Operations
Karl-Wiechert-Allee 74
30625 Hannover (DE)

(56) References cited:
EP-A- 1 622 120
WO-A-2005/071649
WO-A-2005/073948
US-A1- 2004 100 430
US-A1- 2004 164 949
US-B1- 6 452 576

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Description

[0001] The present invention relates to a video display device comprising a plurality of light-emitting elements arranged in a matrix having lines and columns, and to a method for operating such a display device.

[0002] Display devices of this type require driver circuits for controlling the luminosity of each of its light-emitting elements. In passive matrix technology, one driver circuit is associated to a plurality of light-emitting elements and supplies these with operating current pulses according to a time division scheme, i.e. at a given instant, only one of the light-emitting elements associated to a given driver circuit receives from it an operating current and emits light, whereas the others receive no current and remain dark. Passive matrix technology involves simple and inexpensive circuitry, but in order to achieve a reasonable overall luminosity of the display device, the intensity of the pulses supplied to the individual light-emitting elements must be high, causing problems such as premature aging of the light-emitting elements and a low reliability of the display device.

[0003] In active matrix technology, each light-emitting element has a current modulator associated to it, which is programmable to supply its light-emitting element with a continuous operating current, the intensity of which is updated when a new image is to be displayed.

[0004] EP 1 622 120 A1 discloses a display device of this type. Each of the light-emitting elements of this display device has a first current modulator associated to it, for drawing a feed current of programmable intensity for the associated light-emitting element from a circuit node associated to each of the matrix columns. Further, each column has a current generator associated to it, which is controlled by video data representative of desired luminosities of the light-emitting elements of said column for supplying a first current to said circuit node, the intensity of which is representative of a total desired luminosity of all light-emitting elements of said column. I. e. the first current from the current generator is distributed and supplied to the light-emitting elements of the column in proportion to their intended luminosities as defined by the video data received by the current source.

[0005] When displaying a variable image such as a TV image, the luminosities of the light emitting elements must be updated continuously, element by element. Putting things simply, one might say that the luminosity of one element is updated by having the current generator outputting to said circuit node a first current proportional to the sum of the updated luminosity of said one element and the present luminosities of the other elements, and by programming the first current modulator associated to the element to be updated so that it will absorb from the circuit node that portion of the first current which is not absorbed by the first current modulators of all the other elements. It is readily apparent that for such a scheme to work, the current source must be able to control the first current intensity at a resolution of n*m, if n is the number of light-emitting elements in a column and m is the number of luminosity levels which these elements shall be able to display. In a practical embodiment, in which n has a value of approximately 1000 typical for a TV image and m is e.g. 256, the required resolution is approximately 256,000. Such a resolution requires sophisticated and expensive circuitry for the current source.

[0006] The object of the present invention is to provide a video display device in which the required resolution of the voltage source is considerably reduced, so that simple and inexpensive circuitry may be used.

[0007] The invention is as defined in the claims.

[0008] The invention will be more easily understood and further features and advantages will become apparent from the subsequent description of embodiments thereof referring to the appended drawings.

Fig. 1 is a schematic circuit diagram of an exemplary portion of the display device according to an embodiment of the invention;

Fig. 2 is a waveform diagram illustrating currents in the display device of Fig. 1 during the build-up of a first display image; and

Fig. 3 is a waveform diagram illustrating currents during the build-up of a subsequent image.

[0009] The display device of the invention comprises a large number n*1 of light-emitting elements such as OLEDs (Organic Light-Emitting Diodes) arranged on a substrate in a matrix of n lines and 1 columns. Since the columns are identical in design and operation, Fig. 1 illustrates just one of these columns. The column comprises OLEDs 1-1, 2-2,..., 1-n serially connected to an associated current modulator 2-1, 2-2,..., 2-n. The OLEDs and the current modulators are connected in parallel between a circuit node 3 and a negative supply potential V-.

[0010] The current modulators 2-1, 2-2, ..., 2-n may each be formed by a FET having two current electrodes, one connected to the circuit node 3 and the other to the OLED 1-1, 1-2, ... or 1-n, respectively, and a control electrode connected to first sides of a switch 4-1, 4-2, ..., 4-n and of a storage capacitor 5-1, 5-2,..., 5-n. Incidentally, the storage capacitors have their second sides connected to ground, but they might as well be connected to said negative supply voltage V-, to a positive supply voltage V+ or to any other appropriate constant potential. The switches 4-1, 4-2, 4-n have their second sides connected to an output of an operational amplifier 6, of which a non-inverting input is connected to circuit node 3 and an inverting input is connected to ground.

[0011] An operational amplifier 7 has its non-inverting input connected to ground, its inverting input connected to circuit node 3 and its output connected to a first side of a switch 8, a second side of which is connected to a storage capacitor 9 and to a control terminal of a current

modulator 10 which may be of the same type as current modulators 2-1, 2-2, ..., 2-n. Current modulator 10 has its current terminals connected to positive supply voltage V+ and to circuit node 3.

[0012] An exemplary current generator 11 comprises a control block 12, a transistor 13 and a resistor 14. Transistor 13 and resistor 14 are connected in series between the positive supply voltage V+ and the circuit node 3. Control block 12 has an input 15 for receiving digital data representative of desired luminosities of OLEDs 1-1, 1-2, ..., 1-n, inputs 16 for detecting a voltage drop across resistor 14 and an output connected to a control electrode of transistor 13. Transistor 13 may be a bipolar or MOSFET transistor.

[0013] For explaining the operation of the circuitry of Fig. 1, let us assume that the display device is just starting operation, and that initially all current modulators 2-1, 2-2, ..., 2-n, 10 and the current generator 11 are in a blocking state, so that all OLEDs are dark. Further, for the sake of convenience, it will be assumed that the first digital luminosity value received at input 15 is a value D1 corresponding to OLED 1-1. Reference is made to Figs 2 and 3, which illustrate waveforms of output currents I_{DATA} of current generator 11 and I_{10} of current modulator 10.

[0014] The control block reacts to the luminosity value D_1 being input by closing switch 4-1 and making transistor 13 conductive, so that at a time t_{1c} (cf. Fig. 2) a positive current I_{DATA} begins to flow from current generator 11 to circuit node 3. The potential of circuit node 3 thus becomes positive. This causes operational amplifier 6 to output a positive voltage which charges storage capacitor 5-1 and causes current modulator 2-1 to become conductive, enabling a continuous flow of current through resistor 14 and circuit node 3. The control block 12 continuously adapts the voltage applied by it to the control electrode of transistor 13 until the voltage drop detected at inputs 16 is in a predetermined relation to the input luminosity value D1, indicating that a current $I_{DATA}=I_{D1}=C*D1$ having the necessary intensity for generating the desired luminosity D1 is flowing from current generator 11 through current modulator 2-1 and OLED 1-1.

[0015] When this happens, it is likely that the circuit node 3 will at first have a positive potential. This positive potential causes operational amplifier 6 to output a current which continues to charge storage capacitor 2-1, thus gradually increasing the potential at the control electrode of current modulator 2-1 and increasing its conductivity. Control block 12 continuously adjusts the control voltage applied to transistor 13, so that the current through circuit node 3 is kept constant at I_{D1}. Soon, a steady state is reached in which circuit node 3 has ground potential. In this state, control block 12 reopens switch 4-1.

[0016] In a next step, at a time t_{1d}, control block 12 blocks transistor 13, so that current generator 11 becomes non-conductive ($I_{DATA}=0$), and closes switch 8. Since current modulator 2-1 stays conductive, the potential of circuit node 3 decreases, which causes operational amplifier 7 to output a positive current to storage capacitor 9 and to the control electrode of current modulator 10. Again, a steady state is reached as soon as circuit node 3 has returned to ground potential. When this happens, the current through OLED 1-1 is exactly equal to I_{D1}, but the current is supplied not by current generator 11 any more, but by current modulator 10.

[0017] In a subsequent step, from time t_{2a} to t_{2c}, the control block 12 carries out a reset procedure which, for better understanding, will be explained later on.

[0018] By the time t_{2c}, the control block 12 has received a second digital data specifying a desired luminosity D2 of OLED 1-2. At t_{2c}, it closes switch 4-2 and begins to control transistor 13 so as to have a current $I_{DATA}=I_{D2}$ corresponding to said desired luminosity D2 flowing through current generator 11. Again, the potential of circuit node 3 becomes slightly positive, this time causing amplifier 6 to charge capacitor 5-2, and to make current modulator 2-2 conductive. A steady state is reached in which circuit node 3 is at ground potential, and the current $I_{DATA}=I_{D2}$ from current generator 11 is absorbed by OLED 2-2, whereas the current I_{10} from current modulator 10 flows through OLED 1-1. Control block 12 then opens switch 4-2, and at the time t_{2d}, it blocks transistor 13 and closes switch 8 again. A potential decrease at circuit node 3 causes amplifier 7 to continue to charge capacitor 9, until the current I_{10} through current modulator 10 becomes equal to $I_{D1}+I_{D2}$.

[0019] The procedure is repeated for all remaining OLEDs of the column, and at the end of each repetition, the current from current modulator 10 is increased by the desired intensity I_{Di}, i=3,..., n, for each of the OLEDs, finally reaching $I_{\Sigma}=I_{D1}+I_{D2}+...+I_{Dn}$. At this stage, an entire image is visible on the display device.

[0020] The next digital data received by control block 12 is data specifying a desired luminosity D1' of OLED 1-1 in a subsequent picture. In order to adapt the luminosity of OLED 1-1 to this new value, at a time t_{1a}, (see Fig. 3), control block 12 begins a reset procedure by closing switch 4-1, whereby storage capacitor 5-1 is discharged and current modulator 2-1 becomes non-conductive. Then, switch 4-1 is reopened. The potential at circuit node 3 has become slightly positive. By closing switch 8 at time $t_{1b'}$, current modulator 10 is caused to adapt to this new situation: its current decreases to $I_{\Sigma}-I_{D1}$. This procedure of resetting OLED 1-1 enables the control block 12 to set the new luminosity D1' of this OLED in exactly the same way as described before referring to Fig. 2: At a time $t_{1c'}$, it causes current generator 11 to output $I_{DATA}=I_{D1}$, and closes switch 4-1, so that current modulator 2-1 will draw precisely the current $I_{D1'}$ from circuit node 3 when the latter is at ground potential. Switch 4-2 is reopened, and at time $t_{1d'}$, current generator 11 blocks, and switch 8 is closed, so that the current I_{10} supplied by modulator 10 increases to $I_{\Sigma}-I_{D1}+I_{D1'}$. The procedure is continued in a similar manner for all other

OLEDs 1-2, ...1-n.

[0021] Since the control block 12 is used to program the luminosities of the OLEDs one by one, the resolution of the current generator 11 need not be higher than that of a single luminosity data received by the control block 12, regardless of the number of OLEDs in a column.

[0022] Referring to the teachings of EP 1 621 20 A1 it will be readily apparent to a skilled person that the operating procedure of the circuitry of Fig. 1 might be modified as follows: at first, the control block consecutively programs the luminosities of a small number of OLEDs, e. g. OLEDs 1-1, 1-2, as described in the cited document. At the end of this programming, the current I_{DATA} output by current generator 11 amounts to $I_{D1}+I_{D2}$, if it is assumed that I_{D1}, I_{D2} are the current intensities corresponding to the desired luminosities D1, D2 of OLEDs 1-1, 1-2. Then, control block 12 makes the current generator 11 non-conductive, as described above referring to Fig. 2 or 3, and closes switch 8, so that the current $I_{D1}+I_{D2}$ previously supplied by current generator 11 is "copied" to current modulator 10. It is readily apparent that the number of copying steps required for the build-up of a complete image is the smaller, the larger the number of OLEDs consecutively programmed between two copying steps is. On the other hand, the required resolution of the current generator 11 increases in proportion to the number of consecutively programmed OLEDs.

[0023] According to another embodiment, image build-up speed may be increased by not resetting the current modulators 2 prior to programming them. It is easily understood that when the display has just been activated and a first image is formed, the reset step is not necessary. When forming the second image, the luminosity of e. g. OLED 1-1 is programmed by having current generator 11 output a current $I_{DATA}=I_{D1'}-I_{D1}$, wherein $I_{D1'}$ is the current intensity corresponding to the desired luminosity D1' of OLED 1-1 in the second image. Since in this embodiment I_{DATA} may be negative, the current generator 11 must be adapted to generate negative currents, e. g by means of a second transistor, not shown, connected in series between transistor 13 and V- and controlled by control block 12.

[0024] In this embodiment, any inaccuracy of I_{DATA} may cause the luminosities of the OLEDs to drift. In order to limit such drifts, it is conceivable to apply a reset to each OLED when it has been reprogrammed without reset a predetermined number of times.

Claims

1. A video display device comprising a matrix having rows and columns, each of said columns comprising:

- a plurality of light emitting elements (1-1, 1-2, ..., 1-n)
- a plurality of first current modulators (2-1, 2-2, ..., 2-n), each of which associated to one of said light emitting elements(1-1, 1-2, ..., 1-n), arranged to draw a feed current of programmable intensity (I_{D1}. I_{D2}, ..., I_{Dn}) for the associated light emitting element (1-1, 1-2, ..., 1-n) from a circuit node (3)
- a current generator (11), controlled by video data representative of desired luminosities (D1, D2, ..., Dn) of said light emitting elements, arranged to supply a first current (I_{DATA}) to said circuit node (3), the intensity of said first current being representative of a desired luminosity (D1, D2, ..., Dn) of at least one of said light emitting elements (1-1, 1-2, ..., 1-n);

the circuit node (3) having a specific voltage level when the intensity supplied by said current generator (11) is drawn from the current node (3) by the first current modulator (2-1, 2-2, ..., 2-n) associated to said at least one light emitting element(1-1, 1-2, ..., 1-n);

characterized by

- a second current modulator (10) arranged to supply a second current (I_{10}) to said circuit node (3);
- a comparator (7) having a first input connected to said circuit node (3) and a second input connected to a reference terminal, wherein said reference terminal is constantly held at a specific voltage level, wherein an output of said comparator is connected to a control input of said second current modulator (10), for controlling the second current (I_{10}) of said second current modulator (10).

2. The display device of claim 1, wherein said comparator (7) has its output connected to the control input of the second current modulator (10) by a switch (8), and a storage capacitor (9) is connected to the control input for maintaining it at a constant voltage when said switch (8) is open.

3. The display device of claim 1 or 2, wherein the comparator (7) is an operational amplifier having an inverting input connected to said circuit node (3) and a non-inverting input connected to said reference terminal.

4. The display device of one of the preceding claims, further comprising a second comparator (6) having inputs connected to said circuit node (3) and to said reference terminal and a plurality of switches (4-1, 4-2, ..., 4-n) for selectively connecting an output of said second comparator (6) to a control input of one of said first current modulators (2-1, 2-2, ..., 2-n).

5. A method of operating the display device of claim 1, comprising the steps of:

a) supplying a first current (I_{DATA}; I_{D1}, I_{D2}, ..., I_{Dn}) representative of a desired luminosity (D1, D2, ..., Dn) of at least a first one of said light emitting elements to said circuit node (3) from said current generator (11);
b) programming the first current modulator (2-1, 2-2, ..., 2-n) associated to said at least one of said light emitting elements (1-1, 1-2, ..., 1-n) to draw said first current (I_{D1}, I_{D2}, ..., I_{Dn}) from said circuit node (3), whereby the circuit node attains a specific voltage level;
c) ceasing to supply said first current (I_{DATA}; I_{D1}, I_{D2}, ..., I_{Dn}) from said current generator (11);
d) controlling the intensity of said second current (I_{10}) provided by the second current modulator (10) so as to re-establish said specific voltage level at said circuit node (3).

6. The method of claim 5, wherein steps a) to d) are repeated for at least a second one of said light emitting elements and that while repeating steps a) and b) the intensity of the second current (I_{10}) is held at the value set in previous step d).

7. The method of claim 5 or 6, wherein steps a) to d) are repeated for said at least first one of said light emitting elements (1-1, 1-2, ..., 1-n), and that before doing so, the first current modulator (2-1, 2-2, ..., 2-n) associated to said at least one of said light emitting elements (1-1, 1-2, ..., 1-n) is programmed not to draw current from said circuit node (3).

Patentansprüche

1. Videoanzeigevorrichtung, die eine Matrix mit Zeilen und Spalten umfasst, wobei jede der Spalten umfasst:

- eine Mehrzahl von Lichtemitterelementen (1-1, 1-2, ..., 1-n)
- eine Mehrzahl erster Strommodulatoren (2-1, 2-2, ..., 2-n), von denen jeder einem der Lichtemitterelemente (1-1, 1-2, ..., 1-n) zugeordnet ist, die so angeordnet sind, dass sie von einem Schaltungsknoten (3) einen Speisestrom mit programmierbarer Stärke (I_{D1}, I_{D2}, ..., I_{Dn}) für das zugeordnete Lichtemitterelement (1-1, 1-2, ..., 1-n) entnehmen,
- einen Stromgenerator (11), der durch Videodaten gesteuert wird, die die gewünschten Helligkeiten (D1, D2, ..., Dn) der Lichtemitterelemente repräsentieren, der so angeordnet ist, dass er dem Schaltungsknoten (3) einen ersten Strom (I_{DATA}) zuführt, wobei die Stärke des ersten Stroms repräsentativ für die gewünschte Helligkeit (D1, D2, ..., Dn) mindestens eines der Lichtemitterelemente (1-1, 1-2, ..., 1-n) ist;

wobei der Schaltungsknoten (3) einen spezifischen Spannungspegel aufweist, wenn die durch den Stromgenerator (11) zugeführte Stärke von dem Stromknoten (3) durch den ersten Strommodulator (2-1, 2-2, ...,2-n) entnommen wird, der dem mindestens einen Lichtemitterelement (1-1, 1-2, ..., 1-n) zugeordnet ist;
gekennzeichnet durch
- einen zweiten Strommodulator (10), der so ausgelegt ist, dass er dem Schaltungsknoten (3) einen zweiten Strom (I_{10}) zuführt;
- einen Komparator (7) mit einem ersten Eingang, der mit dem Schaltungsknoten (3) verbunden ist, und mit einem zweiten Eingang, der mit einem Referenzanschluss verbunden ist, wobei der Referenzanschluss konstant auf einem spezifischen Spannungspegel gehalten wird, wobei ein Ausgang des Komparators mit einem Steuereingang des zweiten Strommodulators (10) verbunden ist, um den zweiten Strom (I_{10}) des zweiten Strommodulators (10) zu steuern.

2. Anzeigevorrichtung nach Anspruch 1, bei der der Ausgang des Komparators (7) über einen Schalter (8) mit dem Steuereingang des zweiten Strommodulators (10) verbunden ist und bei der mit dem Steuereingang ein Speicherkondensator (9) verbunden ist, um ihn auf einer konstanten Spannung zu halten, wenn der Schalter (8) geöffnet ist.

3. Anzeigevorrichtung nach Anspruch 1 oder 2, bei der der Komparator (7) ein Operationsverstärker mit einem invertierenden Eingang, der mit dem Schaltungsknoten (3) verbunden ist, und mit einem nichtinvertierenden Eingang, der mit dem Referenzanschluss verbunden ist, ist.

4. Anzeigevorrichtung nach einem der vorhergehenden Ansprüche, die ferner einen zweiten Komparator (6) mit Eingängen, die mit dem Schaltungsknoten (3) und mit dem Referenzanschluss verbunden sind, und mit einer Mehrzahl von Schaltern (4-1, 4-2, ..., 4-n) zum wahlweisen Verbinden eines Ausgangs des zweiten Komparators (6) mit einem Steuereingang eines der ersten Strommodulatoren (2-1, 2-2, ..., 2-n) umfasst.

5. Verfahren zum Betreiben der Anzeigevorrichtung nach Anspruch 1,
wobei das Verfahren die folgenden Schritte umfasst:

a) Zuführen eines ersten Stroms (I_{DATA}; I_{D1}, I_{D2}, ..., I_{Dn}), der eine gewünschte Helligkeit (D1, D2, ..., Dn) mindestens eines ersten der Lichtemitterelemente repräsentiert, von dem Stromgenerator (11) zu dem Schaltungsknoten (3);
b) Programmieren des ersten Strommodulators (2-1, 2-2, ..., 2-n), der dem mindestens einen

der Lichtemitterelemente (1-1, 1-2, ..., 1-n) zugeordnet ist, um von dem Schaltungsknoten (3) den ersten Strom (I_{D1}, I_{D2}, ..., I_{Dn}) zu entnehmen, wodurch der Schaltungsknoten einen spezifischen Spannungspegel erreicht;

c) Beenden des Zuführens des ersten Stroms (I_{DATA}; I_{D1}, I_{D2}, ..., I_{Dn}) von dem Stromgenerator (11);

d) Steuern der Stärke des zweiten Stroms (I_{10}), der durch den zweiten Strommodulator (10) zugeführt wird, um den spezifischen Spannungspegel bei dem Schaltungsknoten (3) wiederherzustellen.

6. Verfahren nach Anspruch 5, bei dem die Schritte a) bis d) für mindestens ein zweites der Lichtemitterelemente wiederholt werden und bei dem während des Wiederholens der Schritte a) und b) die Stärke des zweiten Stroms (I_{10}) auf dem im vorhergehenden Schritt d) eingestellten Wert gehalten wird.

7. Verfahren nach Anspruch 5 oder 6, bei dem die Schritte a) bis d) für das mindestens erste der Lichtemitterelemente (1-1, 1-2, ..., 1-n) wiederholt werden und bei dem zuvor der erste Strommodulator (2-1, 2-2, ..., 2-n), der dem mindestens einen der Lichtemitterelemente (1-1, 1-2, ..., 1-n) zugeordnet ist, so programmiert wird, dass er von dem Schaltungsknoten (3) keinen Strom entnimmt.

Revendications

1. Dispositif d'affichage vidéo comprenant une matrice possédant des lignes et des colonnes, chacune desdites colonnes comprenant :

- une pluralité d'éléments électroluminescents (1-1, 1-2, ..., 1-n) ;
- une pluralité de premiers modulateurs de courant (2-1, 2-2, ..., 2-n), dont chacun est associé à un desdits éléments électroluminescents (1-1, 1-2, ..., 1-n), agencés pour débiter un courant d'alimentation d'intensité programmable (I_{D1}, I_{D2}, ..., I_{Dn}) pour l'élément électroluminescent associé (1-1, 1-2, ..., 1-n) à partir d'un noeud de circuit (3) ;
- un générateur de courant (11), commandé par des données vidéo représentant des luminosités souhaitées (D1, D2, ..., Dn) desdits éléments électroluminescents, agencé pour fournir un premier courant (I_{DATA}) audit noeud de circuit (3), l'intensité dudit premier courant représentant une luminosité souhaitée (D1, D2, ..., Dn) d'au moins un desdits éléments électroluminescents (1-1, 1-2, ..., 1-n) ;

le noeud de circuit (3) présentant un niveau de tension spécifique lorsque l'intensité fournie par ledit générateur de courant (11) est débitée à partir du noeud de courant (3) par le premier modulateur de courant (2-1, 2-2, ..., 2-n) associé audit au moins un élément électroluminescent (1-1, 1-2, ..., 1-n) ;

caractérisé par

- un deuxième modulateur de courant (10) agencé pour fournir un deuxième courant (I_{10}) audit noeud de circuit (3) ;
- un comparateur (7) possédant une première entrée connectée audit noeud de circuit (3) et une deuxième entrée connectée à une borne de référence, où ladite borne de référence est constamment maintenue à un niveau de tension spécifique, où une sortie dudit comparateur est connectée à une entrée de commande dudit deuxième modulateur de courant (10), pour commander le deuxième courant (I_{10}) dudit deuxième modulateur de courant (10).

2. Dispositif d'affichage selon la revendication 1, où ledit comparateur (7) a sa sortie connectée à l'entrée de commande du deuxième modulateur de courant (10) par un commutateur (8), et un condensateur de stockage (9) est connecté à l'entrée de commande pour la maintenir à une tension constante lorsque ledit commutateur (8) est ouvert.

3. Dispositif d'affichage selon la revendication 1 ou 2, où le comparateur (7) est un amplificateur opérationnel possédant une entrée inverseuse connectée audit noeud de circuit (3) et une entrée non-inverseuse connectée à ladite borne de référence.

4. Dispositif d'affichage selon une des revendications précédentes, comprenant en outre un deuxième comparateur (6) possédant des entrées connectées audit noeud de circuit (3) et à ladite borne de référence et une pluralité de commutateurs (4-1, 4-2, ..., 4-n) pour connecter de façon sélective une sortie dudit deuxième comparateur (6) à une entrée de commande d'un desdits premiers modulateurs de courant (2-1, 2-2, ..., 2-n).

5. Procédé de fonctionnement du dispositif d'affichage selon la revendication 1, comprenant les étapes suivantes :

a) fourniture d'un premier courant (IDATA; ID1, ID2, ..., IDn) représentant une luminosité souhaitée (D1, D2, ..., Dn) d'au moins un premier desdits éléments électroluminescents audit noeud de circuit (3) à partir dudit générateur de courant (11) ;

b) programmation du premier modulateur de courant (2-1, 2-2, ..., 2-n) associé audit au moins un desdits éléments électroluminescents (1-1, 1-2, ..., 1-n) pour débiter ledit premier courant

(I_{D1}, I_{D2}, ..., I_{Dn}) à partir dudit noeud de circuit (3), où le noeud de circuit atteint un niveau de tension spécifique ;

c) arrêt de la fourniture dudit premier courant (I_{DATA}; I_{D1}, I_{D2}, ..., I_{Dn}) à partir dudit générateur de courant (11) ;

d) commande de l'intensité dudit deuxième courant (I_{10}) fourni par le deuxième modulateur de courant (10), de sorte à rétablir ledit niveau de tension spécifique au niveau dudit noeud de circuit (3).

6. Procédé selon la revendication 5, où les étapes a) à d) sont répétées pour au moins un deuxième desdits éléments électroluminescents et lors de la répétition des étapes a) et b), l'intensité du deuxième courant (I_{10}) est maintenue à la valeur définie à l'étape d) précédente.

7. Procédé selon la revendication 5 ou 6, où les étapes a) à d) sont répétées pour ledit au moins premier desdits éléments électroluminescents (1-1, 1-2, ..., 1-n), et avant cela, le premier modulateur de courant (2-1, 2-2, ..., 2-n) associé audit au moins un desdits éléments électroluminescents (1-1, 1-2, ..., 1-n) est programmé pour ne pas débiter de courant à partir dudit noeud de circuit (3).

Fig. 1

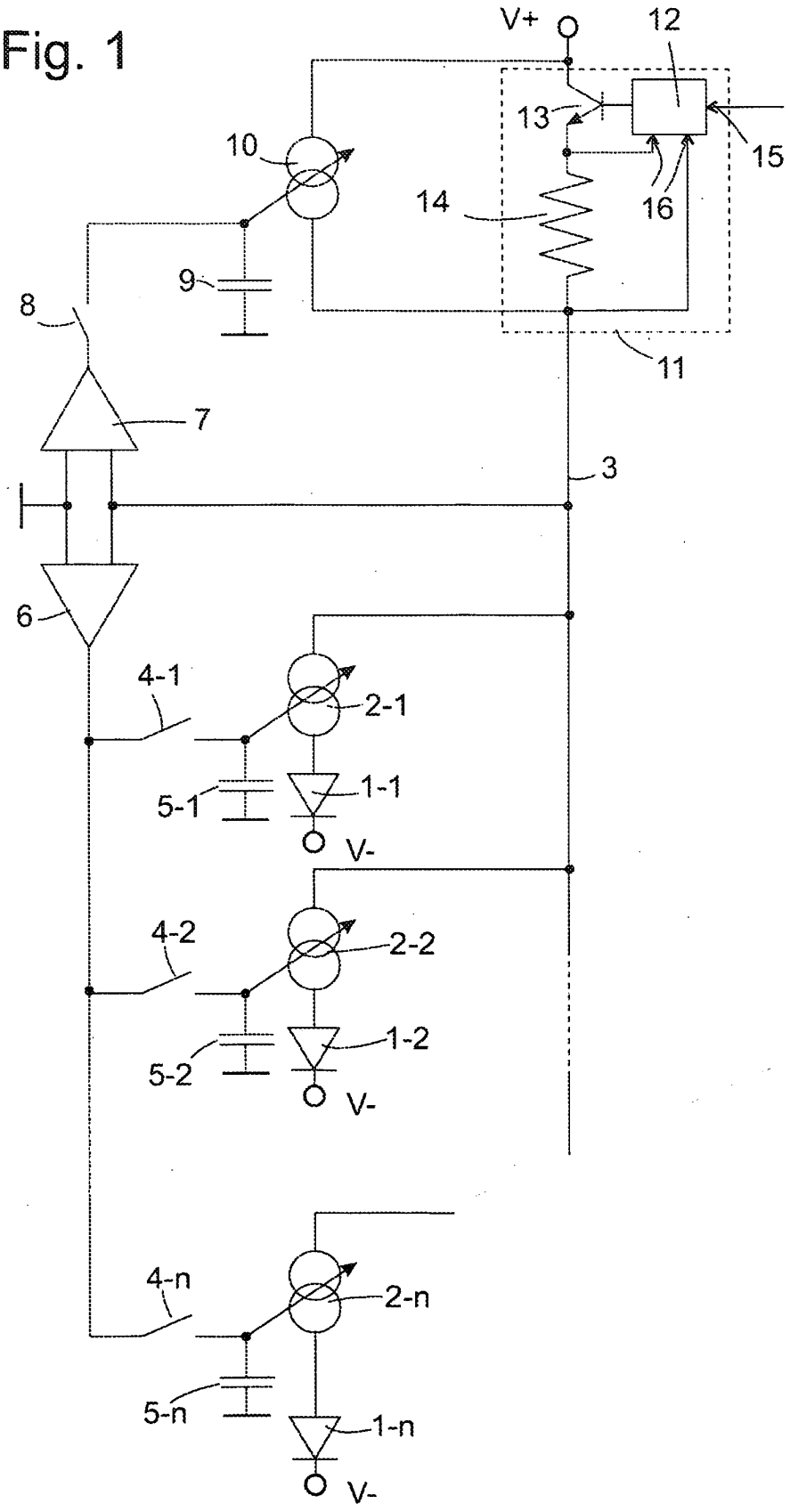


Fig. 2

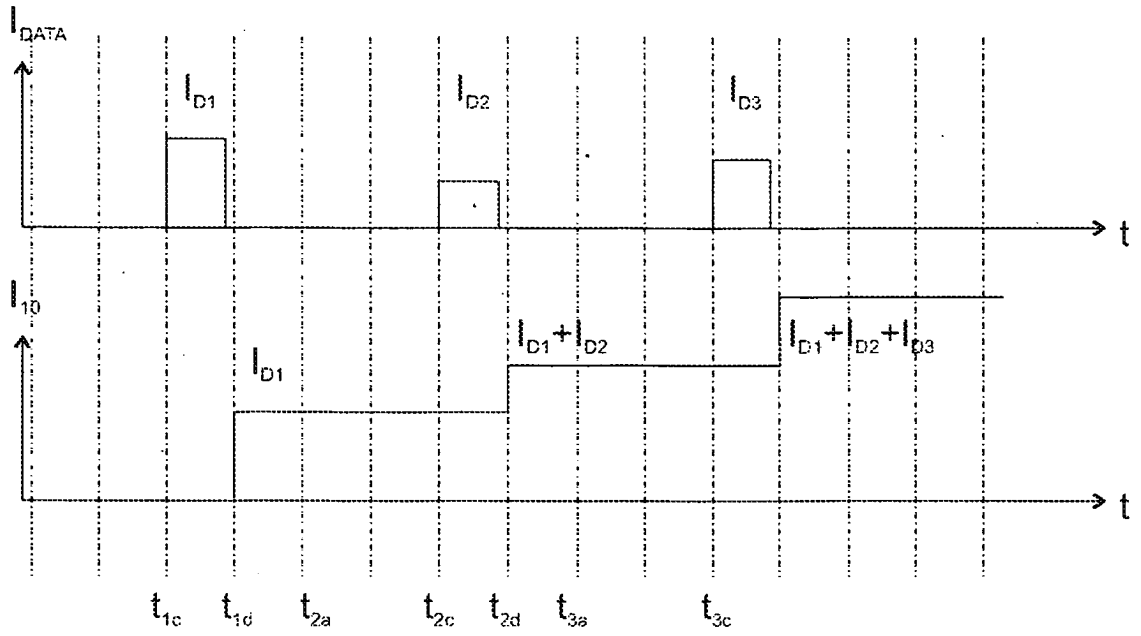
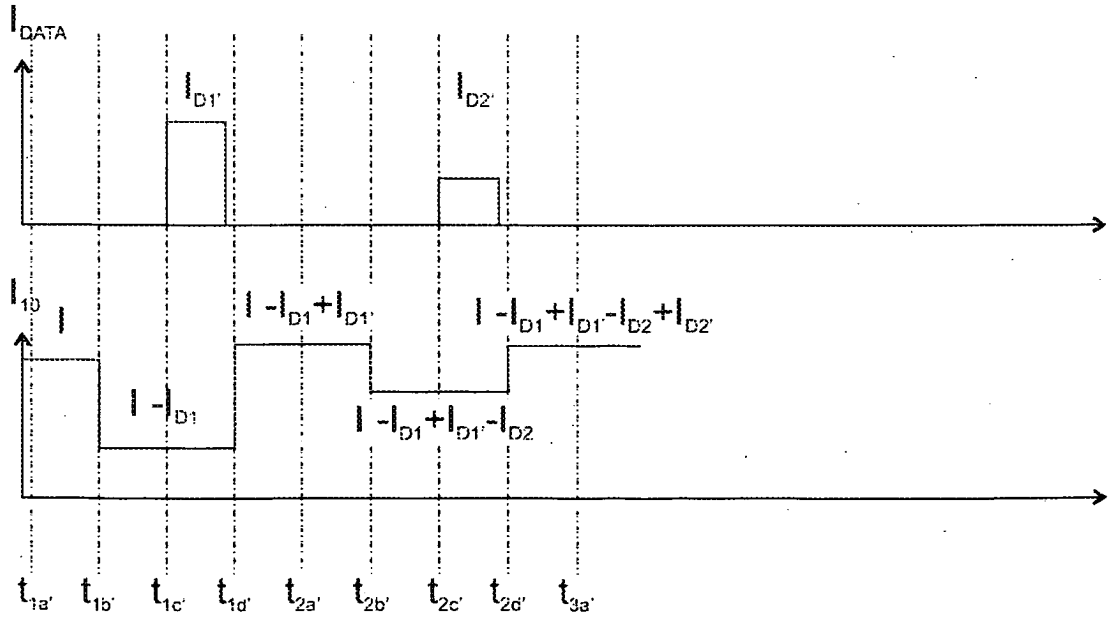

I_DATA
I_D1
I_D2
I_D3
t
I_10
I_D1
I_D1+I_D2
I_D1+I_D2+I_D3
t
t_1c
t_1d
t_2a
t_2c
t_2d
t_3a
t_3c

Fig. 3


I_DATA
I_D1'
I_D2'
I_10
I
I -I_D1
I -I_D1+I_D1'
I -I_D1+I_D1'-I_D2
I -I_D1+I_D1'-I_D2+I_D2'
t_1a'
t_1b'
t_1c'
t_1d'
t_2a'
t_2b'
t_2c'
t_2d'
t_3a'

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- EP 1622120 A1 **[0004]**
- EP 162120 A1 **[0022]**