(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
18 September 2008 (18.09.2008)

PCT

(10) International Publication Number
WO 2008/110991 A1

(51) International Patent Classification:
H04N 13/04 (2006.01)

(21) International Application Number:
PCT/IB2008/050888

(22) International Filing Date: 12 March 2008 (12.03.2008)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
07104257.6 15 March 2007 (15.03.2007) EP

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(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI,

[Continued on next page]

(54) Title: A MULTIPLE VIEW DISPLAY AND A COMPUTER SYSTEM

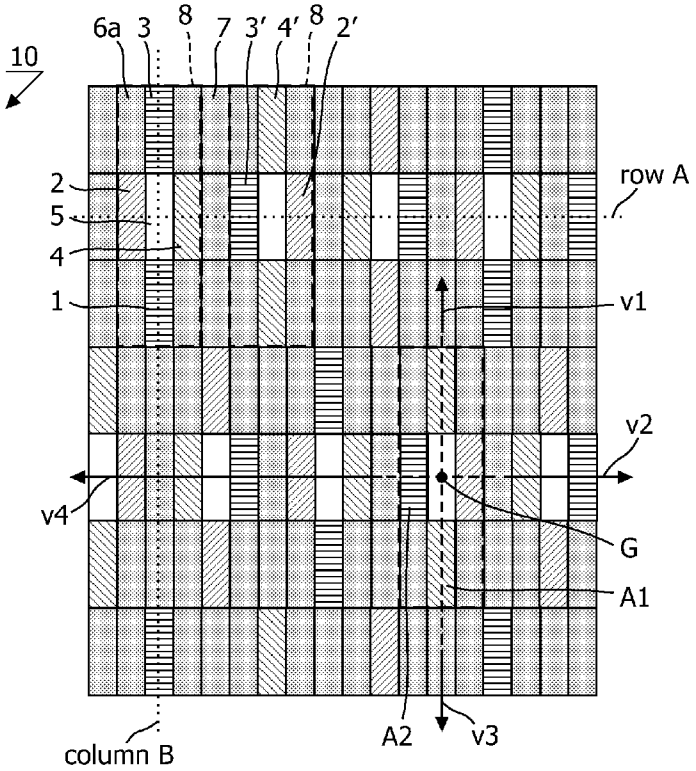

FIG. 1

(57) Abstract: The invention relates to a multiple view display 10 comprising a set of pixels 1, 2, 3, 4 arranged for emitting corresponding light rays and a set of apertures 5 arranged for transmitting a portion of the light rays in dependence on an angle of their propagation, wherein the set of pixels 1, 2, 3, 4 is formed by a repetition of a unit cell 8 comprising a plurality of light emitting pixels, each aperture being arranged within the unit cell and being dimensioned to be substantially comparable to a size of a pixel 1. The invention further relates to a computer program product enabling a programmable device to act as a multiple view display.

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FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL, NO, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report*

— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments*

A multiple view display and a computer system

FIELD OF THE INVENTION

The invention relates to a multiple view display comprising a set of pixels arranged for emitting corresponding light rays and a set of apertures arranged for transmitting a portion of the light rays in dependence on an angle of their propagation.

BACKGROUND OF THE INVENTION

An embodiment of the display as is set forth in the foregoing is known from EP 1 427 223 A2. The known display enables a so-called dual-view display, wherein two different views are rendered and projected using suitable slit-shaped apertures, each view in a different direction. When used, for example, in a middle console of a car, the driver can see suitable information, notably navigation instructions, while a co-driver receives entertainment video.

In the known display a parallax barrier located on top of a suitable LCD screen is used. It is also possible to use other pixilated screens, like PDP or organic light emitting device OLED. The parallax barrier is spatially arranged for transmitting light rays that can pass the barrier propagate in two different directions thereby enabling two different views. However, light rays originating from pixels with information intended for view 1 should not end up in view 2 and vice versa. In other words, ideally there should be no crosstalk between the views.

For crosstalk to be absent, the thickness d of the front plate of the LCD should not exceed a certain value. This value is determined by the requirement that light that originates from a pixel intended for a certain view but is directed in such a way that it could end up in the wrong view, should be reflected by means of total-internal-reflection (TIR). TIR is the effect that a light ray that is traveling inside a medium can escape from this medium only if the angle of this ray with respect to the normal to the surface of this medium does not exceed a certain critical angle. This critical angle depends on the index of refraction n of the medium.

The relation between the maximum thickness of the front plate of the LCD and the other parameters of the system is as follows:

$$d \leq \delta \cdot \sqrt{n^2 - 1}$$

Here, δ is the shortest distance from a pixel to an aperture in the barrier that would lead to crosstalk. This distance in its turn obeys the following relation:

$$\delta = p + \frac{b}{2} - \frac{w}{2}$$

In this relation, p is the (sub)-pixel pitch, b is the width of the black matrix, and w is the width of the apertures in the barrier.

In practice, to ensure that the value of the thickness d of the front plate is not too small, one is inclined to choose a wide black matrix (i.e. large value of b) in combination with small apertures in the barrier (i.e. a small value of w). An alternative is to switch half of the pixels off to mimic a wide black matrix.

It is a disadvantage of the known display that the light output of the display and the resolution of the resulting images is reduced.

SUMMARY OF THE INVENTION

It is an object of the invention to provide a multi-view display, wherein more than two independent views are made possible while images with sufficient resolution and light output are generated.

To this end in the display according to the invention the set of pixels is formed by a repetition of a unit cell comprising a plurality of light emitting pixels, each aperture being arranged within the unit cell and being dimensioned to be substantially comparable to a size of a pixel.

In accordance with the technical measure of the invention due to an interaction of the active, i.e. light emitting, pixels substantially with a single aperture, multiple views can easily be provided, whereby light output and resolutions are not sacrificed. It is found that the technical measure of the invention is applicable not only to conventional displays where the pixels are arranged in columns, but also to a so-called delta-nabla geometry, wherein the pixels are dimensioned as hexagons.

It is noted that multi-view displays per se are known. In the known embodiment of the multi-view display a set of lenses is used for forming respective views in one plane. In the invention, on the contrary, the respective apertures are arranged to form respective views not in one plane, but rather at a view-specific spatial angle determined by suitable geometric inter-relation between the apertures and individual light emitting pixels contributing to respective views.

Preferably, the apertures are formed by a single substantially planar barrier, arranged in front of the display, notably a suitable LCD display. More details of the arrangement of the barrier and the light emitting pixels will be described with reference to Fig. 1.

In a multiple view display according to an embodiment of the invention, the apertures are formed by a three-dimensional superposition of a first barrier comprising a first set of slits and a second barrier comprising a second set of slits, the second set of slits being transversely arranged with respect to the first set of slits.

It is found to be advantageous to use two barriers mutually constituting a set of apertures dimensioned with a size comparable to a size of a single pixel. The slits of the two barriers are transversely arranged, for example orthogonally with respect to each other. A barrier 1 is located at an optical distance d_x from the plane of pixels of the LCD. A barrier 2 is arranged at a distance of d_y from the LCD screen. Preferably, $d_y > d_x$. More preferably, for an aspect ratio of light emitting pixels of 1:k, the preferred relation between respective distances is $0.7\ k\ d_x \lesssim d_y \lesssim 1.3\ k\ d_x$. For example, for the aspect ratio of 1:3, preferred relation between respective distances is about $2d_x \lesssim d_y \lesssim 4\ d_x$. According to this technical measure all resulting views have the same viewing angle with respect to a normal to the display, which is found to be more convenient in practical applications, like a table-top display, for example for a gaming computer.

In an embodiment of the display according to the invention, at least one of the apertures, and preferably each of the apertures, at least partially comprises a color filter.

In a further embodiment of the display according to the invention, the display comprises a controller for supplying a plurality of respective image data to respective pixels constituting the unit cell. More preferably, the apertures are arranged to enable a plurality of alternative viewing modes, the controller is further arranged to enable switching between the alternative viewing modes by altering at least a geometry of the unit cell, a geometry of the aperture cooperating with the unit cell, a repetition pattern of the unit cells, or a repetition pattern of the apertures. Preferably, a first viewing mode is a single viewing mode and a second viewing mode is a multiple viewing mode.

Alternatively, the display comprises a backlight unit arranged to control the angle of propagation of respective light rays. An alternative method of providing multiple views, notably four views would be to use a directional backlight of which the direction the

light is emitted into can be switched between, for example, four directions. In this specific embodiment it is not necessary to use any apertures for enabling multiple views. This switching can be done time-sequentially in synchronism with the information offered to the display. The advantage is that no light is wasted and that the full native resolution of the display is available for each viewer. The disadvantage is the occurrence of flicker unless the frame rate is high enough (in practice at least 4x60=240 Hz). This embodiment has an advantage that all pixels of the display are in the active state, increasing the light output of the display still further.

The computer system according to the invention comprises a processor arranged for generating multiple view data and a display as discussed in the foregoing for generating multiple views.

These and other aspects of the invention will be discussed in further detail with reference to Figures.

Fig. 1 presents a schematic view of an embodiment of the display according to the invention.

Fig. 2 presents a schematic view of a further embodiment of the display according to the invention.

Fig. 3 presents a schematic view of a further embodiment of the display according to the invention.

Fig. 4 presents a schematic view of a further embodiment of the display according to the invention.

Fig. 5 presents a schematic view of a further embodiment of the display according to the invention.

Fig. 6 presents a schematic view of a further embodiment of the display according to the invention.

Fig. 7 presents a schematic view of a further embodiment of the display according to the invention.

Fig. 8 presents a schematic view of a further embodiment of the display according to the invention.

Fig. 9 presents a schematic view of a further embodiment of the display according to the invention.

Fig. 10 presents a schematic view of a further embodiment of the display according to the invention.

Fig. 11 presents a schematic view of a further embodiment of the display according to the invention.

DESCRIPTION OF THE DRAWINGS

An embodiment of a four-view display in accordance with the invention is shown in Fig. 1. The display comprises light emitting pixels of the type 3, 4, 1 and 2 and inactive pixels of the type 6a. The apertures of the type 5 are formed by a suitable optical barrier arranged in front of the display 10. The apertures 5 are dimensioned to be substantially comparable to a size of a pixel. Fig. 1 presents schematically a superposed view 10 of the set of apertures 5 positioned above a suitable screen. This embodiment of the four-view display is based on the use of a conventional LCD with red, green, and blue sub-pixels arranged in columns (not shown). The invention is not limited to LCD screens, but can also be applied to other pixilated screens such as PDP or OLED screens. A unit cell 8 comprising pixels 2, 3, 1 and 4 is formed by combining a suitable plurality of active, light emitting pixels. In this particular embodiment the unit cell 8 is shaped as a rectangle with symmetry axes A1 and A2 and a geometric center G. The light emitting pixels are arranged along the symmetry axes A1, A2 and the respective four views are formed by an oblique light propagation through the aperture 5 arranged above the geometric center G, thereby resulting in respective views v1, v2, v3 and v4. It is noted that the views v1, v2, v3 and v4 are located not in one plane but are spatially distributed at four spatial angles. It is further noted that usually the pixels lying immediately below the aperture 5 are not active. However, it is possible to arrange these pixels as active pixels thereby generating a fifth view propagating perpendicular to a plane of the LCD screen 10.

It is noted that from a geometrical perspective the unit cells may be separated from each other by non-active pixels 7, which do not radiate any light. The active, light emitting pixels 2, 3, 1 and 4 are the pixels that can contribute to the various views due to the fact that only light rays propagating from these pixels can escape the aperture 5. It is noted that in order to avoid crosstalk between adjacent pixels, some pixels, like 7 are always in the off state, which is schematically illustrated by a gray color. The unit cell 8 is translated over the screen 10, whereby respective apertures 5 are arranged within respective unit cells and are dimensioned to be comparable to a size of a pixel. It is further noted that within the context of the present application the term "comparable" refers to values lying within the same order of magnitude. The apertures 5 may be formed on a single optical barrier.

In an embodiment shown in Fig. 1, the light emitting pixels 3 have a green color, the light emitting pixel 2 is red and the light emitting pixel 4 is blue. It is noted that the arrangement of the color pixels within the unit cell shifts when the unit cell is translated across an area of the LCD screen. For example, for an initial selection of the light emitting pixels to be green 3, red 2, blue 4, the following unit cell will have two blue pixels 4', a green pixel 3' and a red pixel 2'. In general, the light emitting pixels will form a sequence of red-blue-green along any row constituting the LCD screen.

Fig. 8 presents a schematic view of a further embodiment of the display according to the invention. In this embodiment the apertures are formed by an interaction of a first set of apertures 85a formed in a first optical barrier located at a first distance from the LCD screen and a second set of apertures 85b located in a second optical barrier located at a second distance from the LCD screen. It is noted that the cross sections shown in Fig. 8 present respective sections of the device according to the invention taken along a row A and a column B, shown in Fig. 1. This embodiment further improves the embodiment discussed with reference to Fig. 1 in that instead of a single barrier with transparent apertures, two barriers are used, and each of the two barriers has long transparent slits instead of hole-like apertures. The slits of the two barriers are orthogonal with respect to each other. Barrier 1, responsible for views corresponding with pixels 2 and 4 shown in Fig. 1, is located at an optical distance d_x from the plane of pixels of the LCD. For barrier 2, responsible for views corresponding to pixels 1 and 2 shown in Fig. 1, this distance is d_y. Preferably, for an aspect ratio of light emitting pixels of 1:k, the preferred relation between respective distances is $0.7\ k\ d_x \leq d_y \leq 1.3\ k\ d_x$. For example, for the aspect ratio of 1:3, preferred relation between respective distances is about $2d_x \leq d_y \leq 4\ d_x$. As a result of this technical measure, all resulting views have the same viewing angle with respect to a normal to the display.

As is schematically illustrated in Fig. 8, four views v1, v2, v3, v4 are formed by oblique light propagation from respective light emitting pixels 81, 82, 83, 84 through respective barriers.

Alternative embodiments of the display according to the invention are shown in Fig. 2 and Fig. 3. In Fig. 2, a unit cell 28 is translated across an LCD area yielding a set of active pixels. The unit cell 28 is a rectangle having a geometric center G. The light emitting pixels 21, 22 are arranged along diagonals D1, D2 of the unit cell. It is noted that in this particular embodiment the unit cell is formed just by two colors, for example red 21 and blue 22, the light emitting pixels of the same color being stacked on top of each other. When the

unit cell 28 is translated along the area of the LCD screen, the color of the light emitting pixels constituting the unit cell is changed. For example, in the unit cell 28' the light emitting pixels are green 23 and red 21'. Also in this embodiment the light emitting pixels along a certain row form a red-blue-green sequence. Regarding a unit cell arranged on one row, it is seen that the primary colors 21, 22, 23 are interleaved, whereby the unit cell 28 upon its translation to a position 28' comprises shifted colors. The unit cell 28 comprises inactive pixels schematically shown in gray. The resulting views are indicated by v1, v2, v3 and v4.

Respective apertures 25 are placed within each unit cell 28, and are shown in Fig. 2 in superposition on the LCD screen, the size of the aperture being substantially the same as the size of a single pixel. It is noted that in this embodiment the position of the aperture 25 is shifted in a vertical direction by a half pixel with respect to rows of the pixels 21 and 22. In this case, preferably a row of pixels between the light emitting pixels 21 and 22 is inactive.

In a further embodiment of the display according to the invention, shown in Fig. 3 the unit cell 34 comprises only active pixels 31, 32 arranged in columns. The unit cell 34 is a rectangle, whereby the light emitting pixels are arranged along diagonals D1, D2 of the rectangle. The unit cells 34, 34a are separated by inactive pixels shown in gray to avoid crosstalk between different views. The aperture 35 is positioned above a geometric center G of the unit cell 34, partially overlapping the area of respective light emitting pixels 31, 32. The aperture 35 is hereby shown by superposition. Also in this embodiment the unit cell 34, when translated across the display area to a position 34a comprises different color pixels 32, 33. Regarding a unit cell arranged on one row, it is seen that the primary colors 31, 32, 33 are interleaved, whereby the unit cell 34 upon its translation to a position 34a comprises shifted colors. Similar to the arrangement shown in Fig. 2, it is noted that in this embodiment the red-blue-green sequence is formed by pairs of pixels having the same color, but constituting adjacent unit cells, like pixels 32, 33.

With the layouts as shown in these figures, four equal views v1, v2, v3 and v4 can be created. Contrary to the embodiment shown in Fig. 1, the views are not oriented along the main axes of the display but rather along the diagonals of the display. Also for these embodiments, the single barrier can in principle be replaced by a double barrier according to the same lines of reasoning as described with reference to Fig. 8.

Fig. 4 presents a schematic view of a further embodiment of the display 40 according to the invention. In this particular embodiment six independent views, schematically indicated by v1, v2, v3, v4, v5 and v6 are produced. The unit cell 48 is a

rectangle with a geometric center G, an inner region I and an outer region O. The light emitting pixels are preferably only the pixels arranged along the outer region O. The pixels located in the inner region I are preferably switched off to avoid crosstalk. However, it is possible that these pixels are used to produce a seventh view propagating substantially perpendicularly to the plane of the LCD screen 40.

The aperture AP for this embodiment comprises four pixels long and 1 pixel high which is of the same order of magnitude as a single pixel. The aperture AP comprises four color filters 41, 42, 42, and 43 and is shown by superposition on the LCD screen. The color selection of the filters 41, 42, 43 depends on the respective position of the rows of primary LCD pixels blue, red, green (B, R, G) and the aperture. In the case where the color code of the LCD pixels constituting the unit cell 48 is red-green-blue-red-green-blue, the color code of the filters is red for 41, green for 42 and blue for 43. To ease comprehension, light emitting pixels that correspond are schematically shown in white. For the present embodiment, the unit cell 48 constitutes 18 pixels, arranged as a rectangle having 3 rows and 6 columns. In this way, view 5 is generated by the three leftmost pixels of the highest row, view 4 is generated by a single leftmost pixel of the second row, view 6 is generated by three rightmost pixels of the upper row, view 1 is generated by the rightmost pixel in the second row, view 3 is generated by the three leftmost pixels in the lower row and view 2 is generated by the three rightmost pixels in the lower row.

Various alternative patterns of color filters, as well as hybrid patterns of color filters and transparent regions are envisaged. Examples of suitable embodiments are schematically shown in Fig. 6. For example a filter sequence (a) comprising color elements 61a, 61b, 61b and 61c can be replaced by a filter sequence (b) comprising a color element 62a two transparent elements 62b and a color element 62c. In this case the dimension of a single color element 62a is the same as a width of a single pixel. In the embodiment (c) with filter elements 63a, 63b and 63c, they are dimensioned wider that a width of the pixel. In a filter sequence (d) the dimensions of the color filter elements 64a, 64b and 64c are smaller than the dimension of the pixel. In the embodiment (e) the color filters 65a, 65e encompass non-transparent area 65b and 65d and a transparent area 65c. In the embodiment (f) the colored filters 66a, 66c surround a transparent region 66b, all being of diminished size, still being of the same order of magnitude as the pixel size.

The resulting views obtainable with these filters are shown in Fig. 7. Wherein for a unit cell (a) provided with the filters 74, 75, 76 six viewing regions are produced, v1, v2, v3, v4, v5 and v6. In this way, view 5 is generated by the tree leftmost pixels of the

highest row, view 4 is generated by a single leftmost pixel of the second row, view 6 is generated by three rightmost pixels of the upper row, view 1 is generated by the rightmost pixel in the second row, view 3 is generated by the three leftmost pixels in the lower row and view 2 is generated by the three rightmost pixels in the lower row.

For the embodiment of the unit cell (b) having a smaller unit cell, four views 1 – 4 are produced using the filters 74a, 75a, 76a. The view 1 is generated by three rightmost pixels of the lower row, view 2 is generated by the three leftmost pixels of the lower row, view 3 is generated by three leftmost pixels of the upper row and view 4 is generated by the three rightmost pixels of the upper view. Preferably, a controller of the device according to the invention is arranged to enable suitable switching between a 6-view display and a 4 view display, more preferably between a single view display and a suitable multi-view display, the latter presenting single content on the screen. This may be enabled by altering at least a geometry of the unit cell, a geometry of the aperture cooperating with the unit cell, a repetition pattern of the unit cells, a repetition pattern of the apertures. This feature is of particular advantage for table-top gaming computer applications, where a number of players may vary between 4 and 6 persons.

Fig. 5 presents an embodiment of a two-barrier arrangement provided with filters for obtaining apertures as described with reference to Figs. 4, 6. In accordance with the description of Fig. 8, the first barrier is preferably arranged at a distance d_x, which relates to a distance to the second barrier d_y in the following way: $d_y > d_x$. More preferred, $2\,d_x \le d_y \le 4\,d_x$ for an aspect ratio of 1:3. According to this technical measure all views have the same viewing angle with respect to a normal to the display. The barrier 1 and the barrier 2 are shown in respective sections A and B taken along a row A and a column B of the display. The light from the LCD screen comprising a repetition of rows with red, green and blue pixels first traverses the barrier 1 comprising red, green and blue filters, after which it passes a barrier 2. The arrows schematically indicate the resulting views after the light rays have passed the double barrier. It is also possible to displace respective triplets of color filters so that the apertures are arranged along respective short and long diagonals of the LCD screen. Such arrangement of filters yields increased light output from the display.

An example of a double barrier with striped patterns of color filters is shown in Fig. 9. In effect, it is equal to the single barrier solution as depicted in Figs. 4, 6. In this embodiment a first barrier comprises double-pixel rows of filters 91, 92 and 93, arranged repetitively along the area of the LCD (not shown). A second barrier comprises filters of the same color 91, 92, 93 arranged orthogonally with respect to the first barrier. The effect of

these barriers is the same as of a barrier wherein the two-pixel wide filters of primary colors (red, blue, green) are arranged along short and long diagonals of the LCD screen.

Fig. 10 presents a schematic view of further embodiments of suitable shapes of individual apertures of the display according to the invention. For ease of comprehension the individual apertures are shown projected on the unit cells. In this way, the unit cell 101 comprises a set of light emitting pixels 101a, 101b, 101c separated by inactive pixels 105. In the center of the unit cell 101 an aperture 101d is positioned, the aperture having substantially the same dimension as a single pixel, but being formed as a rhombus. In the unit cell 102, comprising active pixels 102a, 102b, 10c and inactive pixels 105, the aperture 102d is positioned. The aperture 102d has a shape of a stacked trapezoid, the longer bases extending into respective areas of pixels 102a. In the unit cell 103 comprising active pixels 103a, 103b, 103c and inactive pixels 105, the aperture 103d being shaped as an elongated an broadened pixel is positioned. The aperture 103d comprises areas 103d' and 103d" covered with a suitable filter.

Fig. 11 presents a schematic view of a further embodiment 110 of the display according to the invention. The present embodiment refers to a display 111 in which pixels are arranged in so-called delta-nabla geometry. The display comprising active pixels is produced by translating the unit cell 120 across a display area. Accordingly, a primary cell 120 may be formed by three pixels 115, (green) 116 (blue), 117 (red). In order to enable a multiple view display according to the invention a barrier 112 comprising a set of apertures 118a, 118b, 118c is superposed on the display 111. Respective pixels contributing to respective views are indicated by numerals 1, 2, 3, 4, 5 and 6. The apertures may preferably comprise colored filters, notably cyan 118a, yellow 118b, magenta 118c. The apertures are shown by superposition on the respective unit cell 120.

The computer system according to the invention comprises a processor arranged for generating multiple view data and a display as discussed in the foregoing for generating multiple views. For example, the display may be embedded in a middle console of a car and receive navigation instructions and entertainment video from the processor. The processor may be embedded in the car or in a portable device, e.g. a PDA or a mobile phone. The processor may be a general purpose processor or an application-specific processor. The processor and display may be connected through one or more wires or may be connected without wires, e.g. by using Bluetooth, Wireless USB or WiFi.

While specific embodiments have been described above, it will be appreciated that the invention may be implemented other than described. The descriptions above are

intended to be illustrative, not limiting. Thus, it will be apparent to one skilled in the art that modifications may be made to the invention as described in the foregoing without departing from the scope of the claims set out below. The invention resides in each and every novel characteristic feature and each and every combination of characteristic features. Reference numerals in the claims do not limit their protective scope. Use of the verb "to comprise" and its conjugations does not exclude the presence of elements other than those stated in the claims. Use of the article "a" or "an" preceding an element does not exclude the presence of a plurality of such elements.

The invention can be implemented by means of hardware comprising several distinct elements, and by means of a suitably programmed computer. In the apparatus claim enumerating several means, several of these means can be embodied by one and the same item of hardware. 'Computer program product' is to be understood to mean any software product stored on a computer-readable medium, such as a floppy disk, downloadable via a network, such as the Internet, or marketable in any other manner.

CLAIMS:

1. A multiple view display (110) comprising a set of pixels (116, 117, 118) arranged for emitting corresponding light rays and a set of apertures (118a) arranged for transmitting a portion of the light rays in dependence on an angle of their propagation, wherein

the set of pixels is formed by a repetition of a unit cell (120) comprising a plurality of light emitting pixels, each aperture being arranged within the unit cell and being dimensioned to be substantially comparable to a size of a pixel (116).

2. A multiple view display (10) according to claim 1, wherein the set of pixels (1, 2, 3, 4) is formed by a repetition in a row direction (A) and in a column direction (B) of a unit cell (8) comprising a plurality of light emitting pixels, respective unit cells being separated by a plurality of inactive pixels (7).

3. A display according to claim 1 or 2, wherein the apertures (5) are formed by a three-dimensional superposition of a first barrier comprising a first set of slits (85b) and a second barrier comprising a second set of slits (85a), the second set of slits being transversely arranged with respect to the first set of slits.

4. A display according to claim 3, wherein for an aspect ratio of the light emitting pixels of 1:k, a value of a distance between the display and a first barrier is substantially between 0.7 k times and 1.3 k times a distance between the display and the second barrier.

5. A display according to any one of the preceding claims, wherein at least one of the apertures (103d) at least partially comprises a color filter (103d', 103d").

6. A display according to any one of the preceding claims, wherein the display is arranged with a controller for supplying a plurality of respective image data to respective pixels constituting the unit cell.

7. A display according to claim 6, wherein the apertures are arranged to enable a plurality of alternative viewing modes, the controller being further arranged to enable switching between the alternative viewing modes by altering at least a geometry of the unit cell, a geometry of the aperture cooperating with the unit cell, a repetition pattern of the unit cells, a repetition pattern of the apertures.

8. A display according to claim 7, wherein a first viewing mode is a multiple viewing mode and a second viewing mode is a single viewing mode.

9. A display according to any one of the preceding claims, wherein a distance between respective apertures is selected to avoid crosstalk.

10. A display according to any one of the preceding claims, wherein the unit cell comprises a polygon (120, 8) having a geometric center (G), the aperture (118c) being arranged at least above the geometric center of the polygon, respective multiple views being formed by an oblique light propagation from the light emitting pixels through the aperture.

11. A display according to claim 10, wherein the unit cell comprises a rectangle (34), the light emitting pixels (1, 3; 2, 4) being arranged along respective symmetry axes (A1, A2) of the said rectangle.

12. A display according to claim 10, wherein the unit cell comprises a rectangle (28), the light emitting pixels (21, 22) being arranged along respective diagonals (D1, D2) of the said rectangle.

13. A display according to claim 10, wherein the unit cell comprises a rectangle (40) with an inner region (I) and an outer region (O), the light emitting pixels being arranged along the outer region.

14. A display according to claim 10, wherein pixels lying immediately below the apertures are not active.

15. A computer program product enabling a programmable device to act as the multiple view display according to any one of the preceding claims.

16. A computer system comprising a processor for generating multiple view data and a multiple view display according to any of claims 1 to 14.

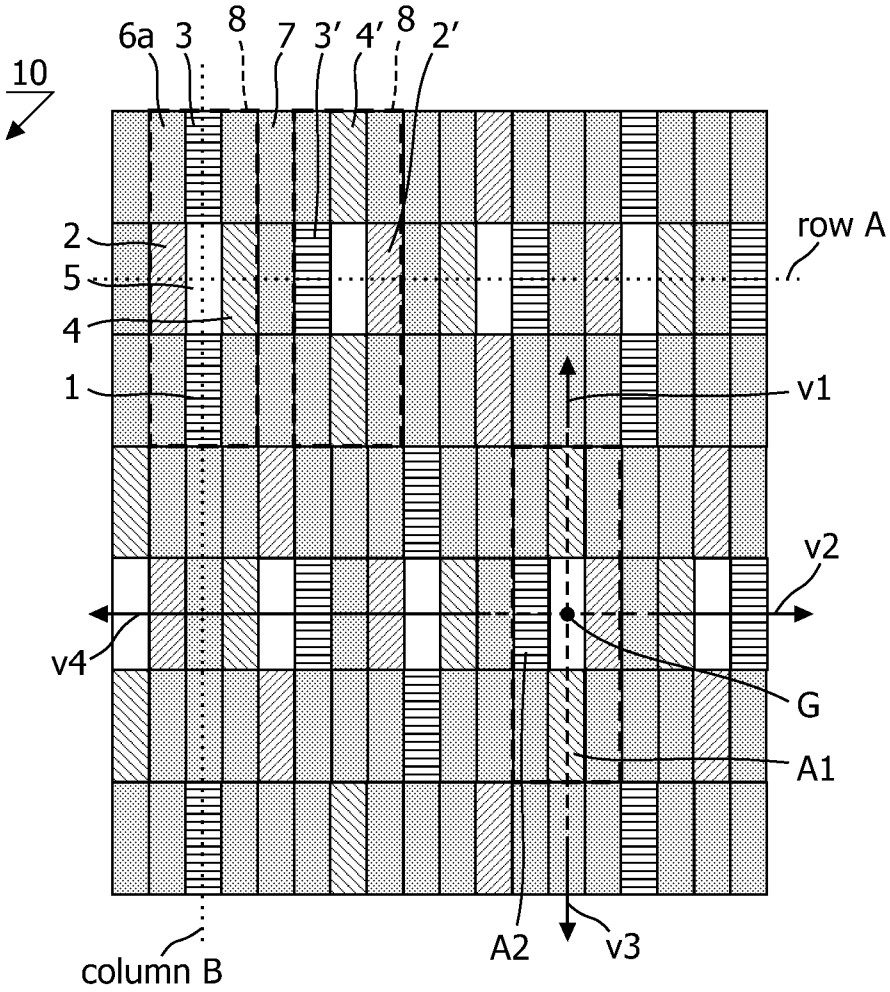


FIG. 1

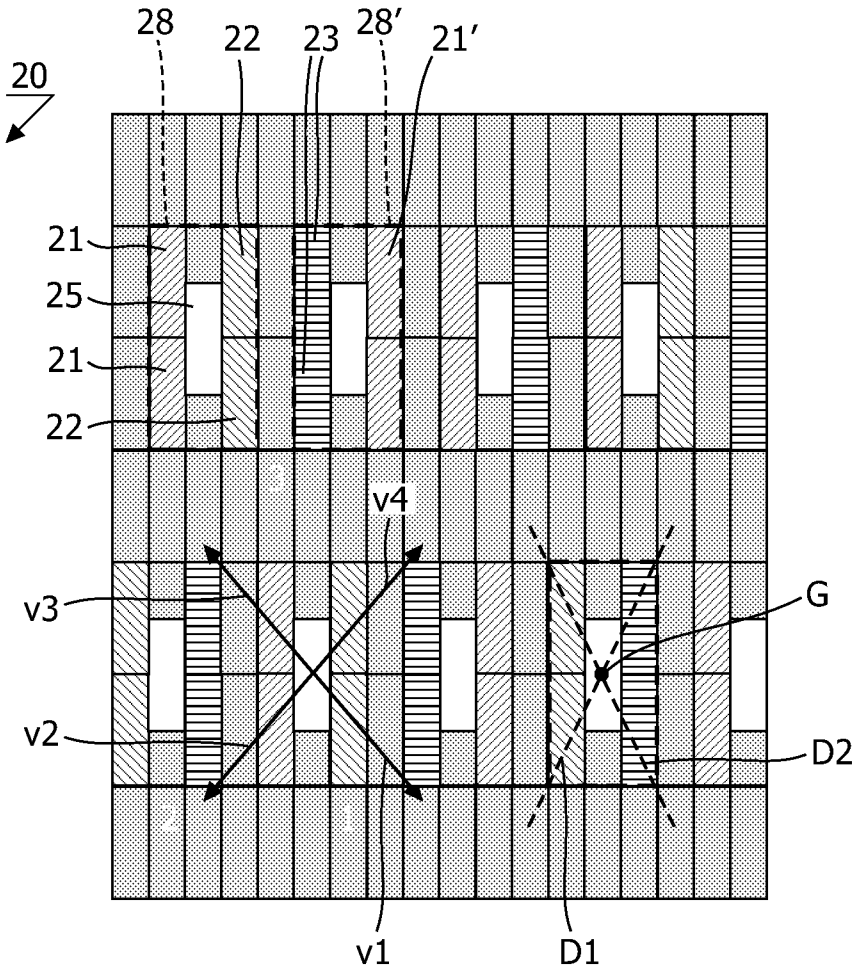


FIG. 2

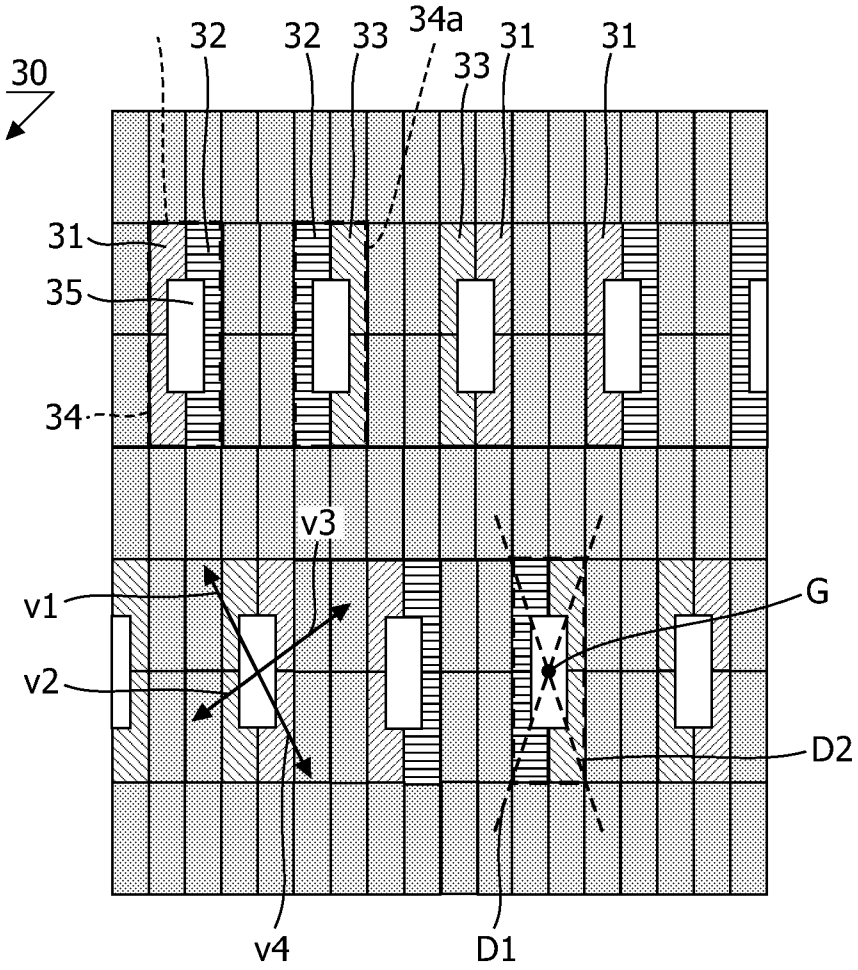


FIG. 3

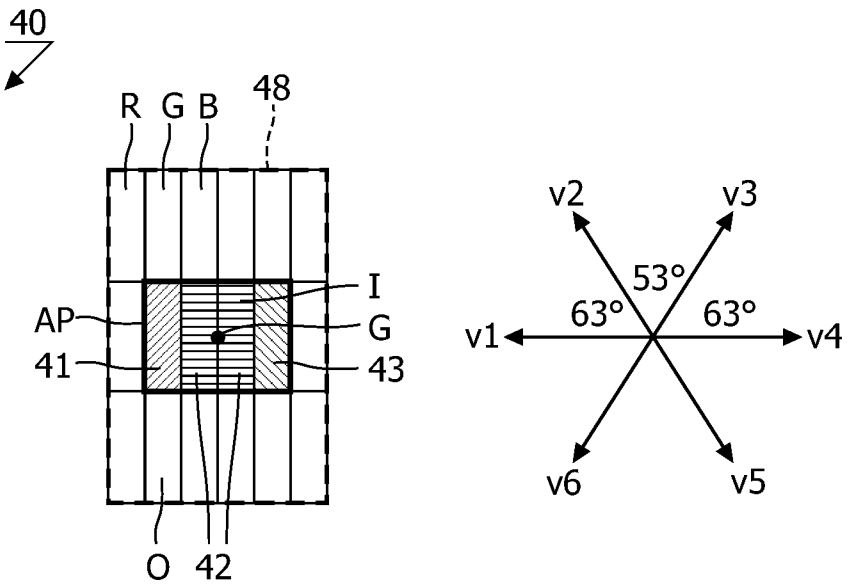

40
R G B
48
I
AP
G
41
43
O 42
v2
v3
53°
63°
63°
v1
v4
v6
v5

FIG. 4

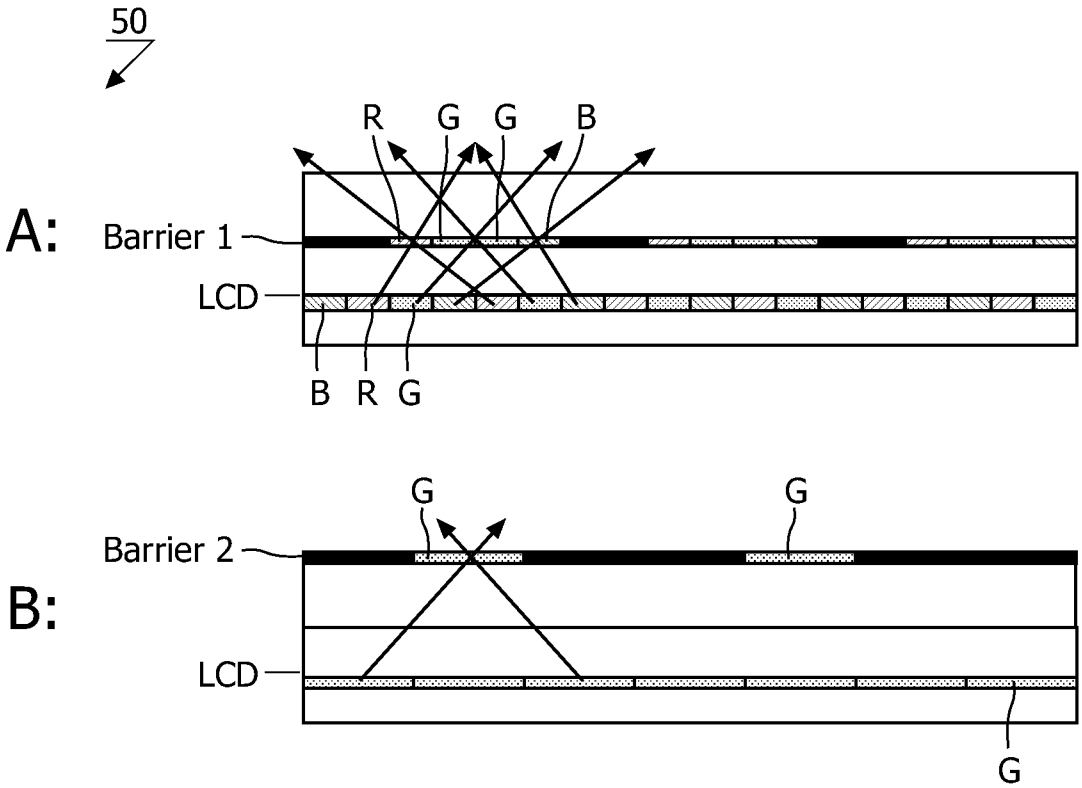

50
A:
R G G B
Barrier 1
LCD
B R G
B:
G G
Barrier 2
LCD
G

FIG. 5

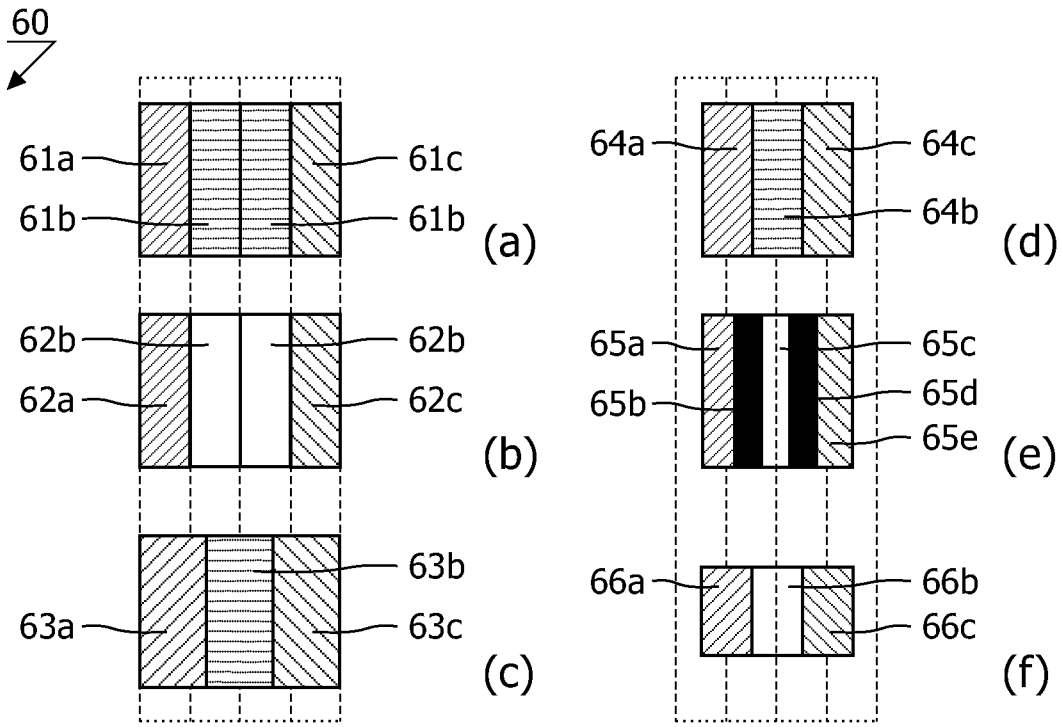

60
61a
61b
61c
61b
(a)
62b
62a
62b
62c
(b)
63a
63b
63c
(c)
64a
64b
64c
(d)
65a
65b
65c
65d
65e
(e)
66a
66b
66c
(f)

FIG. 6

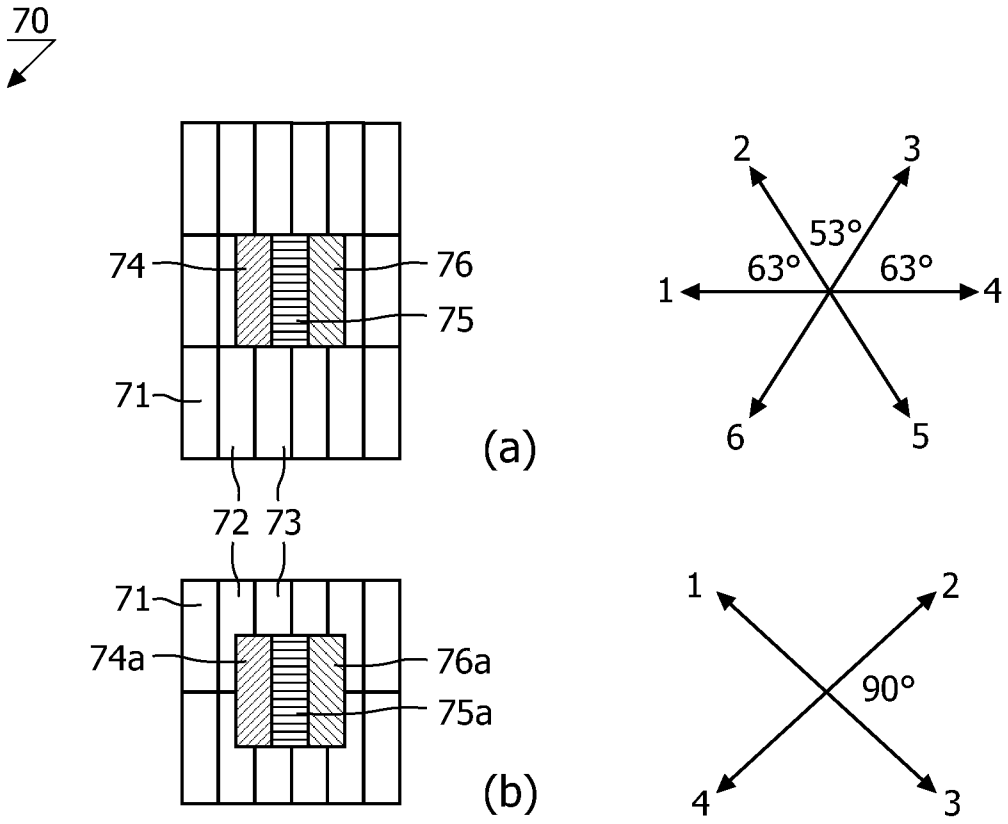

70
74
76
75
71
(a)
72
73
71
74a
76a
75a
(b)
2
3
53°
63°
63°
1
4
6
5
1
2
90°
4
3

FIG. 7

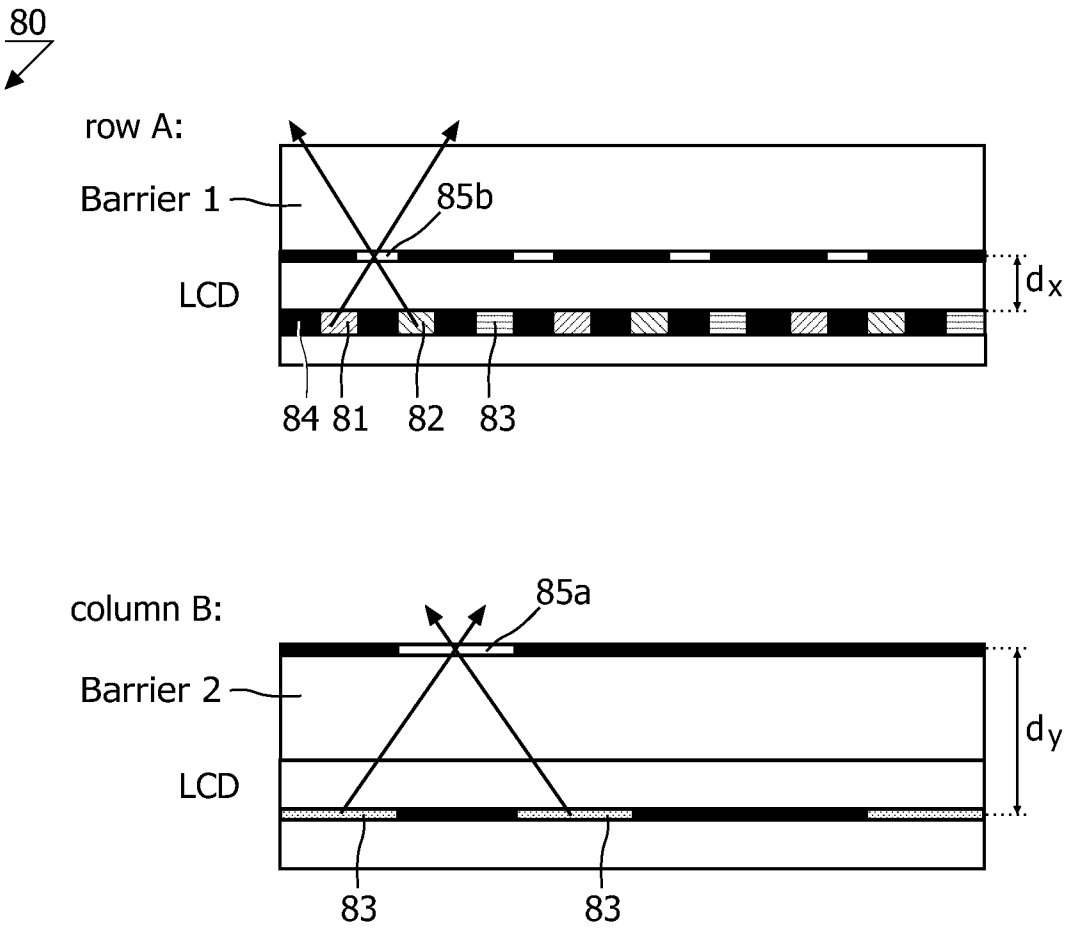

80
row A:
Barrier 1
85b
LCD
dx
84 81 82 83
column B:
85a
Barrier 2
LCD
dy
83 83

FIG. 8

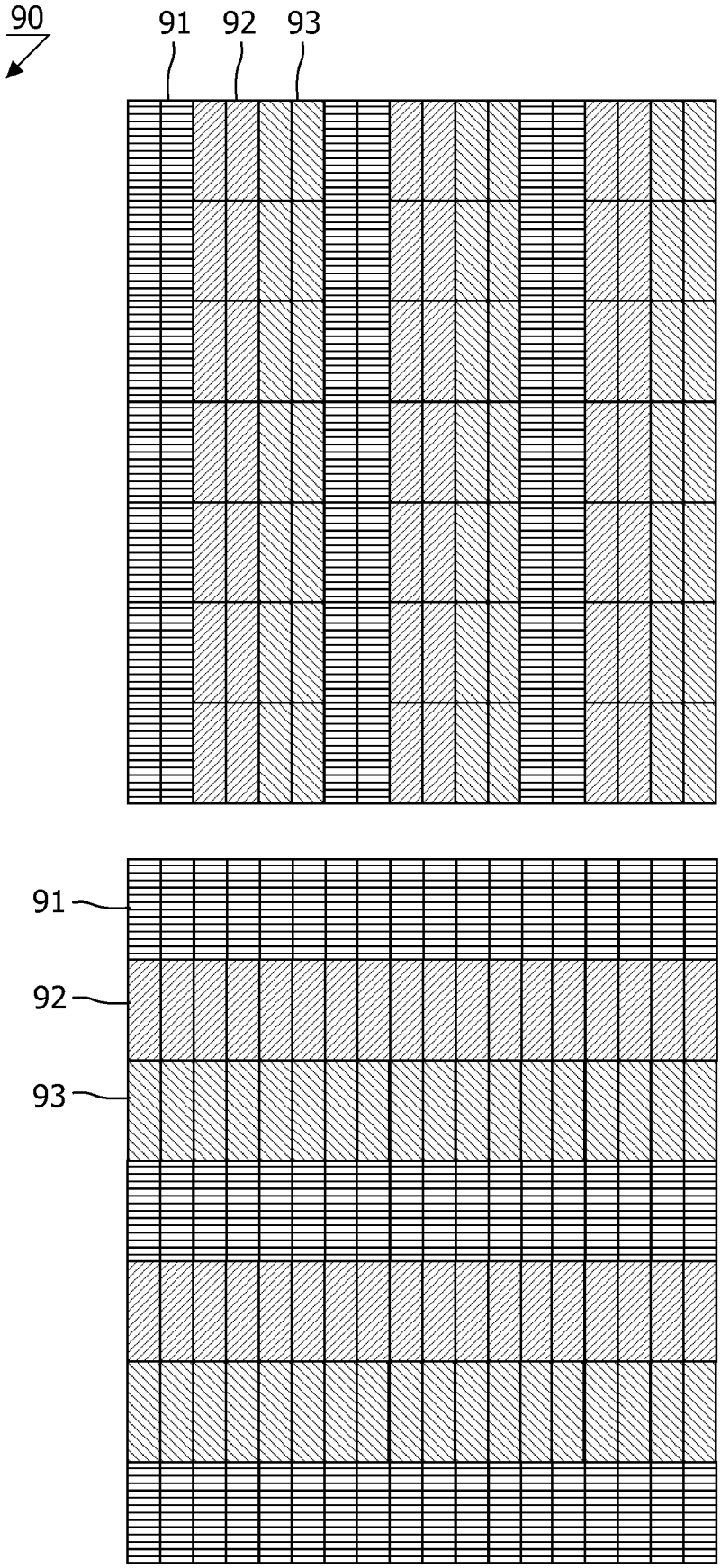
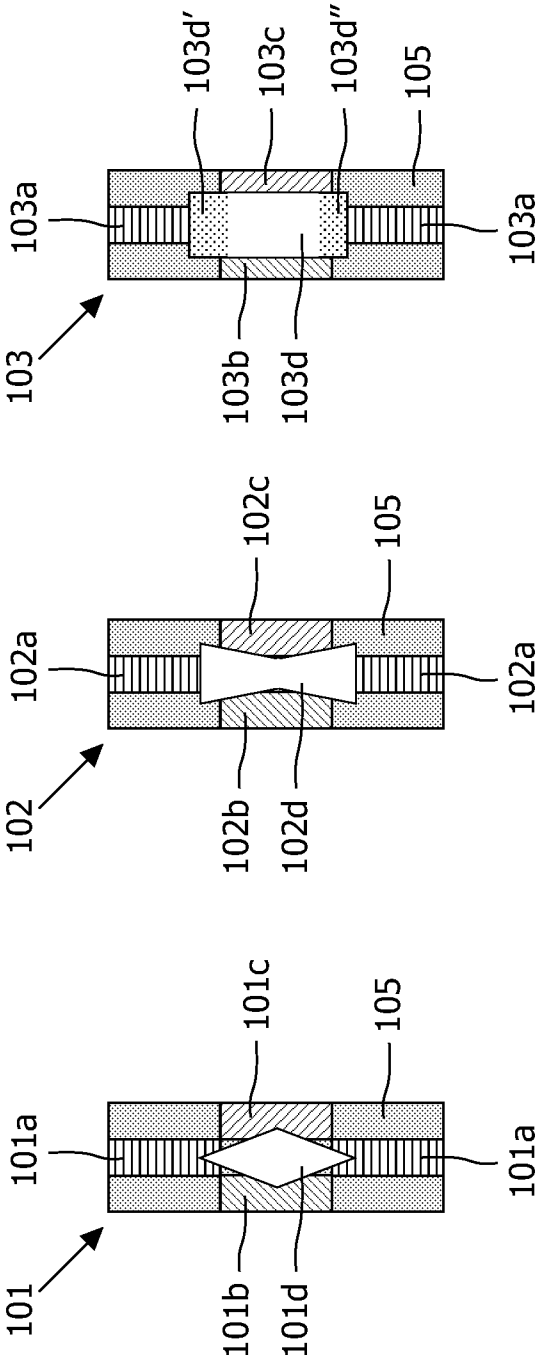


FIG. 9


103d'
103c
103d''
105
103a
103a
103
103b
103d
102c
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102a
102a
102
102b
102d
101c
105
101a
101a
101
101b
101d

FIG. 10

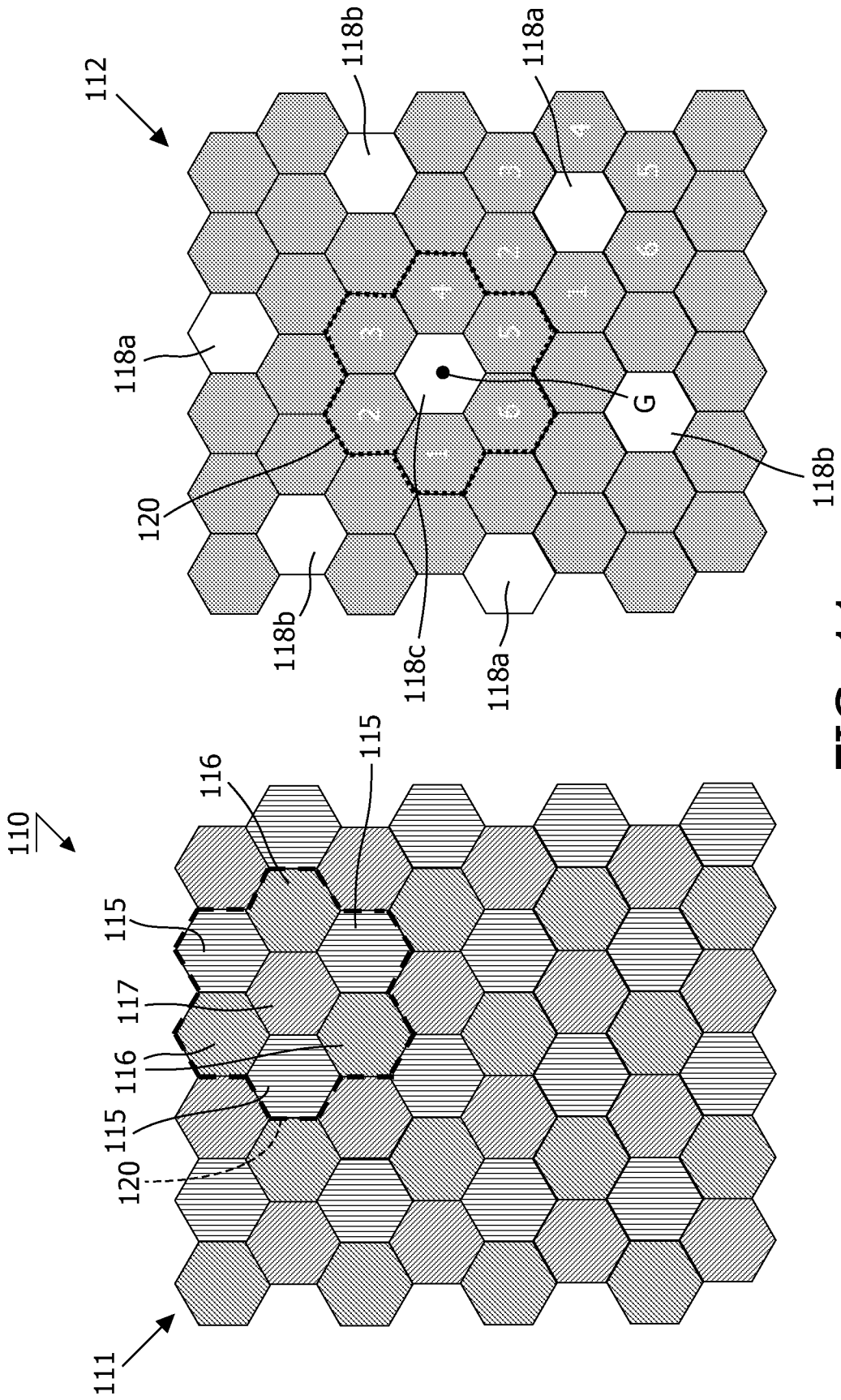

FIG. 11

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2008/050888

A. CLASSIFICATION OF SUBJECT MATTER
INV. H04N13/04

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
H04N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 540 137 A (JAPAN BROADCASTING CORP [JP]) 5 May 1993 (1993-05-05)	1,6-8, 10-13, 15,16
Y	abstract page 3, lines 3-6 page 9, lines 26-39 figures 8A-8B	2,5,9,14
	-/--	

[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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Date of the actual completion of the international search	Date of mailing of the international search report
15 July 2008	25/07/2008

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Mao, Pauline

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2008/050888

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WO 2005/031444 A (KONINKL PHILIPS ELECTRONICS NV [NL]; IJZERMAN WILLEM L [NL]; CORNELISS) 7 April 2005 (2005-04-07)	2,5,14
A	abstract page 2, lines 3-5 figure 1 figures 4-6 page 11, line 16 - page 13, line 31 figure 21 page 25, line 18 - page 26, line 8 page 32, lines 26-29	6-8,15, 16
X	GB 2 405 545 A (SHARP KK [JP]) 2 March 2005 (2005-03-02)	1,5-8, 15,16
Y	abstract figures 12-23 page 9, lines 6-8 page 10, lines 23,24 page 17, lines 15-25; figure 7 page 19, lines 6-8 page 19, line 28 - page 20, line 10	9
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Y	abstract paragraph [0069] paragraph [0117] paragraph [0197]; figure 34 paragraph [0199]; figure 36 claims 11,20,26	2
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X	EP 1 515 178 A (SANYO ELECTRIC CO [JP]) 16 March 2005 (2005-03-16) paragraphs [0001], [0004], [0005]; figures 4,5	1

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Information on patent family members

International application No
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