PATROLL Winning Submission

U.S. Patent 8,736,529

U.S. Patent 8,736,529 ("*Communication Advances*" or the "patent-at-issue") was filed on February 8, 2008 and claims the benefit of U.S. Provisional Pat. App. No. 60/896,264, filed on March 21, 2007. Claim 12 of the patent-at-issue is generally directed to an overdriving method comprising the steps of receiving and storing image data corresponding to an image signal. Dynamic information corresponding to a current image based on the image data is then generated. The dynamic information includes position information that indicates a dynamic region comprising a plurality of pixels and corresponding to and smaller than the current image. Variations of pixels are first calculated only in the dynamic region indicated by the position information, and then a gain is generated for target pixels based on the variations. An overdriving signal is then determined corresponding to each pixel of the dynamic region based on the gain and the image data.

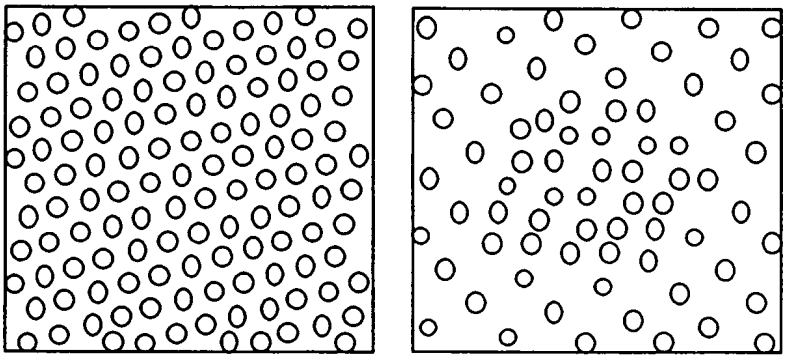
The primary reference, U.S. Pat. Pub. App. 2006/0279523 ("*Panasonic*"), was filed on August 23, 2006 and is a continuation of U.S. App. Ser. No. 09/888,641, filed on June 26, 2001. The patent generally relates to a display apparatus for executing display in accordance with an image signal, including a display panel, a plurality of light-sources for illuminating the display panel, and a control circuit for controlling light-emission luminance of the light-sources. The light-emission luminance includes a first light-emission luminance and a second light-emission luminance, and the display panel includes a plurality of display areas, wherein each of the display areas corresponding to each of the light-sources. The control circuit controls switching timing between the first light-emission luminance and the second light-emission luminance of each of the light-sources in accordance with rewriting timing of the image signal concerned with each of the display areas.

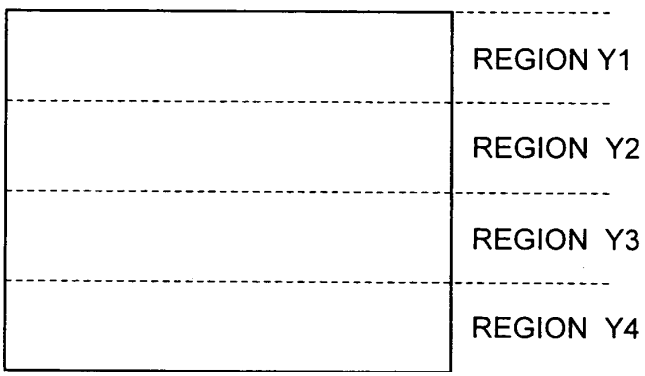
A sample claim chart comparing claim 12 of *Communication Advances* to *Panasonic* is provided below.

US8736529 ("*Communication Advances*")	A. US20060279523 ("*Panasonic*")
12.pre. **An overdriving method**, comprising the steps of:	**A. US20060279523** "**It is an object of the present invention to provide a liquid crystal display apparatus and a control method therefor**, the liquid crystal display apparatus enhancing the luminance of a displayed image with a high-efficiency and suppressing the heat-liberation of the light-source." *Panasonic* at par. 0018 "**The overdrive controlling unit** 3315 **detects a difference in the tone data between these adjacent frames, then judging the movement amount of the image data from this difference. From this movement amount, the overdrive controlling unit determines, for each frame, the response-rate or the image data corrected-value at the optimum for the luminance, thereby executing a correction toward the output tone data** 3311." *Panasonic* at par. 0176
12.a. (a) **receiving image data corresponding to an image signal and dynamic information**,	**A. US20060279523** "Also, as one example of the controlling circuit configuration, the controlling circuit includes the following components: A data storing unit for storing **the display data at least by the amount of 1 frame**, a data comparing unit for comparing corresponding pixels between the display data stored in the data storing unit and **the display data to be inputted**, and a pulse controlling unit that, in correspondence with the comparison result by the data comparing unit, outputs a signal for controlling the time ratio of the 1st light-emission luminance during the period." *Panasonic* at par. 0023 "Incidentally, **in the liquid crystal display element, the luminance of an image to be displayed is calculated from an image-signal transferred to the display apparatus**, and then the 1st and the 2nd current values and the time sharing of the 1st and the 2nd time-periods may be adjusted in agreement with the calculated luminance (a viewpoint 1)." *Panasonic* at par. 0086 "In FIG. 1, **the liquid crystal display apparatus** 36 **mainly allows a motion-frame picture from, as image inputs, the television input terminal** 29, **the video input terminal** 30, **the S input terminal** 31, **and so on, and mainly allows a freeze-frame picture from the analogue PC input terminal** 32, **the digital PC input terminal** 33, **and so on**. . . . **In the liquid crystal display module** 28, **the inputted digital image**

(cont.) 12.a. (a) **receiving image data corresponding to an image signal and dynamic information**,	**data (DATA) is inputted into the switching controlling circuit** 25 **as well as into the liquid crystal panel** 27. **The switching controlling circuit** 25 **detects the state of this inputted digital image data (DATA). In addition, the switching controlling circuit** 25 **outputs a detection signal, i.e., the detection result, to the light-dimmer circuit** 23. **In accordance with the state of this detection signal, the light-dimmer circuit** 23 **outputs to the inverter circuit** 21 **a light-dimmer controlling signal for obtaining an excellent display state**. This allows the light-dimmer circuit 23 to perform a light-source control over the fluorescent lamp 8." *Panasonic* at par. 0090 "In this embodiment, the explanation will be given below regarding **a system for executing a control over the blinking lighting-up of the light-source suitable for the motion-frame picture display in correspondence with the detection of the movement amount**." *Panasonic* at par. 0146 "Also, **the above-described data storing units** 50 **are provided by the amount of a plurality of frames, thereby making it possible not only to execute the comparison between the adjacent frame data but also to execute the motion-frame picture detection for the time-period of the plurality of frames. This makes it possible to grasp the tendency of the movement, thus allowing a more faithful motion-frame picture judgement**." *Panasonic* at par. 0153 "**The overdrive controlling unit** 3315 **detects a difference in the tone data between these adjacent frames, then judging the movement amount of the image data from this difference**. From this movement amount, the overdrive controlling unit determines, for each frame, the response-rate or the image data corrected-value at the optimum for the luminance, thereby executing a correction toward the output tone data 3311." *Panasonic* at par. 0176 "1. **A display apparatus for executing display in accordance with an image signal**, comprising:" *Panasonic* at claim 1

12.b. **wherein the dynamic information includes position information that indicates a dynamic region corresponding to a current image and the dynamic region comprises a plurality of pixels and is smaller than the current image**;	**A. US20060279523** "Also, as one example of the controlling circuit configuration, **the controlling circuit includes the following components: A data storing unit for storing the display data at least by the amount of 1 frame, a data comparing unit for comparing corresponding pixels between the display data stored in the data storing unit and the display data to be inputted**, and a pulse controlling unit that, in correspondence with the comparison result by the data comparing unit, outputs a signal for controlling the time ratio of the 1st light-emission luminance during the period." *Panasonic* at par. 0023 "**In the liquid crystal display module** 28, **the inputted digital image data (DATA) is inputted into the switching controlling circuit** 25 **as well as into the liquid crystal panel** 27. **The switching controlling circuit** 25 **detects the state of this inputted digital image data (DATA). In addition, the switching controlling circuit** 25 **outputs a detection signal, i.e., the detection result, to the light-dimmer circuit** 23. **In accordance with the state of this detection signal, the light-dimmer circuit** 23 **outputs to the inverter circuit** 21 **a light-dimmer controlling signal for obtaining an excellent display state**. This allows the light-dimmer circuit 23 to perform a light-source control over the fluorescent lamp 8." *Panasonic* at par. 0090 "In this embodiment, the explanation will be given below regarding **a system for executing a control over the blinking lighting-up of the light-source suitable for the motion-frame picture display in correspondence with the detection of the movement amount**." *Panasonic* at par. 0146 "Accordingly, instead of the above-described method of storing the display data in the entire display region by the amount of 1 frame, **the data storing unit** 50 **may also be formed into the following register configuration: Data comparing pixels (i.e., detection points) have been determined in advance in the display region, and only the display data on the pixels are stored**. However, the total number of the pixels to be compared, which is determined by a restriction on the controlling circuit size, is required to be determined so that the total number in the case of using the frame memory and that in the case of being formed into the register configuration become substantially the same result. **Here, FIGS. 21A, 21B illustrate examples of the data comparing pixels (i.e., the detection points). FIG. 21A**

(cont.) 12.b. **wherein the dynamic information includes position information that indicates a dynamic region corresponding to a current image and the dynamic region comprises a plurality of pixels and is smaller than the current image**;	**illustrates the case where the detection points are set uniformly over the display region of the display screen. FIG. 21B illustrates the case where the detection points are set in a manner of being concentrated onto the center of the screen. In the case of FIG. 21A where the points are distributed uniformly, the point number that becomes equal to a constant ratio with respect to the entire display region which actually displays the display data (for example, when the constant ratio is set to be 10%, if the actual display region includes horizontal 1024 pixels×vertical 768 pixels, i.e., 786432 pixels in total, the point number becomes equal to its 10%, i.e., 78643 pixels) is distributed uniformly over the actual display region. Meanwhile, in the case of FIG. 21B illustrating the central distribution, the constant ratio point number (i.e., 78643 pixels) is distributed more in the central portion than in the peripheral portion over the display region.**" *Panasonic* at par. 0154 FIG. 21A FIG. 21B  "A switching controlling circuit 25 illustrated in FIG. 22 is the same as the circuit explained in FIG. 18, except for the location of **a mode judging unit** 55 **for dividing the display region into a plurality of regions (e.g., dividing the display region into 4 regions as illustrated in FIG. 23) so as to judge in which region there exist many motion-frame picture displays. The data comparing unit** 52 **compares, on the basis of 1 display pixel (which is synchronized with 1 clock of Dotck), the present frame display data (Data) with**

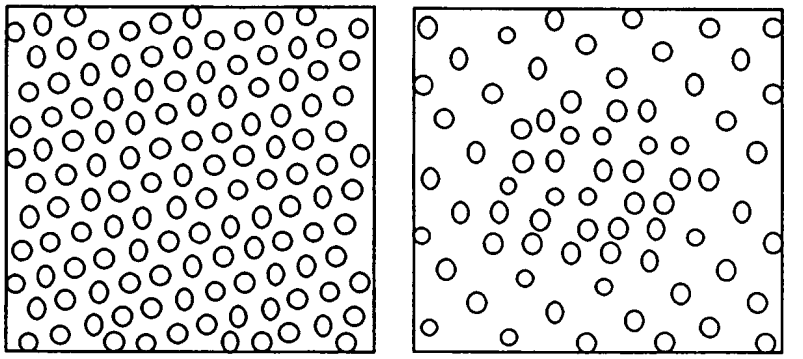
(cont.) 12.b. **wherein the dynamic information includes position information that indicates a dynamic region corresponding to a current image and the dynamic region comprises a plurality of pixels and is smaller than the current image**;	**the previous frame display data (Data′) read from the data storing unit** 50. **As a result of this, if both of the display data are different from each other, the display data are judged to be of the motion-frame pictures and the motion-frame picture judgement signal is outputted toward the 1 display pixel. The mode judging unit** 55, **as illustrated in FIG. 23, divides the display region into the 4 regions and adds the motion-frame picture judgement signals for each region, then outputting, from this addition result, a mode signal for indicating a region where there exist the most motion-frame picture judgement signals**. Next, in accordance with the mode signal, the pulse controlling unit 53 sets a starting time ps of the 1st time-period and a time pw of the 1st time-period." *Panasonic* at par. 0157 FIG. 23 
12.c. (b) **storing the image data**; and	**A. US20060279523** "Also, as one example of the controlling circuit configuration, the controlling circuit includes the following components: **A data storing unit for storing the display data at least by the amount of 1 frame**, a data comparing unit for comparing corresponding pixels between **the display data stored in the data storing unit** and the display data to be inputted, and a pulse controlling unit that, in correspondence with the comparison result by the data comparing unit, outputs a signal for controlling the time ratio of the 1st light-emission luminance during the period." *Panasonic* at par. 0023 "Also, **the above-described data storing units** 50 **are provided by the amount of a plurality of frames, thereby making it possible not only to execute the comparison between the adjacent frame data but also to execute the motion-frame picture detection for the time-period of the**

(cont.) 12.c. (b) **storing the image data**; and	**plurality of frames**. This makes it possible to grasp the tendency of the movement, thus allowing a more faithful motion-frame picture judgement." *Panasonic* at par. 0153
12.d. (c) **calculating variations of pixels only in the dynamic region indicated by the position information, and then determining an overdriving signal corresponding to each pixel of the dynamic region**, wherein step (c) includes:	**A. US20060279523** "Also, as one example of the controlling circuit configuration, **the controlling circuit includes the following components: A data storing unit for storing the display data at least by the amount of 1 frame, a data comparing unit for comparing corresponding pixels between the display data stored in the data storing unit and the display data to be inputted, and a pulse controlling unit that, in correspondence with the comparison result by the data comparing unit, outputs a signal for controlling the time ratio of the 1st light-emission luminance during the period**." *Panasonic* at par. 0023 "Accordingly, instead of the above-described method of storing the display data in the entire display region by the amount of 1 frame, **the data storing unit** 50 **may also be formed into the following register configuration: Data comparing pixels (i.e., detection points) have been determined in advance in the display region, and only the display data on the pixels are stored**. However, the total number of the pixels to be compared, which is determined by a restriction on the controlling circuit size, is required to be determined so that the total number in the case of using the frame memory and that in the case of being formed into the register configuration become substantially the same result. **Here, FIGS. 21A, 21B illustrate examples of the data comparing pixels (i.e., the detection points). FIG. 21A illustrates the case where the detection points are set uniformly over the display region of the display screen. FIG. 21B illustrates the case where the detection points are set in a manner of being concentrated onto the center of the screen. In the case of FIG. 21A where the points are distributed uniformly, the point number that becomes equal to a constant ratio with respect to the entire display region which actually displays the display data (for example, when the constant ratio is set to be 10%, if the actual display region includes horizontal 1024 pixels×vertical 768 pixels, i.e., 786432 pixels in total, the point number becomes equal to its 10%, i.e., 78643 pixels) is distributed uniformly over the actual display region. Meanwhile, in the case of FIG. 21B illustrating the central distribution, the constant ratio point number (i.e., 78643**

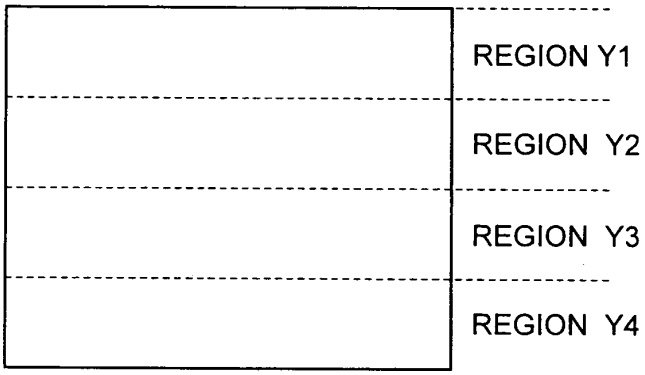
(cont.)
12.d. (c) **calculating variations of pixels only in the dynamic region indicated by the position information, and then determining an overdriving signal corresponding to each pixel of the dynamic region**, wherein step (c) includes:

pixels) is distributed more in the central portion than in the peripheral portion over the display region." *Panasonic* at par. 0154

FIG. 21A FIG. 21B



"A switching controlling circuit 25 illustrated in FIG. 22 is the same as the circuit explained in FIG. 18, except for the location of **a mode judging unit** 55 **for dividing the display region into a plurality of regions (e.g., dividing the display region into 4 regions as illustrated in FIG. 23) so as to judge in which region there exist many motion-frame picture displays. The data comparing unit** 52 **compares, on the basis of 1 display pixel (which is synchronized with 1 clock of Dotck), the present frame display data (Data) with the previous frame display data (Data′) read from the data storing unit** 50. **As a result of this, if both of the display data are different from each other, the display data are judged to be of the motion-frame pictures and the motion-frame picture judgement signal is outputted toward the 1 display pixel. The mode judging unit** 55, **as illustrated in FIG. 23, divides the display region into the 4 regions and adds the motion-frame picture judgement signals for each region, then outputting, from this addition result, a mode signal for indicating a region where there exist the most motion-frame picture judgement signals. Next, in accordance with the mode signal, the pulse controlling unit** 53 **sets a starting time ps of the 1st time-period and a time pw of the 1st time-period**." *Panasonic* at par. 0157

(cont.) 12.d. (c) **calculating variations of pixels only in the dynamic region indicated by the position information, and then determining an overdriving signal corresponding to each pixel of the dynamic region**, wherein step (c) includes:	FIG. 23  "**The overdrive controlling unit** 3315 **detects a difference in the tone data between these adjacent frames, then judging the movement amount of the image data from this difference. From this movement amount, the overdrive controlling unit determines, for each frame, the response-rate or the image data corrected-value at the optimum for the luminance, thereby executing a correction toward the output tone data** 3311." *Panasonic* at par. 0176
12.e. (c1) **first calculating the variations based on the image data, and then generating a gain for a target pixel based on the variations**, and	**A. US20060279523** "Also, as one example of the controlling circuit configuration, **the controlling circuit includes the following components: A data storing unit for storing the display data at least by the amount of 1 frame, a data comparing unit for comparing corresponding pixels between the display data stored in the data storing unit and the display data to be inputted, and a pulse controlling unit that, in correspondence with the comparison result by the data comparing unit, outputs a signal for controlling the time ratio of the 1st light-emission luminance during the period**." *Panasonic* at par. 0023 "**The present invention includes a panel on which a plurality of pixels are located, a light-source for visualizing an image displayed on the plurality of pixels, and a controlling circuit for controlling the light-source**." *Panasonic* at par. 0083 "At this time, **it is advisable to perform the control so that the effective value of the current applied to the lamps for causing the light-source to perform the light-emission during each lighting-up period becomes substantially**

(cont.) 12.e. (c1) **first calculating the variations based on the image data, and then generating a gain for a target pixel based on the variations**, and	**constant regardless of the ratio of the above-described lighting-up time-period and that of the above-described pausing time-period of the light-source. Also, changing the current effective value makes it possible to change the illumination light-quantity of the light-source**." *Panasonic* at par. 0134 "In this embodiment, the explanation will be given below regarding **a system for executing a control over the blinking lighting-up of the light-source suitable for the motion-frame picture display in correspondence with the detection of the movement amount**." *Panasonic* at par. 0146 "As described earlier, **the time ratio of the 1st lighting-up luminance (i.e., the lighting-up time-period) and that of the 2nd lighting-up luminance (i.e., the pausing time-period in the present example) are changed in correspondence with the information amount about the movement of the image-signal, thereby allowing the more beautiful motion-frame picture display**. Namely, as illustrated in FIGS. 11A, 11B, and 11C, **the lighting-up time-period is made shorter when the movement is fast and the lighting-up time-period is made longer when the movement is slow, or the lighting-up time-period is made shorter when the moving information amount (i.e., the moving pixel number) over the entire surface of the display region is large and the lighting-up time-period is made longer when the moving information amount is small, thereby allowing the more beautiful motion-frame picture display. At this time, the current effective value applied to the lamps for causing the light-source to perform the light-emission during each lighting-up period is changed in correspondence with the ratio of the lighting-up time-period and that of the pausing time-period of the light-source. This changes the illumination light-quantity of the light-source, thus making it possible to stabilize the luminance level of the motion-frame picture display**." *Panasonic* at par. 0149 "**The switching controlling circuit** 25 **generates and outputs light-source lighting-up signals BL1 to BL4 for executing the control over the blinking lighting-up of the respective fluorescent lamps** 8. **The data comparing unit** 52 **compares, on the basis of 1 display pixel (which is synchronized with 1 clock of Dotck), the present frame display data (Data) with the previous frame display data (Data′) read from the data storing unit** 50. **As a result of this, if both of the display**

(cont.) 12.e. (c1) **first calculating the variations based on the image data, and then generating a gain for a target pixel based on the variations**, and	**data are different from each other, the display data are judged to be of the motion-frame pictures and the motion-frame picture judgement signal is outputted toward the 1 display pixel. The mode judging unit** 55, **as illustrated in FIG. 23, divides the display region into the 4 regions and adds the motion-frame picture judgement signals for each region, then outputting, from this addition result, a mode signal for indicating a region where there exist the most motion-frame picture judgement signals**." *Panasonic* at par. 0160
12.f. (c2) **generating the overdriving signal for the target pixel based on the gain and the image data**.	**A. US20060279523** "Also, as one example of the controlling circuit configuration, **the controlling circuit includes the following components: A data storing unit for storing the display data at least by the amount of 1 frame, a data comparing unit for comparing corresponding pixels between the display data stored in the data storing unit and the display data to be inputted, and a pulse controlling unit that, in correspondence with the comparison result by the data comparing unit, outputs a signal for controlling the time ratio of the 1st light-emission luminance during the period**." *Panasonic* at par. 0023 "**The present invention includes a panel on which a plurality of pixels are located, a light-source for visualizing an image displayed on the plurality of pixels, and a controlling circuit for controlling the light-source**." *Panasonic* at par. 0083 "Namely, **in agreement with the state of the image-signal, when the movement is slow, the slowness in the liquid crystal response-rate presents no problem**. Accordingly, frame frequencies of input/output are made to coincide with each other, and the lighting-up time-period and the pausing time-period of the light-source, by being made to correspond to this output frame frequency, are also controlled by the output frame period (FIG. 11A). Next, **when the movement of the image-signal is faster as compared with the above-described case, in order to improve (i.e., speed up) the liquid crystal response-rate, the output frame frequency is made 2 times faster than the input frame frequency so as to insert dummy data**. The lighting-up time-period and the pausing time-period of the light-source, by being made to correspond to this, are also controlled by the output frame period (FIG. 11B)." *Panasonic* at par. 0132

(cont.) 12.f. (c2) **generating the overdriving signal for the target pixel based on the gain and the image data**.	"Moreover, **when the movement of the image-signal is faster as compared with the above-described case, the output frame frequency is made 3 times faster than the input frame frequency so as to insert more amount of dummy data, thereby improving the response-rate**. The lighting-up time-period and the pausing time-period of the light-source, by being made to correspond to this, are also controlled by the output frame period (FIG. 11C)." *Panasonic* at par. 0133 "At this time, **it is advisable to perform the control so that the effective value of the current applied to the lamps for causing the light-source to perform the light-emission during each lighting-up period becomes substantially constant regardless of the ratio of the above-described lighting-up time-period and that of the above-described pausing time-period of the light-source. Also, changing the current effective value makes it possible to change the illumination light-quantity of the light-source**." *Panasonic* at par. 0134 "As described earlier, **the time ratio of the 1st lighting-up luminance (i.e., the lighting-up time-period) and that of the 2nd lighting-up luminance (i.e., the pausing time-period in the present example) are changed in correspondence with the information amount about the movement of the image-signal, thereby allowing the more beautiful motion-frame picture display**. Namely, as illustrated in FIGS. 11A, 11B, and 11C, **the lighting-up time-period is made shorter when the movement is fast and the lighting-up time-period is made longer when the movement is slow, or the lighting-up time-period is made shorter when the moving information amount (i.e., the moving pixel number) over the entire surface of the display region is large and the lighting-up time-period is made longer when the moving information amount is small, thereby allowing the more beautiful motion-frame picture display. At this time, the current effective value applied to the lamps for causing the light-source to perform the light-emission during each lighting-up period is changed in correspondence with the ratio of the lighting-up time-period and that of the pausing time-period of the light-source. This changes the illumination light-quantity of the light-source, thus making it possible to stabilize the luminance level of the motion-frame picture display**." *Panasonic* at par. 0149

(cont.) 12.f. (c2) **generating the overdriving signal for the target pixel based on the gain and the image data**.	"**The switching controlling circuit** 25 **generates and outputs light-source lighting-up signals BL1 to BL4 for executing the control over the blinking lighting-up of the respective fluorescent lamps** 8. **The data comparing unit** 52 **compares, on the basis of 1 display pixel (which is synchronized with 1 clock of Dotck), the present frame display data (Data) with the previous frame display data (Data′) read from the data storing unit** 50. **As a result of this, if both of the display data are different from each other, the display data are judged to be of the motion-frame pictures and the motion-frame picture judgement signal is outputted toward the 1 display pixel. The mode judging unit** 55, **as illustrated in FIG. 23, divides the display region into the 4 regions and adds the motion-frame picture judgement signals for each region, then outputting, from this addition result, a mode signal for indicating a region where there exist the most motion-frame picture judgement signals**." *Panasonic* at par. 0160 "**The overdrive controlling unit** 3315 **detects a difference in the tone data between these adjacent frames, then judging the movement amount of the image data from this difference. From this movement amount, the overdrive controlling unit determines, for each frame, the response-rate or the image data corrected-value at the optimum for the luminance, thereby executing a correction toward the output tone data** 3311." *Panasonic* at par. 0176