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(54) **Method and apparatus for driving a plasma display panel**

(57) The invention relates to a method for processing data of video pictures for displaying the pictures on a display device like a plasma display panel. For having a good video picture quality one key characteristic is to have a good response fidelity of the plasma cells. This is not always the case since the fidelity of each cell depends on the excitation of the neighboring cells. The so-called neighborhood effect can reduce the vertical sharpness in the picture.

The invention solves this problem with a vertical peaking process in which it is analysed whether the cell

excitation in an activated sub-field after an inactivated sub-field for a current pixel gets support by a parallel cascaded cell excitation of a neighbouring cell. If no such support is found, the sub-field code word for the current pixel is modified in such a manner that the entry in the sub-field code word for the inactivated sub-field is replaced by an entry for an activated sub-field. In this way it is assured that cell excitation in the activated sub-fields for the current pixel is supported by a parallel cascaded cell excitation in the neighbouring cell in order to maintain the cascade effect.

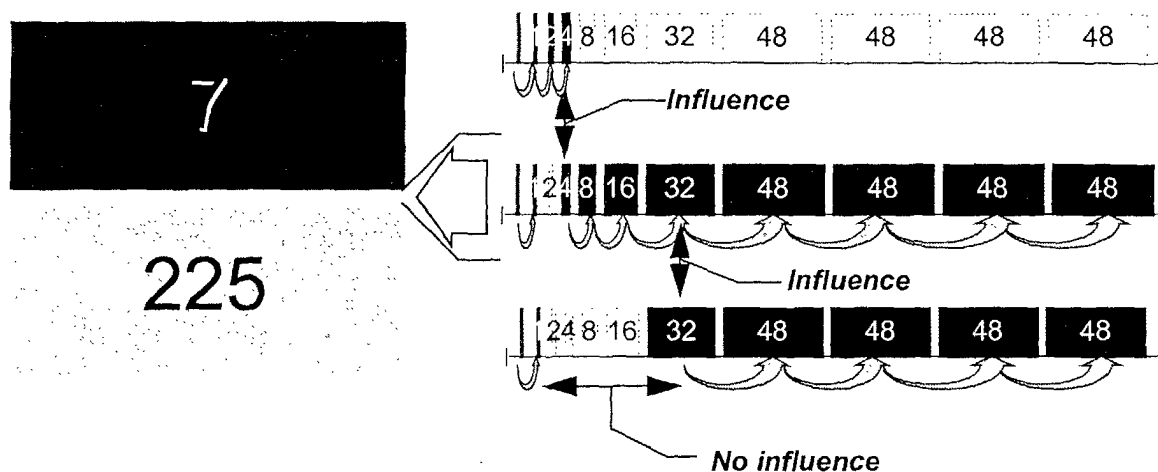


Fig.4E

Description

[0001] The invention relates to a method for processing video pictures for display on a display device. More specifically the invention is closely related to a kind of video processing for improving the response fidelity of an active matrix display like plasma display panel (PDP), organic light emitting diode (OLED) or other display device where the display elements generate light in a number of small lighting pulses in a frame period for brightness control.

Background

[0002] Although plasma display panels are known for many years, plasma displays are encountering a growing interest from TV manufacturers. Indeed, this technology now makes it possible to achieve flat colour panels of large size and of limited depth without any viewing angle constraints. The size of a plasma display panel may be much larger than that of any known classical CRT picture tube.

[0003] A plasma display panel comprises a matrix array of discharge cells which can be switched ON or OFF. In contrast to a CRT picture tube or LCD display in which the grey levels of a video picture are expressed by an analogue control of the light emission, the grey levels of a plasma display panel are controlled by modulating a number of light pulses generated in the discharge cells. This time-modulation will be integrated by the eye over a period corresponding to the eye time response.

[0004] Referring to the latest generation of TV sets a lot of work has been done to improve the picture quality of plasma display panels so that video pictures are produced as good or even better than that of the known standard TV technology. In order to achieve the best picture quality a key issue is the so-called response fidelity of the plasma display panel.

[0005] A good response fidelity of a plasma display panel corresponds to the ability to exactly switch on only the discharge cell of a plasma display panel which are specified by the corresponding pixel data of a video picture.

[0006] The ability of a local discharge cell to be switched on, however, depends on the excitation of the neighbouring/ surrounding discharge cells. The reactivity of a discharge cell is much stronger if discharge cells surrounding the local cell are also excited at the same time. The result of this conditioning effect is that the discharge cells located in the middle of an illuminated area of the plasma display panel will work perfectly but not the discharge cells located at a transition between a dark area and an illuminated area or single cells within a dark area.

[0007] In order to improve the reactivity of discharge cells in a dark area a prior art solution provides for a regular excitation of all discharge cells for a short period at the beginning of each frame period of a plasma display panel. This so-called priming operation, however, reduces the contrast ratio of the plasma display panel by increasing the background luminance of the picture being displayed on the plasma display panel. And this is a disadvantage.

[0008] In a further patent application of the applicant, see WO 01/56003 it is proposed to use self-priming and refreshing sub-fields in combination for enhancing the response fidelity. A self-priming sub-field is characterized by having a prolonged addressing period and/or a higher writing voltage. A so-called refreshing code is used for sub-field coding in which for all input video values there is never more than one sub-field inactivated between two activated sub-fields in the SF code word.

Invention

[0009] It is an object of the present invention to disclose a method and an apparatus for processing video pictures to be displayed on a plasma display panel having the features of an improved response fidelity without reducing the contrast ratio of the video picture.

[0010] This object is achieved by a method according to claim 1 and an apparatus according to claim 9. Preferred embodiments are disclosed in the dependent claims.

[0011] The present invention relates to a kind of vertical peaking which aims to increase the level of a critical transition to assure a good conditioning of the cells. According to the invention before the sub-field code word for a current pixel is forwarded to the display driving unit it is analysed whether the cell excitation in an activated sub-field after an inactivated sub-field for the current pixel gets support by a parallel cascaded cell excitation of a neighbouring cell. If this is not the case, the sub-field code word for either the current pixel or the neighbouring pixel is modified in such a manner that the entry in the sub-field code word for the inactivated sub-field is replaced by an entry for an activated sub-field so that cell excitation in the activated sub-fields for the current pixel is supported by a parallel cascaded cell excitation in the neighbouring cell in order to maintain the cascade effect.

[0012] This inventive technique greatly improves the response fidelity of the plasma display panel without reducing the contrast ratio of the video picture to be displayed. This is true above all in case that the PDP is produced with matrix technology combined with the AWD addressing scheme.

[0013] This technique ensures a perfect transition between a black area and a grey area on a plasma display panel

by supplying more energy to a discharge cell at the transition border than to a discharge cell at the middle of the grey area.

[0014] As the peaking process according to the invention reinforces the vertical transitions in the picture, it is similar to the Mach phenomenon appearing behind the human retina and thus improves the sharpness impression of the picture.

[0015] The peaking algorithm is easy to implement since it does not request complicated computations but only three additional line memories.

[0016] If the algorithm is combined with an optimised sub-field encoding process, in which the low order sub-fields are preferred for sub-field encoding, it is avoided to add too much luminance to the transitions that would be visible.

Drawings

[0017] Exemplary embodiments of the invention are illustrated in the drawings and are explained in more detail in the following description.

Fig. 1 shows schematically a structure of a discharge cell of a plasma display panel;

Fig. 2 shows a sub-field organisation corresponding to a standard 8 bit representation of the video signal levels;

Fig. 3 shows an example of a sub-field organisation with 10 sub-fields and a priming period at the beginning;

Figs. 4A-E show light generation and non-light generation periods for different video values in a video picture;

Fig. 5 shows a block diagram of a vertical peaking apparatus according to the invention;

Fig. 6A shows the original sub-field code words of a vertical transition;

Fig. 6B illustrates different stages of the vertical peaking algorithm applied to the original subfield code words of the transition shown in Fig. 6A;

Figs. 7A-B illustrate the Mach-phenomenon;

Fig. 8 presents an example of a sub-field organisation used for an improved sub-field encoding process according to the invention;

Fig. 9 presents an example for the improved sub-field encoding process according to the invention; and

Fig. 10 shows a block diagram of a circuit implementation of the invention in a PDP.

Exemplary Embodiments

[0018] A plasma display technology makes it possible to produce real flat displays of large size and of very limited depth without any viewing angle constraints. In addition, since the display is an active matrix display and the light generation in each matrix cell is digitally controlled, it gives the possibility to achieve really perfect sharpness in the pictures like a pure transition black to white.

[0019] A plasma display panel (PDP) utilizes a matrix array of discharge cells which could be switched ON or OFF. Unlike a CRT or LCD in which grey levels are expressed by analogue control of the light emission, a PDP controls the grey levels by modulating the number of light pulses per frame.

[0020] For producing the small light pulses, an electrical discharge will appear in a gas filled cell, called plasma and the produced UV radiation will excite a colored phosphor which emits the light.

[0021] In order to select which cell should be lighted, a first selective operation called addressing in which a writing voltage is applied to the cell will create a charge in the cells to be lighted. In the cells that shall not generate light, there is no writing voltage applied to the cells during the addressing phase. Each plasma cell can be considered as a capacitor which keeps the charge for a long time. Afterwards, a general operation called "sustain" applied during the lighting period will add charges in the cell. In the cell addressed during the first selective operation, the two charges together will build up between two electrodes of the cell a firing voltage. UV radiation is generated which excites the phosphor for light emission. The discharge of the cell is made in a very short period and there remains some charge in the cell. With the next sustain pulse, this charge is increased again up to the firing voltage so that the next discharge will happen

and the next light pulse will produced. During the whole sustain period of each specific sub-field, the cell will be lighted in small pulses. At the end, an erase operation will remove all the charges to prepare a new cycle.

[0022] The principle structure of a plasma cell in matrix plasma display technologie is shown in Fig. 1. Reference number 10 denotes the face plate made of glass. With reference number 11 a transparent line electrode is denoted. The back plate of the panel is referenced with reference number 12. There are two dielectric layers 13 for isolating face and back plate against each other. In the back plate are integrated column electrodes 14 being perpendicular to the line electrodes 11. The inner part of the cells consists of the luminous substance 15 (phosphor) and separators 16 for separating the different coloured phosphors (green 15a), (blue 15b), (red 15c) from each other. The UV radiation caused by the discharge is denoted with reference number 17. The light emitted from the green phosphor 15a is indicated with arrows having the reference number 18. From this structure of a PDP it is clear, that there are three plasma cells necessary, corresponding to the three colour components R,G,B, to produce the colour of a picture element of the displayed picture.

[0023] In a PDP the brightness of each cell is controlled by modulating the number of light pulses per frame in the discharge cell.

[0024] In TV/video technology it is common to have a 8 bit representation of the video signals (R,G,B signals). Possible video levels are hence from 0 to 255. Each level will be represented by a combination of the 8 following bits: 1 - 2-4 - 8 - 16 - 32 - 64 - 128. To realize such a coding with the PDP technology, the frame period will be divided e.g. in 8 light generation periods (also called sub-fields), each one corresponding to a bit. The number of light pulses for the bit 2 is double the size as for the bit 1 etc.. By combining these 8 sub-fields 256 grey levels may be achieved. An example of a sub-field organisation for this standard binary 8 bit representation is shown in Fig. 2.

[0025] To improve the response fidelity of the plasma cells, a prior art solution is the so-called priming technique, wherein each cell will be regularly excited in a frame. Fig. 3 shows an example of a sub-field organisation with 10 sub-fields and one priming period at the beginning. The weights of the sub-fields indicated by the numbers differ from the standard binary coding of Fig. 2. This type of sub-field organisation and sub-field coding has advantages in regard to dynamic false contour effect reduction. The priming period at the beginning consists of a strong writing pulse and an erase operation at the end. For more details regarding the priming technique, it is referred to WO 01/56003. This operation has to be used parsimoniously in the frame period to avoid a strong reduction of the contrast ratio, i.e. more background luminance. Consequently, priming will be used only ahead of the low order sub-fields to ensure their light generation. However, the fact not to use priming ahead of high order sub-fields can lead to a non-homogeneity of the panel since the cell reaction for these sub-fields may depend a lot on the neighborhood activity.

[0026] According to the invention an improved technique with a vertical peaking is employed.

[0027] The illustrations shown in Figs. 4A-E will be used to explain the solution. In these figures also the 10 sub-field organisation of Fig. 3, wherein a priming operation is carried out only at the start of each frame is used.

[0028] In the example shown in Figs. 4A-E, the priming operation regularly excites each cell of the panel at the beginning of each frame. Consequently, the sustain operation in the first sub-field having the weight 1 is very effective due to its short time distance to the priming operation so that its behavior does not depend on the neighbouring cells. If the first sub-field is activated, the sustain operation in the next sub-field will be effective again since the energy stays concentrated in the time. In fact, if all the activated sub-fields are concentrated around the priming operation, it will ensure a perfect reaction of the cells which will be independent from the neighborhood. This effect is similar to a cascade effect.

[0029] As illustrated in Fig. 4A, in which the black sub-fields represent the activated sub-fields the video value 31 is generated by generating light consecutively in the first 5 sub-fields behind the priming operation. The cascade effect means that each well-activated sub-field acts as a priming for the next one. This excitation spread from one sub-field to the next one starting from the priming operation as origin leads to a good response fidelity of the panel.

[0030] Nevertheless, in the case of a coding having an interruption of this cascade effect, the light generation in the sub-fields located after the interruption will be very sensible to the neighborhood activity. This is illustrated in Fig. 4B.

[0031] As shown in Fig. 4B, the sub-field code word for the value 225 includes for example an interruption of sub-field activation between the first and the sixth sub-field. As explained in connection with the value 31 the light generation in the cells with the first activated sub-field of value 225 works without any problem. However, the cascade effect is immediately interrupted after this first sub-field. The cell excitation with the sixth sub-field is not supported by an excitation in the previous sub-field resulting in a strong dependence of the cell activation from the neighborhood activity.

[0032] In fact, a display cell for a pixel of a video picture having the value 225 located in a homogeneous area in which the neighboring cells are excited with the sixth sub-field will work very well. Due to the neighboring effect, the light generation with the sixth sub-field of the value 225 will be perfect resulting in a positive impact on following sub-fields also, i.e. a new cascade effect is possible.

[0033] Such a case is shown in Fig. 4C. On the left of Fig. 4C a vertical transition is shown between a homogenous area having pixels with video values 63 for a colour component and a homogenous area having pixels with video values 225 for the same colourcomponent. In the right part of Fig. 4C the light generation with the corresponding sub-field

code words for the values 63 and 225 is shown. The cells being driven with the video value 225 and lying on a line next to the region where a video value of 63 is valid will benefit from the excitation of the neighbouring cells above in the sixth sub-field. The cascade effect for the last five activated sub-fields in case of the video values 225 will be present and the display shows a picture with a sharp transition.

[0034] In case of a pixel having the value 225 at a transition without a neighbouring cell being excited in the sixth sub-field, there will be no such conditioning effect. Consequently, the light generation with the sixth sub-field may malfunction resulting in a negative impact on the succeeding sub-fields, too. Such a case is illustrated in Fig. 4D.

[0035] Fig. 4D shows the effect of a lack of conditioning in the case of a vertical transition from a dark area with video level 7 for one colour component to a light area with video value 225 for the same colour component. This kind of transition is a rather critical one above all in the case of the plasma matrix technology, which is quite sensitive to the neighborhood activity, in particular if an AWD (Address While Displaying) addressing scheme is used which excites one specific sub-field in a vertical direction one line after the other.

[0036] It is now the basic idea of the invention to add artificially a vertical influence to those transitions where no direct influence is present in order to achieve a good panel response. Using the example shown in Fig. 4D, a line will be added between the two regions with video values 7 and 225 to get a perfect transition. This is illustrated in Fig. 4E. The line located between the two areas with video values 7 and 225 will have the value 253 or 252 to make a good arbitration of the influence of the cell activations in the region with video value 7 on the cells in the region with video value 225. This will provide a perfect transition between the two areas.

[0037] This idea of the invention will now be disclosed in the form of a so-called vertical peaking algorithm. This algorithm is based on a comparison between the sub-field encodings for each color component (Red, Green, Blue) located on two consecutive lines. For that purpose a line memory is needed per color component. The line memory includes L storage cells having the capacity of N bits per cell. L represents the number of pixels per line on the PDP screen and N represents the number of sub-fields in the used sub-field organisation.

[0038] For instance, a panel having 768 pixels and using a sub-field organisation with 10 sub-fields for sub-field coding needs to have three line memories, each one having a size of $768 \times 10 \text{ bit} = 7.5 \text{ kBit}$.

[0039] An implementation of this line memory concept is shown in Fig. 5. Reference sign 20 denotes a line memory and reference sign 21 refers to a comparison unit. The comparison algorithm carried out in the comparison unit 21 is as follows:

In the line memory the sub-field code words of a line n-1 are stored. For generating the compensated sub-field code words for the next line n the comparison unit 21 compares each of the N bits of a sub-field code word for a pixel of line n from MSB to LSB with the corresponding bit of the corresponding sub-field code word for the corresponding pixel of line n-1. If the k^{th} bit of the SF-code word of line n equals '1' and the corresponding bit of the SF-code word of line n-1 equals '0' it is checked whether the next lower significant $k-1^{\text{th}}$ bit of the SF code word for line n equals '0'. If this is the case, the $k-1^{\text{th}}$ bit of the SF code word for line n is set to '1'. In all other cases this bit remains unchanged. A source code of a computer programme in the C programming language is listed below. As depicted in Fig. 5 each updated SF code word for line n will be entered in the line memory 20 so that after processing of a complete line the processing of the next line can start without delay and it is assured that the compensated code words are stored in the line memory as reference for the next line.

```

For (k=N; k>0; k --)      /* loop on each of the N bits from
5                          MSB to LSB*/
{
    if ((In[k] == 1) && (In-1[k] == 0)) /*Critical transi-
10                          tion*/
    {
        if (In[k-1] == 0)
        {
15                          In[k-1] = 1;
        }
    }
20 }

```

[0040] In this listing k represents a bit number and $k \in [1, N]$. Further n represents the line number. $I_n[k]$ is the k^{th} bit of the SF code word of a pixel in line n. $I_{n-1}[k]$ represents the corresponding bit of the SF code word for the pixel located at the same horizontal position in line n-1. Above given loop needs to be executed for each colour component R,G,B separately. Therefore the line memory 20 and the comparison unit 21 needs to be provided in triplicate in the plasma display apparatus.

[0041] A computation example is illustrated in Fig. 6. In Fig 6 the SF code words of two corresponding pixels of line n and line n-1 are shown. In a SF code word the bit entry '1' means an activated sub-field, i.e. in this sub-field light is generated, and '0' means an inactivated sub-field in which no light is generated.

[0042] Fig. 6A shows the original SF code words for two corresponding pixels in line n and line n-1 before employing the vertical peaking algorithm. With the sub-field organisation of Figs. 3-4 the SF code word for the pixel of line n corresponds to the video value 95 and that of line n-1 to the value 39.

[0043] Fig. 6B illustrates 4 comparison operations and their results. In stage 1 the bit entries for sub-field SF8 are compared, in stage 2 the bit entries for sub-field SF7 are compared, in stage 3 the bit entries for sub-field SF5 are compared, and in stage 4 the bit entries for sub-field SF4 are compared. Each comparison operation determines whether a bit entry in the SF code word for the pixel of line n needs to be modified or not. At the bottom of Fig. 6B the resulting modified SF code word for the pixel of line n is shown. The compensated new SF code word corresponds to the video value 157.

[0044] Obviously, the comparison algorithm according to the invention results in a modification of the video picture content. This can be visible. By making an adaptation of the sub-field coding process to the human visual system it is possible to reduce the visibility.

[0045] The human visual system may be regarded as a picture encoder to reduce the information received by the retina to essential information which could be rapidly interpreted by the brain.

[0046] For instance, the pupil is working similar to a low-pass filter which reduces the amount of high spatial frequencies. For the adaptation of the the inventive concept to the HVS it is not necessary to make a complete exposition of the human visual system but to extract some important characteristics thereof.

[0047] One key point for this exposition is the way the eye analyses the high spatial frequencies. In fact, between the different neurons located directly after the retina, there are lateral connections first studied by a scientist E. Mach. The Mach phenomenon is as follows:

[0048] When a person observes two juxtaposed uniform regions having different luminance (e.g. light grey and dark grey), the person will have the impression that near to the border the luminance increases in the illuminated area and decreases in the dark area. Fig. 7A illustrates this phenomenon. Fig. 7A shows that the signal coming from the retina will be integrated to increase the sensitivity to high spatial frequency. Further studies have shown that this phenomenon is directly linked to the impression of sharpness and can be explained by a simple model of the neuronal structure behind the retina, as shown in Fig. 7B. Fig. 7B illustrates the lateral inhibition happening between two adjacent neurons S1, S2. When the neuron S1 is stimulated by the photoreceptor E1, it reduces the sensitivity of the neuron S2 by means of a reduction term $-b_{12}$ depending on the stimulus intensity and vice versa.

[0049] The Mach phenomenon is directly responsible for the human sharpness impression. The vertical peaking process according to the invention performs a similar processing as the human eye. In consequence the inventive algorithm also improves the global sharpness impression of a video picture.

[0050] The improvement of the global sharpness of the picture is, however, effective only as long as the peaking does not add too much light on the transition. To reduce this light increasing a plasma optimized coding is used according to another aspect of the invention with which the energy is concentrated in the low-order sub-fields.

[0051] This encoding technique is based on slope increasing coding in which the weight of a sub-fields is increased slowly from one sub-field to another.

[0052] An example of a sub-field organisation for such a coding is given in Fig. 8. The numbers below the arrows represent the evolution of the weight difference between two consecutive sub-fields. By slowly increasing this difference it is possible for each encoded value to concentrate the energy in the low-order sub-fields as shown in Fig. 9. In the example illustrated in Fig. 9 it is shown that there are two possibilities to encode the value 43. However, only the first one (in the upper part) will be taken since it concentrates the energy in the low-order sub-fields.

[0053] Consequently such an encoding process ensures that the peaking algorithm does not add too much energy to a video picture.

[0054] The inventive peaking algorithm may further slightly increase the noise in a video picture. Therefore, a noise reduction algorithm like with a median filter may be used in the signal processing path behind the peaking algorithm to improve the quality of the peaking algorithm.

[0055] In Fig. 10 a circuit implementation of the invention is illustrated. Input R,G,B video data is forwarded to a sub-field coding unit 30. The sub-field code words are forwarded to a memory 31 separately for the different colour components R,G,B. This memory preferably has a capacity of two frame memories. This is recommendable due to the plasma driving process. The plasma display panel is driven in sub-fields as explained above and therefore for every pixel only one bit (in fact three bits because of the three colour components) needs to be read out of this memory per sub-field. On the other hand data needs to be written in the memory. To avoid any conflicts between writing and reading, there are two independent frame memories used. When data is read from one frame memory, the other frame memory is used for writing of data and vice versa.

[0056] The line memories 35 for the vertical peaking algorithm are placed between sub-field coding unit 30 and frame memory 31. The comparison algorithm is best being performed by the control unit 34. It has read and write access to the storage cells of the line memories 35.

[0057] The resulting sub-field code words are collected in serial parallel conversion unit 32 for a whole line of the PDP. As there are e.g. 854 pixel in one line, this means 2962 sub-field coding bits needs to be read for each line per sub-field period. These bits are input in the shift registers of the serial parallel conversion unit 32.

[0058] The corrected sub-field code words are stored in memory unit 31. Reading and writing from and to this memory unit is also controlled by the external control unit 34. Also it controls the sub-field coding process and the serial parallel conversion. Further it generates all scan, sustain and erase pulses for PDP control. It receives horizontal and vertical synchronising signals for reference timing.

[0059] With the algorithm explained above it can happen that the luminance of the darker pixel of the transition is increased. An example is that the top region of the transition has a video value of 225 and the bottom region of the transition has e.g. the value 8. In this case with the algorithm explained above, the modification of the sub-field code word for the pixel with value 8 would result in the corresponding sub-field code word 1111000000 having the assigned video value 15. This kind of modification would reduce the Mach phenomenon and therefore could slightly reduce the sharpness impression. To avoid this it is hence an improved embodiment of the invention to take into account which of the two pixels under comparison has the greater video value assigned and to make the modification in the sub-field code word of the pixel having the greater video value assigned. This improvement however requires the implementation of two line memories per colour component. Also a delay of one video line for outputting the sub-field code words to the frame memory is required in this case.

[0060] The invention can be used in particular in PDPs. Plasma displays are currently used in consumer electronics, e.g. for TV sets, and also as a monitor for computers. However, use of the invention could also be appropriate for active matrix displays where the light emission is also controlled with small pulse in sub-fields, i.e. where the PWM principle is used for controlling light emission, e.g. OLED displays.

[0061] The invention is not restricted to the described embodiments. Various modifications are possible and are considered to fall within the scope of the claims.

Claims

1. Method for processing video pictures for display on a display device (33) having a plurality of luminous elements in the form of discharge cells corresponding to the pixels of a video picture, wherein the time duration of a video

frame or video field is divided into a plurality of sub-fields during which the discharge cells can be activated for light emission in small pulses corresponding to a sub-field code word which is used for brightness control, **characterized in that** before the sub-field code word of a current pixel is forwarded to the display driving unit (32,34) it is analysed whether the cell excitation in an activated sub-field after an inactivated sub-field for the current pixel gets support by a parallel cascaded cell excitation of a neighbouring cell and if not, the sub-field code word of the current pixel or the neighbouring pixel is modified in such a manner that an entry in the sub-field code word for an inactivated sub-field is replaced by an entry for an activated sub-field so that cell excitations in the activated sub-fields for the current pixel is supported by a parallel cascaded cell excitation in the neighbouring cell in order to maintain the cascade effect.

2. Method according to claim 1, wherein the sub-field code word of only the current pixel is modified.
3. Method according to claim 1, wherein the sub-field code word of that pixel from the current and neighbouring pixel is modified that has the greater video value assigned.
4. Method according to one of claims 1 to 3, wherein if the current pixel has the position x on line n, the neighbouring pixel is the pixel with the position x on line n-1.
5. Method according to one of claims 1 to 4, wherein the analysis step is made for each bit of the sub-field code word for the current pixel starting from the most significant bit up to at least the lower significant bit where it was found that the cell excitation in the corresponding sub-field gets support by a parallel cascaded cell excitation of the neighbouring sub-field.
6. Method according to one of claims 1 to 5, wherein a sub-field encoding process is used in which in case that there is more than one alternative for assigning a sub-field code word to a given input video value, the sub-field code word of that alternative is assigned to the input video value, that has the most entries for sub-field activation in the low-order bits.
7. Method according to one of claims 1 to 6, wherein a sub-field organisation is used for driving the display in which the sub-field weights increase in predetermined steps, relatively slowly from sub-field to sub-field when ordering the sub-fields according to their weights.
8. The method according to claim 7, wherein the frame period is sub-divided in 10 sub-fields (SF), when the maximum activation period of a luminous element during a frame period has a relative duration of 255 time units, then the sub-fields (SF) in the sub-field organisation have the following durations:

Sub-field number	Duration/relative time units
1	1
2	2
3	4
4	7
5	11
6	18
7	29
8	43
9	60
10	80

9. Method according to one of claims 1 to 8, wherein a noise reduction step is performed with the sub-field code words after the analysis step and before forwarding the sub-field code words to the driving unit (32, 34).
10. Method according to one of claims 1 to 9, wherein the sub-field code word analysis step is performed for each colour component separately.

11. Apparatus for processing video pictures to be displayed on a plasma display panel (33) consisting of a matrix array of discharge cells, each discharge cell being allocated to a pixel of a video picture, the apparatus comprising a sub-field coding unit (30) in which a sub-field code word is assigned to a given input video value, the apparatus further comprising a driving unit (32, 34) for light generation in small pulses corresponding to said sub-field code words, **characterized in that**, the apparatus further comprises a peaking unit (35) that receives as an input the sub-field code words from the sub-field coding unit (30) and outputs modified sub-field code words to the driving unit (32,34) based on an analysis where it is checked whether the cell excitation in an activated sub-field after an inactivated sub-field for a current pixel gets support by a parallel cascaded cell excitation of a neighbouring cell.
12. Apparatus according to claim 11, wherein the peaking unit (35) includes a line memory (20) for each colour component in which the modified sub-field code words of the previous video line are stored for said analysis.

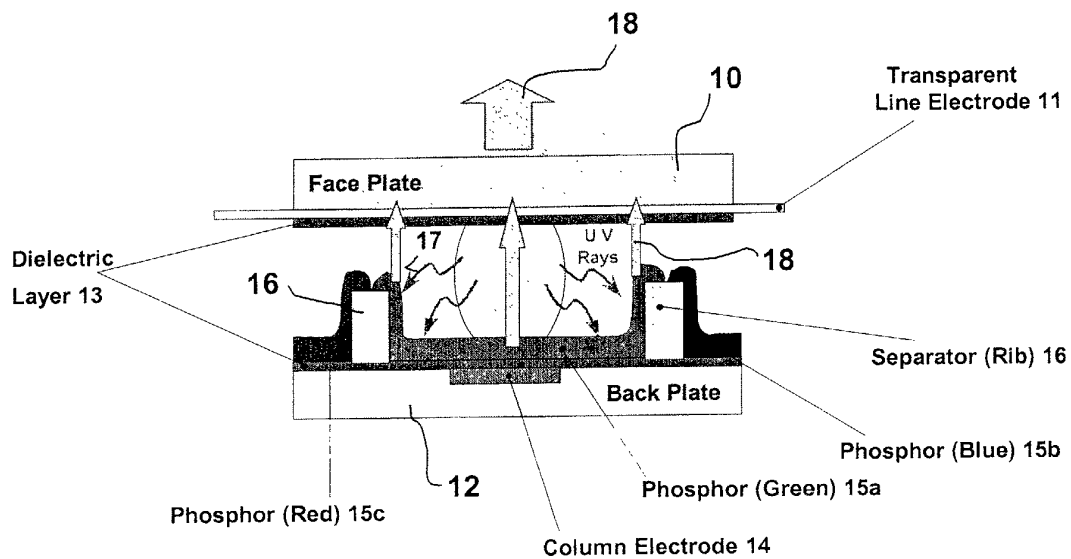


Fig.1

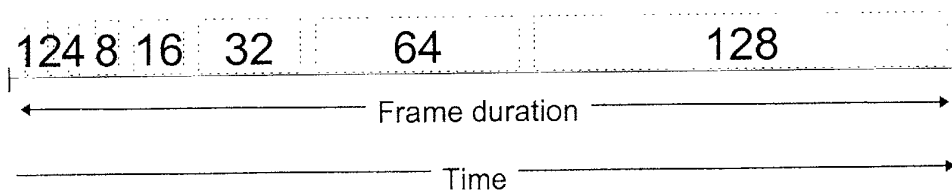


Fig.2

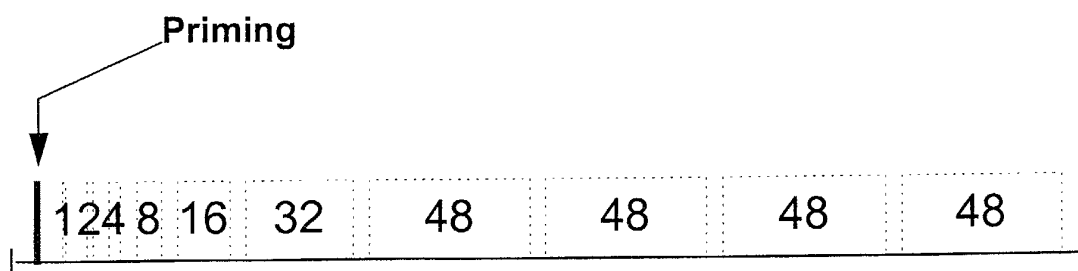


Fig.3

Case of value 31 :

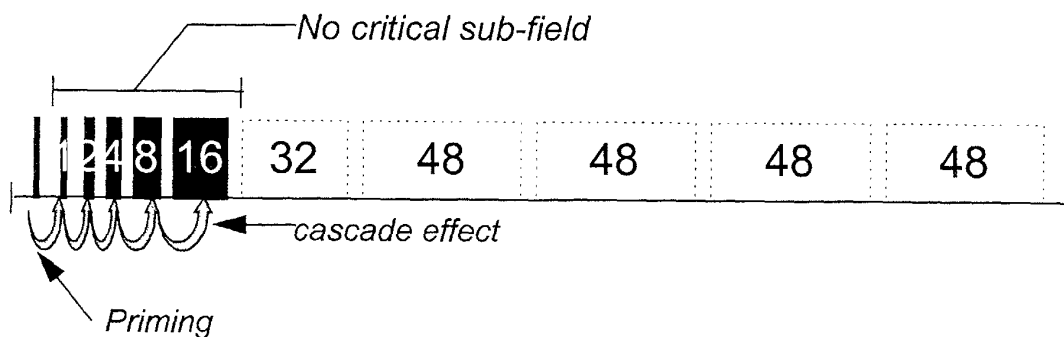


Fig.4A

Case of value 225 :

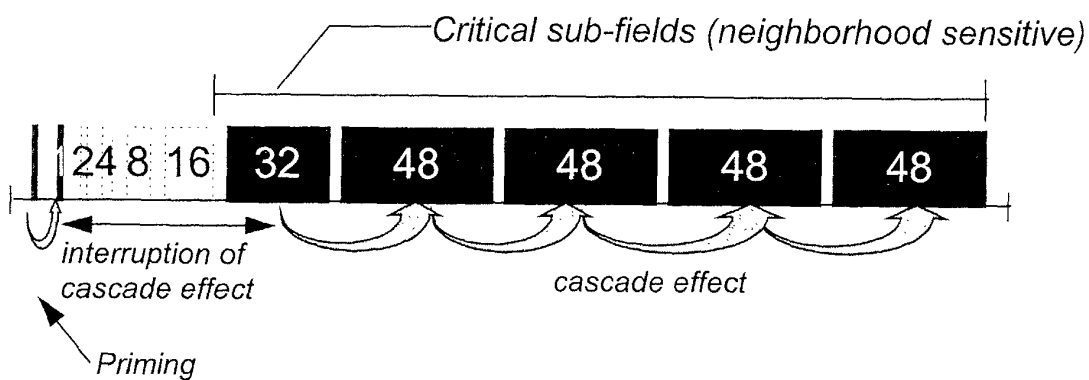


Fig.4B

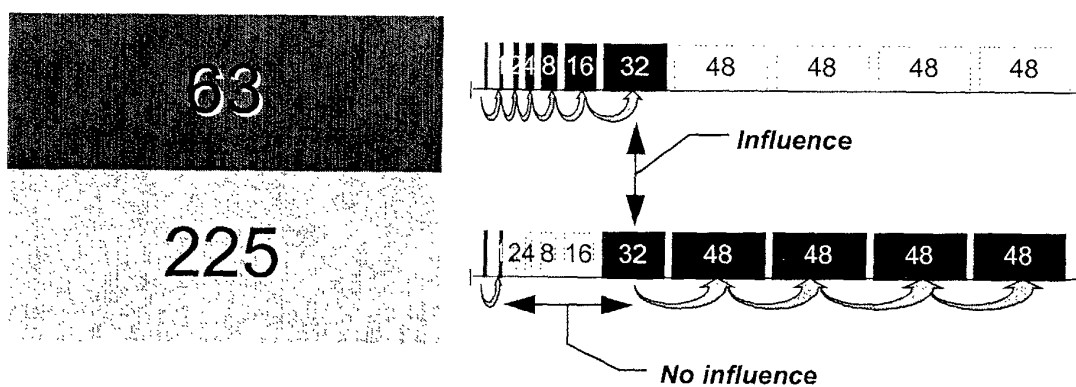


Fig.4C

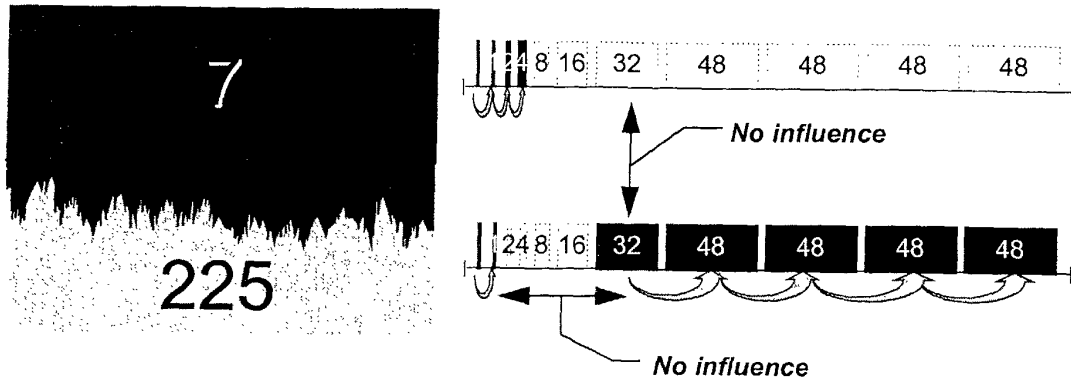


Fig.4D

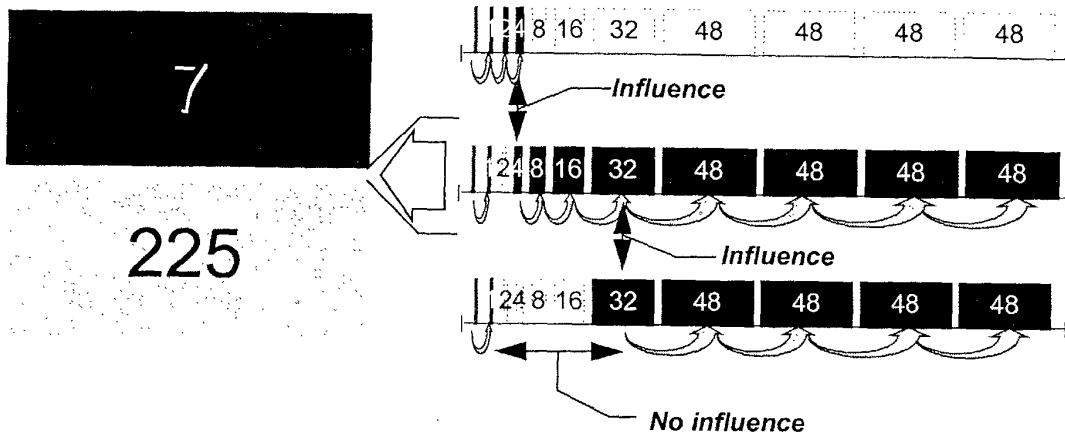


Fig.4E

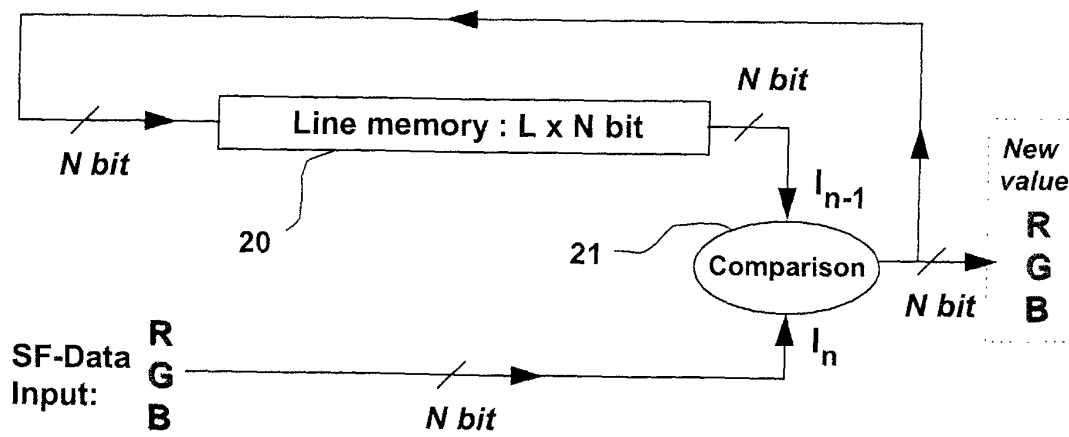


Fig.5

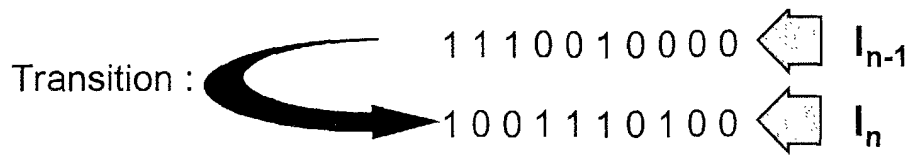


Fig.6A

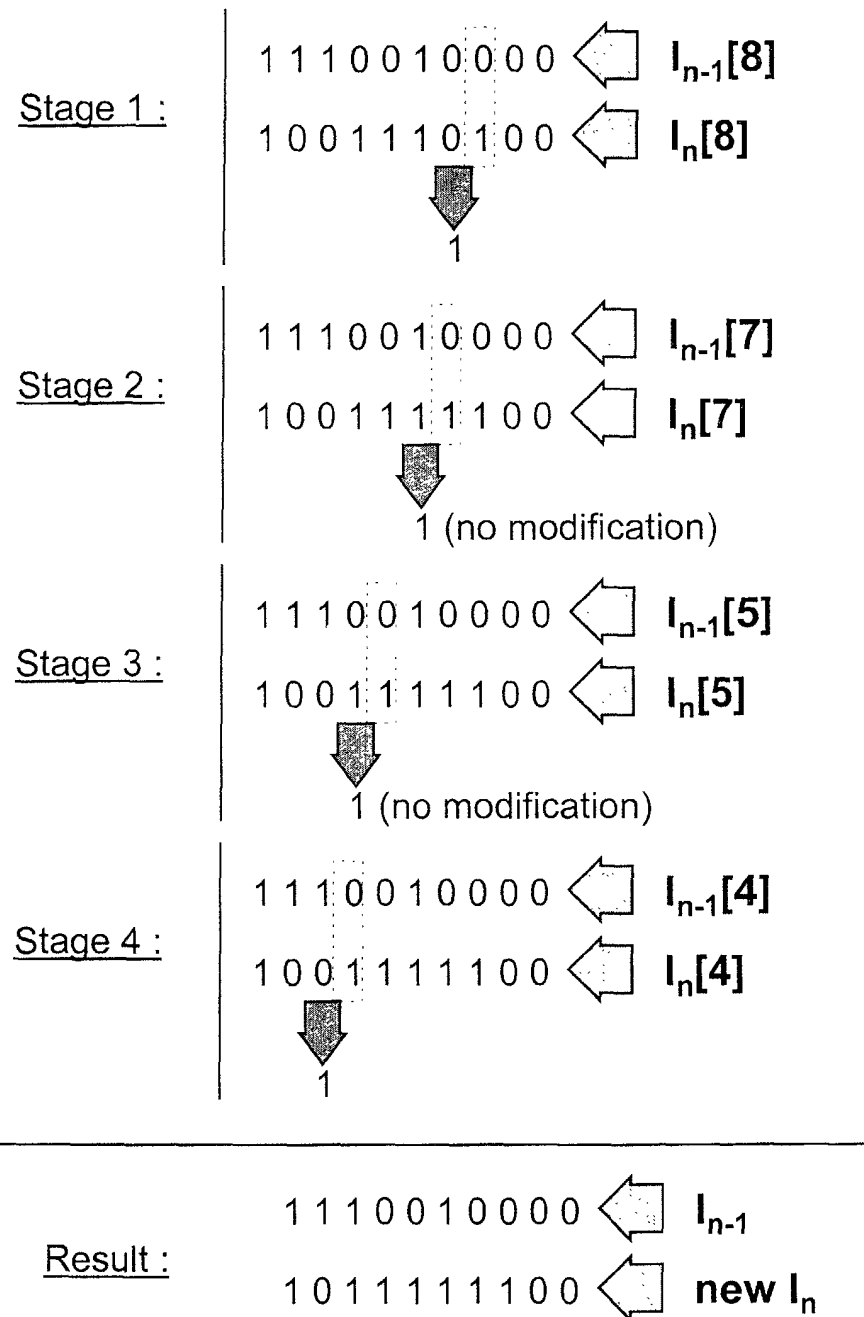


Fig.6B

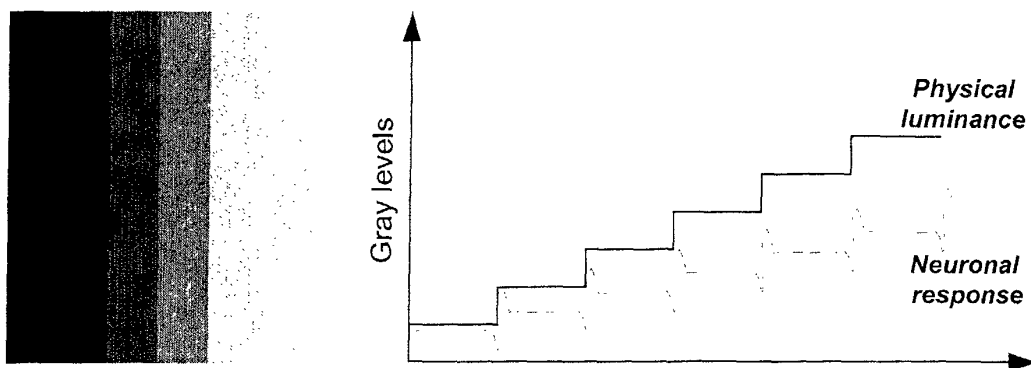


Fig.7A

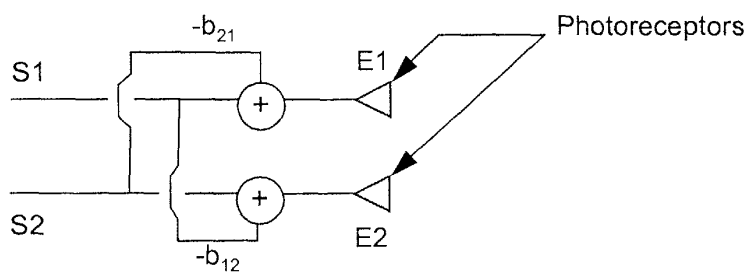


Fig.7B

1 - 2 - 4 - 7 - 11 - 18 - 29 - 43 - 60 - 80 ($\Sigma = 255$)

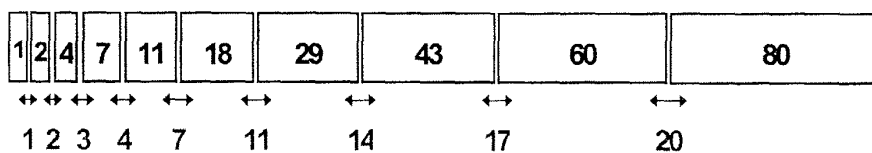


Fig.8

Value 43 :

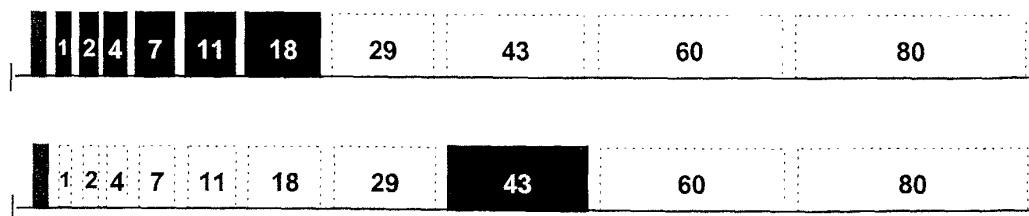


Fig.9

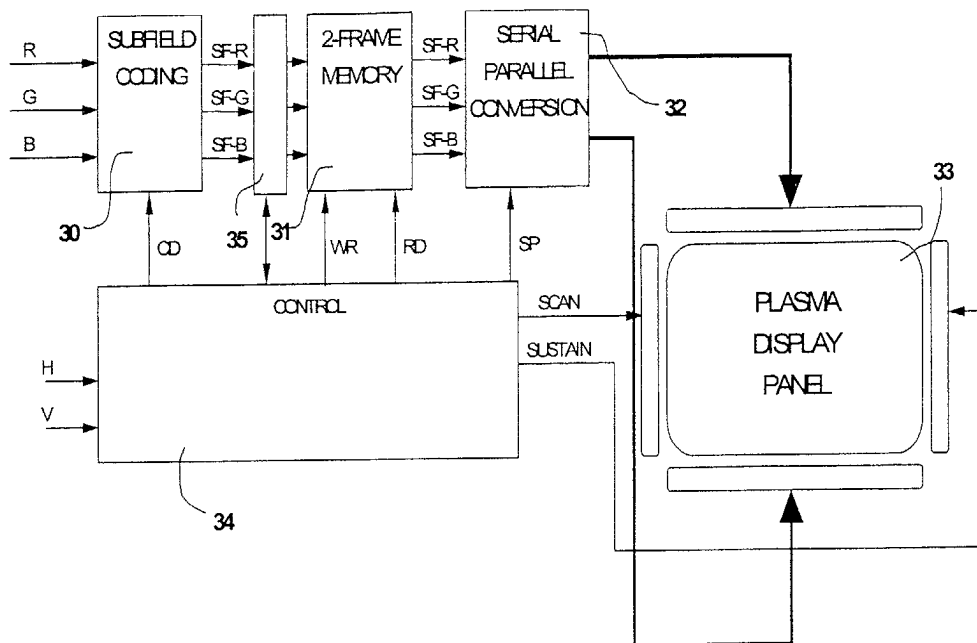


Fig.10



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 01 25 0422

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A	EP 1 022 713 A (NEC CORP.) 26 July 2000 (2000-07-26) * abstract * * column 3, line 5 - line 29 * * column 12, line 32 - column 13, line 7 * * column 21, line 28 - column 22, line 3; figures 4,20,21 * ---	1-5,11, 12	G09G3/28
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			G09G
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
THE HAGUE		31 May 2002	O'Reilly, D
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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31-05-2002

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