Description

This invention relates to television apparatus, for displaying the picture information of a television signal that was produced by an interlaced scanning process, hereinafter referred to as the interlaced signal, in a non-interlaced scanning format.

Television signals based on present day standards create visible artifacts on conventional television receivers and monitors. In broadcast systems such as the 525 line-per-frame, 30 frame-per-second 525/30 NTSC system or the 625/25 PAL system, artifacts occur because of the interlaced scanning process. This process divides the 525-line picture or frame of the NTSC standard into two successive 262½-line fields. The 262½ lines of one field are scanned in 1/60th of a second followed by scanning of an additional 262½ lines of another field with lines of the second field occupying the spaces between the lines of the first field. One subjective effect of this interlaced scan is to create in the presence of motion in the picture scene an apparent vertical drift of the lines of the raster known as "line crawl". The apparent drift is substantially more apparent when viewing a wide-screen display at close range. Another well-known objectionable visible effect is interline flicker on line-to-line transition that occurs because of the interlaced scanning format.

Recent interest in the development of high definition television systems (HDTV) has been directed towards techniques that are intended to enhance the subjective performance of present systems within the contraints of existing standards. One approach, a technique referred to as progressive scan, or non-interlaced scan, has been described in patent materials and literature. For example, all the scan lines are scanned consecutively from the top of the display screen and downward to the bottom of the display screen during each vertical scanning interval. Progressive scan results in the reduction of interlaced scanning format related artifacts such as interline flicker and line crawl that exist in conventional two-to-two interlaced displays. The subjective effect is a more pleasing picture presentation to the viewer

GB-A-2114848 discloses a circuit for producing, from an incoming signal of standard interlaced format (e.g. an NTSC signal), signals for display in non-interlaced scanning format (i.e. progressively scanned format).

The circuit of GB-A-2114848 comprises a delay line comprising, inter alia , two field memories. The luminance signal (Y) of one (undelayed) field of the incoming signal is produced by subtracting a chrominance signal from the incoming signal of that field. The chrominance signal is produced by a frame comb circuit. The luminance signal (Yd) for an incoming signal delayed by one field is produced by subtracting another chrominance signal produced by a field comb circuit from the field delayed incoming signal. Thus two luminance signals (Y and Yd) are made available simultaneously.

A motion detector operates on the difference between an undelayed incoming signal and a frame delayed incoming signal.

In the absence of motion a field of the progressively scanned image is formed by the two luminance signals Y and Yd, derived from successive fields.

In the presence of motion, the image is formed by luminance signals derived from the same field. For that purpose a line interpolation circuit is used to interpolate the additional lines required from the undelayed luminance signal Y involving a loss of resolution additional to any losses produced by the comb filtering.

US-A-4245237 discloses a circuit for the controllable non-linear processing of standard interlaced format television signals. An incoming signal (e.g. an NTSC signal) is comb filtered to separate the luminance and chrominance components, resulting in a loss of vertical detail in the luminance component. The vertical detail is recovered by filtering the chrominance component. The recovered detail is subject to processing in a circuit having a non-linear signal amplitude transfer function before being added to the luminance component. The luminance and chrominance components are processed and displayed in a standard interlaced format.

According to the present invention, there is provided a television apparatus for generating from an incoming television signal produced by an interlaced scanning process first and second video signals such that the video lines thereof provide picture information for display in a non-interlaced television display, said apparatus comprising: a first line comb filter responsive to said incoming television signal for producing a first luminance signal and a first vertical detail signal, each derived from said incoming television signal; a delay element for delaying said incoming television signal by substantially one field time thereof; a second line comb filter responsive to said field delayed television signal for producing a field delayed second luminance signal and a field delayed second vertical detail signal, each derived from said field delayed television signal; a source for providing a motion indicating signal; first combining means coupled to said first comb filter, to said second comb filter and to said source for combining said first and second vertical detail signals with said first luminance signal as a function of said motion indicating signal for generating

said first video signal; second combining means coupled to said second comb filter for combining said second vertical detail signal with said second luminance signal for generating said second video signal; and means for displaying said first and second video signals in a non-interlaced fashion.

Reference will now be made, by way of example, to the accompanying drawings, in which:-

FIGURE 1a, b, c and d are useful in explaining the picture information from the television signal of FIGURE 2 that is displayed in the corresponding scan lines of the cathode ray tube of FIGURE 4;

FIGURE 2 illustrates schematically video lines in two consecutive fields of the television signal;

FIGURE 3 illustrates the block diagram of the separator block of figure 4;

FIGURE 4 illustrates the block diagram of a television apparatus of the invention that includes the separator block of FIGURE 3 for displaying the picture information of the television signal of FIGURE 2, in non-interlaced scanning format; and

FIGURE 5a-ℓ illustrate schematically timing diagrams useful in explaining the operation of the television apparatus of FIGURE 4.

FIGURE 1a illustrates a faceplate 121 of a cathode ray tube such as illustrated in FIGURE 4, as described later on, that includes in a given portion 120 four horizontal display lines, 122-125, illustrated in solid lines, and four interleaving horizontal display lines, 126-129, illustrated in broken lines. FIGURE 1a is used below in explaining the standard interlaced as well as the non-interlaced scanning format of the invention.

FIGURE 2 illustrates schematically a composite interlaced color NTSC signal 130. In an interlaced scanning format, video lines n, n+1, n+2 and n+3 of a field m of signal 130 provide picture information for display in lines 122, 123, 124 and 125, respectively, of FIGURE 1a. FIGURE 1b illustrates schematically the vertical spacing between lines 122-125, respectively, and the associated video lines n through n+3 of field m of Figure 2 having their picture information displayed in a vertical scanning interval s. Likewise, FIGURE 2 illustrates schematically video lines n+263, n+264, n+265 and n+266, of the immediately following field, m+1, of signal 130 that provide picture information for display in lines 126, 127, 128 and 129, respectively, of Figure 1a having their picture information displayed in a vertical scanning interval s+1. Similarly, FIGURE 1b illustrates schematically the vertical spacing between lines 126-129, respectively and the four associated video lines n+263 through n+266 of field m+1 of Figure 2 for the standard interlaced format. In the same manner, video lines n+525, n+526, n+527 and n+528 of a field m+2, not illustrated in FIGURE 2, supply picture information for display in a vertical scanning interval s+2 in the interlaced scanning format in scan lines 122-125, as illustrated in FIGURE 1b.

In 2:1 interlaced scanning format the picture information of only one field is displayed during one vertical scanning interval. Two adjacent display lines that display picture information from field m, such as display lines 122 and 123, are spaced vertically by a distance 2d, as illustrated in FIGURE 1b. Whereas, adjacent display lines in which the picture information from fields m and m+1, respectively, is displayed, for example lines 122 and 126, are displaced vertically by a distance d which is $\frac{1}{2}$ the length of distance 2d, as illlustrated in FIGURE 1b.

FIGURE 4 illustrates a television apparatus 150, embodying aspects of the invention, that displays the picture information of an interlaced television signal in a non-interlaced format, as described later on. Apparatus 150 includes a cathode ray tube 119 having a faceplate 121 such as illustrated in FIGURE 1a.

FIGURE 3 illustrates a separator block 135 of apparatus 150 of FIGURE 4 embodying aspects of the invention, for generating the signals that provide picture information for display in the display lines of faceplate 121 of FIGURE 4 in a non-interlaced format. Identical numbers and symbols in Figures 1b, 2, 3, and 4 indicate similar items or functions. Referring to FIGURE 3, an analog, composite NTSC signal 130 of FIGURE 2 is applied to a terminal 400c of separator block 135 from a source which is not shown. The source of signal 130 may be the demodulated output of a conventional IF stage of a television receiver. It should be noted that the invention will be described with reference to NTSC composite signal but other interlaced signals are within the scope of the invention. The invention may be implemented using digital or analog techniques, or both.

NTSC signal 130 in FIGURE 2 is applied to a separator 404' of FIGURE 3 which is, illustratively, a two-terminal transversal filter having a 1-H delay unit 401', also known as a comb filter. The 1-H delay is equal to the scan line time of 63.5 microseconds, as illustrated in FIGURE 2. 1-H delay unit 401' of FIGURE 3 is a clocked first-in first-out (FIFO) buffer. A clock 230k supplies the clock signal to unit 401', as described later on. In separator 404' of FIGURE 3, a 1-H delayed signal 201' and the non-delayed NTSC signal 130 are combined and the result multiplied by a scale factor of $\frac{1}{2}$, in an adder/scaler 402', to form a luminance signal Y_d which is combed. Luminance signal Y_d includes the luminance-representative component of NTSC signal 130 of FIGURE 2 having a frequency spectrum with signal energy in the vicinity of integer multiples of the 15734 Hz line rate and nulls of signal energy in the vicinity of odd integer multiples of one half of the

line rate. As a result of the combing process, the chrominance-representative component of NTSC signal 130 is substantially low in luminance signal Y_d of FIGURE 3.

Similarly, delayed and undelayed signals are applied to a subtractor/scaler 403' that subtracts the signals and multiplies the result by a scale factor of $\frac{1}{2}$ to form a combed chrominance signal C_d. Signal C_d represents a portion of the luminance information and the chrominance information having a frequency spectrum with signal energy concentrated in the vicinity of odd integer multiples of one half the line rate and nulls of signal energy in the vicinity of integer multiples of the line rate. As a result of the combing process, the luminance-representative component of NTSC signal 130 of FIGURE 2 is substantially reduced in signals C_d of FIGURE 3.

NTSC signal 130 is delayed by a 262-H delay unit 400, where 262-H delay is equal to 262 times the video line time of 63.5 microseconds, which is substantially a field time of NTSC signal 130, as illustrated in FIGURE 2, to form a signal 200. Unit 400 is a clocked first-in first-out buffer. Clock 230k supplies the clock signal to unit 400, as described later on. Signal 200 is applied to a separator 404 which is, illustratively, similar to separator 404'. Separator 404 generates signals Y_{fd}, C_{fd} and 201 that correspond to signals Y_d, C_d and 201' of separator 404', respectively and have a similar frequency spectrum contents. Luminance signal Y_d is subtracted from signal Y_{fd} in a subtractor 405 and a resulting signal 205 is applied through a low pass filter 1406 to form a luminance motion signal Y_{dif}, as described later on.

Referring to FIGURE 2, instants 151, indicate the midpoints in time of each of video lines n through n+3 and n+262 through n+265, respectively. Assume that video line n+264 at its instant 151 is present at terminal 400c of block 135 of FIGURE 3 as illustrated symbolically in the respective circle in Figure 3 that contains the symbol n + 264. Figure 5e illustrates schematically video lines of NTSC signal 130 of Figure 2. In Figure 5e, video line n + 264 is illustrated between time t10 and time t13. Identical numbers in Figures 5e and 2 indicate identical items or functions. It follows that video signals 200, 201 and 201' of Figure 3 are equal to video lines n+2, n+1 and n+263 of FIGURE 2, respectively, at their respective instants 151, as illustrated symbolically inside the respective circles in FIGURE 3.

Luminance signal $Y_{fd'}$ at instant 151, is equal to one-half the term that is obtained by adding the instantaneous level of video line n+2 to that of video line n+1 at their respective instants 151. Thus, luminance signal Y_{fd} at instant 151 represents the averaged or estimated luminance of consecutive video lines in field m of NTSC signal 130 of FIGURE 2. Simultaneously, luminance signal Y_d is equal to one-half the term that is obtained by adding video line n+263 to video line n+264 at their respective instants 151. Thus, luminance signal Y_d at instant 151 represents the averaged or estimated luminance of consecutive video lines from field m+1 of NTSC signal 130 of FIGURE 2.

Also assume that in the absence of motion, signals Y_{fd} and Y_d of FIGURE 3 are of close values because of the high correlation between the picture information that characterizes adjacent locations on the faceplate 121 of FIGURE 1a. Thus, in the absence of motion, signal Y_{dif} that is obtained by subtracting luminance signal Y_d from luminance signal $Y_{fd'}$ is small. Motion causes the amplitude of motion signal Y_{dif} to be higher than in the case of no motion. This is so because from the time field m of NTSC signal 130 of Figure 2 is generated, in a television camera, to the time field m+1 is generated, the object moves causing the picture to change; therefore, the signal Y_{dif} increases. Low pass filter 1406 removes high frequencies, illustratively over 1MHz, in order to eliminate the residual chrominance signal in signal Y_{dif} that may remain in signal 205.

The following equation summarizes the process of generating motion signal Y_{dif} in the frequency range up to the cutoff frequency of low pass filter 1406; between times t10 and t13 of Figure 5e:

Motion signal Y_{dif} =

$$\frac{\text{Video line n+1 plus video line n+2}}{2} - \frac{\text{Video line n+263 plus video line n+264}}{2}$$

In one embodiment, motion detector 406 may include a peak detector that receives motion signal Y_{dif} and generates a detected luminance motion signal M at a terminal 406a that is indicative of the absolute value of the peak voltage of motion signal Y_{dif}. Also, detector 406 may include an integration circuit for integrating the output signal of the peak detector. In addition, motion signal M may be generated to occur during only an entire scan line time or only an entire frame time. The operations accomplished by motion signals Y_{dif} and motion signal M are described later on.

Combed chrominance signal C_{fd} of separator 404 of FIGURE 3 is coupled to a subtractor 425 that

inverts the polarity of signal C_{fd}. In subtractor 425, signal C_{fd} is subtracted from a signal 225a having the value 0 for generating a signal 225b in which the phase of the color subcarrier is inverted relative to that in signal C_{fd}. Signal 220b is band pass filtered in a band pass filter 407 to provide a chroma signal C_a. The luminance information remaining in chrominance signal C_{fd} after the line combing process, is substantially reduced in chroma signal C_a. When video line n+264 of FIGURE 2 is coupled to terminal 400c of FIGURE 3, chrominance signal C_{fd} is equal to one half the term that is obtained by subtracting video line n+1 from video line n+2. The respective phase of the color subcarrier in video lines n+2 and n+1 are 180° apart. Therefore, chrominance signal C_{fd} as well as chroma signal C_a contains the "averaged" chrominance information of video lines n+2 and n+1 of field m of Figure 2. Some reduction in chrominance picture resolution occurs as a result of the averaging process. The effect of such reduced resolution in the chrominance contents of the picture is not significant because of the well known fact that the human eye's sensitivity to fine chrominance details is low. FIGURE 5b illustrates schematically chroma signal C_a that includes a chroma line 56 from time t10 to time t13.

The following equation summarizes the process for generating chroma line 56 of chroma signal C_a of FIGURE 5b in the range of frequencies of the respective band pass filter:

chroma line 56 =

$$\frac{\text{video line n+2 minus video line n+1}}{2}$$

It can be deduced from the equation of chroma line 56 that chroma signal Ca of FIGURE 3 contains the averaged chrominance component of the respective video lines of NTSC signal 130.

Chrominance signal C_{fd} of separator 404 is low pass filtered in low pass filter 408, having illustratively 1MHz cut-off frequency, to form a vertical detail signal V_{df}. Signal V_{df} is applied via a gain device 409 to form a vertical detail signal V'_{df}. Signal V'_{df} is coupled to an input terminal 410a of an adder 410 Combed luminance signal Y_{df} is coupled to the other input terminal of adder 410 that adds the signals at its respective terminals to form a luma signal Y_a. Signal V'_{df} of Figure 3 restores low frequency vertical details of luminance signal Y_{fd} that are missing as a result of the combing process in separator 404, as explained in detail below. The gain factor A of gain device 409 may be a constant or may vary with the level of vertical detail signal V_{df} of low pass filter 408 to provide a subjectively pleasing picture. FIGURE 5a illustrates schematically luma signal Y_a that includes a signal part 52 from time t10 to time t13.

The following equation summarizes the process of generating luma line 52 of luma signal Y_a of FIGURE 5a in the range of frequencies below the cutoff frequency of the corresponding low pass filter:

luma line 52 =

$$\frac{\text{video line n+2 plus video line n+1}}{2}$$

$$+ \text{A} \times \frac{\text{video line n+1 minus video line n+2}}{2}$$

Assume that gain device 409 has a unity gain. Therefore, in the first 1MHz of the spectrum of signal 130 of FIGURE 2,the above equation becomes reduced to : luma line 52 = n+1. Thus, luma line 52 is equal to the luminance component of video line n+1, as indicated by the symbol ~(n+1) in FIGURE 5a. Thus, luminance signal Y_a of Figure 5a contains all luminance information in the first 1MHz of NTSC signal 130 of Figure 2.

Combed chrominance signal C_d of separator 404' is subtracted from combed chrominance signal C_{fd} of separator 404 in a subtractor 411 to form a signal 211. Signal 211 is bandpass filtered in a band pass filter 412 to form a difference signal C_{dif}. Band pass filter 412 passes, illustratively, the frequency spectrum range from 2.5 to 4.5 MHz, and attenuates substantially signal 211 outside this range. Signal C_{dif} may supply a chrominance motion estimate and is analogous to luminance motion signal Y_{dif}. Signal C_{dif} is coupled through a gain controlled device 413 to form a signal 213. Illustratively, the gain factor K of device 413 increases as the absolute value of motion signal Y_{dif} increases, and vice versa.

Assume, in a first hypothetical example, that the gain factor K is equal to 1, corresponding to a unity gain, when the absolute value of motion signal Y_{dif} exceeds a first level. K=1 is indicative that motion is detected. Conversely, K is equal to 0, corresponding to zero gain, when the absolute value of motion signal

Y_{dif} does not exceed the first level. K=0 is indicative that motion is not detected. It should be understood that other motion indicative signals may be used, instead, for controlling gain controlled device 413. One such example is a signal that is derived from signal C_{dif}.

Combed chrominance signal C_d of separator 404' is coupled through a band pass filter 1412, that is illustratively similar to band pass filter 412 or 407, to form a chrominance signal C'_d. Chrominance signal C'_d is added to signal 213 in an adder 414 to form a chroma signal C_b. FIGURE 5d illustrates schematically chroma signal C_b that includes a chroma line 64 from time t10 to time t13. The following equation summarizes the process of generating chroma line 64 of FIGURE 5d within the range of frequencies that are passed in the corresponding band pass filters: chroma line 64 =

$$\frac{\text{video line n+263 minus video line n+264}}{2} +$$

$$K \times \frac{\text{video line n+1 minus video line n+2}}{2} -$$

$$K \times \frac{\text{video line n+263 minus video line n+264}}{2}$$

Assuming the facts of the first hypothetical example, K=0 when motion is not detected. Therefore, the above equation becomes reduced to:
chroma line 64 =

$$\frac{\text{video line n+263 minus video line n+264}}{2}$$

Similarly to chroma signal C_a, that was discussed above, chroma signal C_b contains averaged chrominance information of NTSC signal 130. On the other hand, when motion is detected, then in the frequency spectrum that is passed by band pass filter 412, the above equation that summarizes the process becomes reduced to:
chroma line 64 =

$$\frac{\text{video line n+1 minus video line n+2}}{2}$$

Thus, in the first example in which k=1 when motion is detected, chrome line 64 of chrome signal C_b contains the averaged chrominance picture information of video lines n+1 and n+2 of field m of NTSC signal 130; whereas, when motion is not detected C_b contains the averaged chrominance picture information of video lines 264 and 263 of field m+1 of NTSC signal 130. Note that when motion is detected, chroma signals C_a and C_b contain substantially the same chrominance information that is derived from the same field of NTSC signal 130.

Luminance signal Y_d of separator 404' of FIGURE 3 is coupled to an input terminal 415a of an adder 415. Signal Y_{dif} is coupled through a gain controlled device 416 to an input terminal 415b of adder 415. Device 416 is controlled by motion signal M, illustratively, in a similar manner as gain controlled device 413. In the first hypothetical example, assume that the gain factor K is equal to 1, when the value of motion signal Y_{dif} exceeds the first level. K=1 indicates that motion is detected, as in device 413. Conversely, K is equal to 0 when motion is not detected as in device 413.

Combed signal C_d of separator 404' is coupled through a low pass filter 417, having illustratively 1MHz cutoff frequency, to form a signal 217. Signal 217 is coupled through a gain device 418 to an input terminal 419a of a gain controlled device 419 to form a vertical detail signal V_d. Gain device 418, illustratively, has the same characteristics as gain device 409 and functions similarly except that the gain factor -A is negative for the purpose of inverting the polarity of signal 217. Vertical detail signal V_d is coupled through gain controlled device 419 to an input terminal 415d of adder 415. Gain controlled device 419 operates in an opposite manner from any of gain controlled devices 413 and 416. In device 419, the gain factor J increases when the value of motion signal M decreases, and vice versa. Assume in the first hypothetical

example that gain device 418 has a unity gain and that the gain factor J is equal 0 when the value of motion signal Y_{dif} exceeds the first level. J=0 indicates that motion is detected. Conversely, J equals 1 when the absolute value of motion signal Y_{dif} does not exceed the first level. J=1 indicates that no motion is detected. Vertical detail V_{df}, that is the low pass filtered signal C_{fd}, is coupled through a gain device 420 to form a vertical detail signal V''_{df} at an input terminal 421a of a gain controlled device 421. Gain device 420, illustratively, has the same characteristics as gain device 409 and functions similarly. Assume for the first hypothetical example that gain device 420 has a unity gain. Gain controlled device 421 is controlled by motion signal M, illustratively, in a similar manner as gain controlled device 413 or 416. Thus the gain factor K of gain controlled device 419 equals 1 when motion is detected and equals 0 when motion is not detected. Signal V''_{df} is coupled through gain controlled device 421 to an input terminal 415c of adder 415. Adder 415 combines the signals at terminals 415a-d to form a luma signal Y_b. FIGURE 5c illustrates schematically luma signal Y_b that includes a luma line 60 from time t10 to time t13.

The following equation summarizes the process of generating luma line 60 of FIGURE 5c in the frequency range up to the cutoff frequency of the respective low pass filter:

luma line 60 =

$$\frac{\text{video line n+263 plus video line n+264}}{2} +$$

$$K \times \frac{\text{video line n+2 plus video line n+1}}{2} -$$

$$K \times \frac{\text{video line n+263 plus video line n+264}}{2} +$$

$$A \times K \times \frac{\text{video line n+1 minus video line n+2}}{2} -$$

$$A \times J \times \frac{\text{video line n+263 minus video line n+264}}{2}$$

Assume the facts of the first hypothetical example that when motion is not detected, k=0 and J=1. Thus, for frequencies up to the cut-off frequencies of the low pass filters, the above equation becomes reduced to:

luma line 60 = video line n+264.

Thus, when motion is not detected, luma signal Y_b contains the luminance information of the respective video line of NTSC signal 130 that occurs simultaneously in terminal 400c. It should be understood that in this case, luma signal Y_b is formed by signal Y_d that is coupled to terminal 415a of adder 415 and by vertical detail signal V_d which reinserts vertical detail through terminal 415d of adder 415.

Similarly, when motion is detected k=1 and J=0. Thus, for frequencies up to the cut off frequencies of the low pass filters, the above equation becomes reduced to:

luma line 60 = video line n+1.

Thus, when motion is detected, luma signal Y_b substantially contains the same luminance information that is provided by luma signal Y_a. This luminance information was supplied by video line n+1 in the prior field time of NTSC signal 130. It should be understood that in this case, luma signal Y_b is formed by signal Y_{fd} that is coupled to terminal 415b of adder 415 and by vertical detail signal V_{df} which reinserts vertical detail through terminal 415c of adder 415.

Each of luma lines 52 and 60 and chroma lines 56 and 64, for example, of FIGURES 5a, c, b and d, respectively, is developed at the same time that video line n+264 of FIGURE 5e is being developed. Luma line 52 and chroma line 56 of luma signal Y_a and chroma signal C_a, respectively, of FIGURES 5a and b, respectively, provide luma and chroma information, respectively, for display in line 123 of FIGURE 1a as described later on. Similarly, luma line 60 and chroma line 64 of luma signal Y_b and chroma signal C_b, respectively, of FIGURES 5c and d, respectively, provide luma and chroma information, respectively, for display in line 127 of FIGURE 1a. Line 127 is immediately adjacent to line 123.

FIGURE 5t illustrates an example of motion signal M of FIGURE 3. There, motion is detected between time t11a and t12a. FIGURE 5c illustrates the effect of motion signal M on the contents of luma line 60.

As explained before, irrespective of motion signal M, luma line 52 and chroma line 56 of FIGURES 5a and b, respectively, contain the approximated luminance and chrominance picture information, respectively,

of video line n+1 of field m of NTSC signal 130 of FIGURE 2.

When no motion is detected, luma line 60 and chrome line 64 of FIGURES 5c and d, respectively, contain the approximated luminance and chrominance picture information, respectively, of video line n+264 of field m+1 of NTSC signal 130 of FIGURES 2 and 5e.

On the other hand, when motion is detected, luma line 60 and chroma line 64 of luma signal Y_b and chroma signal C_b of FIGURES 5c and d, respectively, contain substantially the same approximated picture information as in luma line 52 and chroma line 56, respectively, of FIGURES 5a and b, respectively. Thus, so long as motion signal M of FIGURE 3 indicates that motion is detected, the picture information that is displayed in adjacent display lines is the same except for very fine picture details, assuming the facts of the first hypothetical example. Therefore, the artifacts that would have caused discontinuities in the edges of moving objects, as explained before, are eliminated.

The motion compensation scheme may be activated by motion detector 406 of FIGURE 3 on a pixel basis as illustrated in FIGURES 5c and 5ℓ, thus compensating for motion in a given section of a display line. Alternatively, once activated, the motion compensation scheme may remain operative over an entire line or frame period.

In the first hypothetical example the gain factor K of devices 413, 416 and 421 is equal to 1 and the gain factor J of device 419 is equal to 0 when motion is detected; conversely, when no motion is detected the gain factor K of devices 413, 416 and 421 is equal to 0 and the gain factor J of device 419 is equal to 1. As a trade off between motion compensation and vertical picture resolution, the respective gain factor may exhibit a more smooth or soft characteristic as a function of the absolute value of motion signal Y_{dif} of FIGURE 3. Thus, motion signal M may cause devices 413, 416, 419 and 421 to proportionate the respective signal parts of NTSC signal 130 of FIGURE 2 that are included in luma signal Y_b and chroma signal C_b of FIGURES 5c and d, respectively. Alternatively, some or all of the gain factors K and J of devices 413, 416, 419 and 421 of FIGURE 3 may be set to a certain value independently of motion signal M.

Television apparatus 150 of FIGURE 4 includes separator block 135 of FIGURE 3. NTSC signal 130 of FIGURE 2 is also coupled in apparatus 150 to a timing unit 430. Timing unit 430 utilizes horizontal and vertical sync pulses of NTSC signal 130 for generating a synchronized horizontal scanning current H and a synchronized vertical scanning current V for driving a horizontal deflection winding 432 and a vertical deflection winding 431, respectively. The scanning frequency of horizontal scanning current H is twice that of a standard television receiver using the interlaced scanning format; whereas, the frequency of vertical scanning current V is of the same. Timing unit 430 may include a phase-locked-loop circuit, not shown, that generates clock signals that are phase locked to the color burst signal of NTSC signal 130 of FIGURE 2 for generating clock signals 230j-k and for generating a timing signal 230ℓ, all of FIGURE 4. Clock signal 230k of illustratively 4 x Sc, where Sc is the 3.58 MHz frequency of the color subcarrier of NTSC signal 130 of FIGURE 2 is coupled to separator block 135 for clocking the clocked delay lines, as explained before.

Referring to FIGURE 4, chroma signal C_a of block 135 of FIGURES 3 is applied through a terminal F to 1H delays 434 and 435, respectively. Chroma signal C_b of block 135 of FIGURE 3 is applied through a terminal G to 1H delay units 436 and 437 of FIGURE 4, respectively. The 1H delay units 434-437 may comprise first-in first-out (FIFO) buffers.

FIGURES 5f-5i illustrate schematically clocks 230f, 230g, 230h and 230i of FIGURE 4 respectively, that are coupled to 1H delay units 434, 436, 435 and 437, respectively. Clock 230f of FIGURE 5f clocks samples of a chroma line 55 of chroma signal Ca of FIGURE 5b between time t5 and time t8, for example, into 1H delay unit 434 of FIGURE 4 at a first clock rate as illustrated by the short vertical lines in FIGURE 5f. Simultaneously, clock 230g of FIGURE 5g clocks samples of a chroma line 63 of chroma signal Cb of FIGURE 5d into 1-H delay unit 436 of FIGURE 4 at the same first clock rate. The samples in unit 434 of FIGURE 4 are clocked out at a second clock rate which is double the rate of the first clock, as illustrated by the short vertical lines of clock 230f in FIGURE 5f, between times t9 and t11. The samples in unit 436 of FIGURE 4 are clocked out at the second clock rate, as illustrated by the short vertical lines of clock 230g of FIGURE 5g between time t12 and t13. The samples from unit 434 and 436, respectively, of FIGURE 4 are coupled to terminals A and B of a switch 433a, respectively.

FIGURE 5j illustrates schematically a signal 233 that is coupled by a wiper k of switch 433a to a terminal E. Wiper k is controlled by timing signal 230ℓ. Wiper k couples the samples of unit 434 at terminal A to terminal E for forming the respective portion of signal 233 between times t9 and t11 as illustrated in FIGURE 5j; likewise, wiper k of FIGURE 4 couples the samples of unit 436 at terminal B to terminal E between times t12 and t13.

In a like manner, clock 230i of FIGURE 5i clocks samples of a chroma line 56 of FIGURE 5b between time t10 and time t13 into 1-H delay unit 435 of FIGURE 4 at the first clock rate as illustrated by the short vertical lines in FIGURE 5i. Simultaneously, clock 230h of FIGURE 5h clocks samples of a chroma line 64

of FIGURE 5d into 1-H delay unit 437 of FIGURE 4 at the same first clock rate. The samples in unit 435 of FIGURE 4 are clocked out at the second clock rate which is double the rate of the first clock, as illustrated by the short vertical lines of clock 230i in FIGURE 5i between times t14 and t16. The samples in unit 437 of FIGURE 4 are clocked out at the second clock rate, as illustrated by the short vertical lines of clock 230h of FIGURE 5h, respectively, between time t17 and t18. The samples from unit 435 and 437 of FIGURE 4 are coupled to terminals C and D of switch 433a, respectively.

Wiper k couples the samples of unit 435 at terminal C to terminal E between times t14 and t16 of FIGURE 5j for generating the respective portion of signal 233; likewise, wiper k of FIGURE 4 couples the samples of unit 437 at terminal D to terminal E between times t17 and t18. Signal 233 at terminal E is coupled to a color demodulator 438. Thus, signal 233 of FIGURE 5j contains the speeded up I chrominance component of chroma signal C_a of FIGURE 5b and chroma signal C_b of FIGURE 5d, respectively, in alternate, time-compressed, display video line time slots. For the example of FIGURE 5j, each time slot is equal to one-half the 52.6 microseconds active video line time of NTSC signal 130 of FIGURE 2.

Color demodulator 438 of FIGURE 4 receives a color carrier 230j from timing unit 430 of twice the frequency of the color subcarrier of NTSC signal 130 of FIGURE 2. Color demodulator 438 of FIGURE 4 combines signal 233 at terminal E with color carrier 230j, for generating a speeded up color signal I_{2H} and a speeded up color signal Q_{2H}. Signals I_{2H} and Q_{2H} are coupled to the respective terminals of a conventional I, Q, Y matrix 439. FIGURE 5j also may illustrate schematically signals Q_{2H} or I_{2H} of FIGURE 4. It should be understood that color demodulation may be accomplished, in a different embodiment of the invention prior to the speedup process.

A speedup unit 433' in FIGURE 4, that is illustratively constructed similarly to speedup unit 433 has terminals E', F' and G' that correspond to terminals E, F and G respectively, of speedup unit 433. Unit 433' of FIGURE 4 receives clocks 230f-i and signal 230ℓ as does unit 433 and it operates similarly. Luma signal Y_a of block 135 of FIGURE 3 is applied to terminal F' of speedup unit 433' of FIGURE 4 and luma signal Y_b is applied to terminal G' of speedup unit 433'. A signal Y_{2H} at terminal E' of unit 433' is coupled to matrix 439. Thus, signal Y_{2H} contains the speeded up luminance information of luma signal Y_a of FIGURE 5a and of luma signal Y_b of FIGURE 5c, respectively, in alternate time slots. FIGURE 5k illustrates schematically signal Y_{2H} of FIGURE 4, for the first example. Note that the luminance picture information of luma line 52 is speeded up to be contained in signal Y_{2H} between time t14 and time t16. Signal Y_{2H} of FIGURE 5k, between times t17a and time t17b, contains the luminance picture information of luma line 52 of FIGURE 5a between time t11a and time t12b, because of the effect of motion signal M of FIGURE 5ℓ.

I, Q, Y matrix 439, of conventional construction, generates signals R, G and B from signals I_{2H}, Q_{2H} and Y_{2H} for driving the respective guns of cathode ray tube 119. FIGURE 5j may also illustrate schematically signals R, G and B, respectively.

FIGURE 1c illustrates diagrammatically, as an approximation, the respective video lines of NTSC signal 130 of FIGURE 2 that supply luminance picture information for display during a vertical scanning interval s in each of scan lines 122-129 of FIGURE 1a for an example in which no motion is detected. The picture information is displayed in non-interlaced format during one vertical scanning interval. Note that the same respective video line of NTSC signal 130 of FIGURE 2 provides luminance information for display in the same line as in the interlace scanning format of FIGURE 1b. For example, between time t14 and time t16 of FIGURE 5j, signals R, G and B of FIGURE 4 provide the luminance information of video line n+1 for display in line 123.

FIGURE 1d illustrates diagrammatically, as an approximation, the respective video lines of NTSC signal 130 of FIGURE 2 that supply luminance information for display during the vertical scanning interval s in each of scan lines 122-129 of FIGURE 1a, for an example in which motion compensation is performed in scan line 127. In this case, signals R, G and B, between time t17 and time t18 of FIGURE 5j, contain together the luminance information of video line n+1 of NTSC signal 130 of FIGURE 2 display in scan line 127. Note that in the case where no motion is detected, as illustrated in FIGURE 1c, the luminance information of video line n+264 of NTSC signal 130 of FIGURE 2 supplies the luminance picture information for display in scan line 127.

When motion is detected between time t11a and time t12a of FIGURE 5c, signal Y_{2H} of FIGURE 5k between time t17a and t17b contains luminance information of video line n+1 of FIGURE 2 that was coupled to terminal 400c of FIGURE 4 during the previous field m of NTSC signal 130 of FIGURE 2, as illustrated in line 127 of FIGURE 1d. Also note that the same luminance information that is contained between time t15a and time t16b of FIGURE 5k is also contained between time t17a and time t17b of FIGURE 5k. Thus, in each vertical scanning interval, assuming the facts of the hypothetical example, the luminance information for displaying a moving object is derived substantially from the immediately preceding field only. Moreover, the substituted picture information, in the presence of motion, is derived

from a signal that contains the picture information that is displayed in an adjacent scan line.

Claims

1. A television apparatus for generating from an incoming television signal (130) produced by an interlaced scanning process first (Yb) and second (Ya) video signals such that the video lines thereof provide picture information for display in a non-interlaced television display, said apparatus comprising:
   a first line comb filter (404') responsive to said incoming television signal (130) for producing a first luminance signal (Yd) and a first vertical detail signal (Vd), each derived from said incoming television signal (130);
   a delay element (400) for delaying said incoming television signal by substantially one field time thereof;
   a seconds line comb filter (404) responsive to said field delayed television signal (200) for producing a field delayed second luminance signal (Yfd) and a field delayed second vertical detail signal (Vdf), each derived from said field delayed television signal;
   a source (405,1406) for providing a motion indicating signal (Ydif);
   first combining means (415) coupled to said first comb filter (404'), to said second comb filter (404) and to said source (405,1406) for combining said first (Vd) and second (Vdf) vertical detail signals with said first luminance signal (Yd) as a function of said motion indicating signal (Ydif) for generating said first video signal (Yb);
   second combining means (410) coupled to said second comb filter (404) for combining said second vertical detail signal (Vdf) with said second luminance signal (Ydf) for generating said second video signal (Ya); and
   means (119,430,433',430) for displaying said first and second video signals in a non-interlaced fashion.

2. Apparatus according to Claim 1, wherein the first combining means (415) combines said first and second vertical detail signals (Vd,Vdf) with said first luminance signal (Yd) as a function of the motion indicating signal (Ydif) such that under relatively low motion conditions said first video signal (Yb) comprises said first luminance signal (Yd) and said first vertical detail signal (Vd) and under relatively high motion conditions said first video signal comprises said first luminance signal (Yd) and said second vertical detail signal (Vdf).

3. Apparatus according to Claim 2, wherein said source (405,1406) comprises means (405) for forming the difference (Vdif) between the first and second luminance signals (Yfd-Yd) as the motion indicating signal (Ydif).

4. Apparatus according to Claim 1, 2 or 3, wherein the said source (405,1406) includes a low pass filter (1406) for limiting the bandwidth of the motion indicating signal (Ydif) to a frequency range below that of a given chrominance signal frequency range.

5. Apparatus according to Claim 1, 2, 3 or 4 wherein the first combining means (415) additionally combines the said motion indicating signal (Ydif) with said first luminance signal (Yd) as a function of said motion indicating signal (Ydif).

6. Apparatus according to Claim 5 when dependent directly or indirectly on Claim 3, wherein:
   under relatively low motion conditions, the first video signal (Yb) comprises at least to a major extent luminance and vertical detail signal components derived from the same field as the first luminance signal (Yd); and
   under relatively high motion conditions, the first video signal (Yb) comprises at least to a major extent luminance and vertical detail signal components derived from the same field as the second video signal (Ya).

7. Apparatus according to Claim 6, wherein the first combining means comprises an adder (415), first controllable gain means (418,419) for coupling the first vertical detail signal (Vd) to the adder, second controllable gain means (420,421) for coupling the second vertical detail signal (Vdf) to the adder, and

from a signal that contains the picture information that is displayed in an adjacent scan line.

Claims

1. A television apparatus for generating from an incoming television signal (130) produced by an interlaced scanning process first (Yb) and second (Ya) video signals such that the video lines thereof provide picture information for display in a non-interlaced television display, said apparatus comprising:
   a first line comb filter (404') responsive to said incoming television signal (130) for producing a first luminance signal (Yd) and a first vertical detail signal (Vd), each derived from said incoming television signal (130);
   a delay element (400) for delaying said incoming television signal by substantially one field time thereof;
   a seconds line comb filter (404) responsive to said field delayed television signal (200) for producing a field delayed second luminance signal (Yfd) and a field delayed second vertical detail signal (Vdf), each derived from said field delayed television signal;
   a source (405,1406) for providing a motion indicating signal (Ydif);
   first combining means (415) coupled to said first comb filter (404'), to said second comb filter (404) and to said source (405,1406) for combining said first (Vd) and second (Vdf) vertical detail signals with said first luminance signal (Yd) as a function of said motion indicating signal (Ydif) for generating said first video signal (Yb);
   second combining means (410) coupled to said second comb filter (404) for combining said second vertical detail signal (Vdf) with said second luminance signal (Ydf) for generating said second video signal (Ya); and
   means (119,430,433',430) for displaying said first and second video signals in a non-interlaced fashion.

2. Apparatus according to Claim 1, wherein the first combining means (415) combines said first and second vertical detail signals (Vd,Vdf) with said first luminance signal (Yd) as a function of the motion indicating signal (Ydif) such that under relatively low motion conditions said first video signal (Yb) comprises said first luminance signal (Yd) and said first vertical detail signal (Vd) and under relatively high motion conditions said first video signal comprises said first luminance signal (Yd) and said second vertical detail signal (Vdf).

3. Apparatus according to Claim 2, wherein said source (405,1406) comprises means (405) for forming the difference (Vdif) between the first and second luminance signals (Yfd-Yd) as the motion indicating signal (Ydif).

4. Apparatus according to Claim 1, 2 or 3, wherein the said source (405,1406) includes a low pass filter (1406) for limiting the bandwidth of the motion indicating signal (Ydif) to a frequency range below that of a given chrominance signal frequency range.

5. Apparatus according to Claim 1, 2, 3 or 4 wherein the first combining means (415) additionally combines the said motion indicating signal (Ydif) with said first luminance signal (Yd) as a function of said motion indicating signal (Ydif).

6. Apparatus according to Claim 5 when dependent directly or indirectly on Claim 3, wherein:
   under relatively low motion conditions, the first video signal (Yb) comprises at least to a major extent luminance and vertical detail signal components derived from the same field as the first luminance signal (Yd); and
   under relatively high motion conditions, the first video signal (Yb) comprises at least to a major extent luminance and vertical detail signal components derived from the same field as the second video signal (Ya).

7. Apparatus according to Claim 6, wherein the first combining means comprises an adder (415), first controllable gain means (418,419) for coupling the first vertical detail signal (Vd) to the adder, second controllable gain means (420,421) for coupling the second vertical detail signal (Vdf) to the adder, and

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third controllable gain means (416) for coupling the motion indicating signal (Ydif) to the adder, the gains of the controllable gain means (416,418,419,420,421) being controllable as functions of the motion indicating signal (Ydif).

8. Apparatus according to Claim 7, wherein the difference forming means (405) subtracts the first luminance signal (Yd) from the second luminance signal (Ydf), the first controllable gain means (418,419) has a gain of -A.J, the second controllable gain means (420,421) has a gain of +A.K and the third controllable gain means (416) has a gain of K, where A is a constant, J and K are functions of the motion indicating signal, and J varies in an opposite sense to K as a function of the motion indicating signal (Ydif).

9. Apparatus according to any preceding claim wherein the said source (405,1406) comprises means (406) for causing the combining means to operate as a function of the motion indicating signal on a pixel-by-pixel basis.

10. Apparatus according to any one of Claims 1 to 7 wherein the said source (405,1406) comprises means (406) for causing the combining means to operate as a function of the motion indicating signal on a line-by-line basis.

11. Apparatus according to any one of Claims 1 to 7 wherein the said source (405,1406) comprises means (406) for causing the combining means to operate as a function of the motion indicating signal on a frame-by-frame basis.

Revendications

1. Appareil de télévision pour produire à partir d'un signal de télévision d'entrée (130), produit par un procédé de balayage entrelacé de premier (Yb) et second (Ya) signaux vidéo, tels que les lignes vidéo de ceux-ci produisent une information d'image pour une visualisation dans un dispositif de visualisation de télévision non-entrelacé, ledit appareil comprenant :
   un premier filtre en peigne de lignes (404') répondant au signal de télévision d'entrée (130) pour produire un premier signal de luminance (Yb) et un premier signal de détail vertical (Vd), chacun dérivé dudit signal de télévision d'entrée (130);
   un élément à retard (400) pour retarder le signal de télévision d'entrée de sensiblement une période de trame de celui-ci;
   un second filtre en peigne de lignes (404) répondant au signal de télévision retardé d'une trame (200) pour produire un second signal de luminance retardé d'une trame (Yfd) et un second signal de détail vertical retardé d'une trame (Vdf), chacun dérivé dudit signal de télévision retardé d'une trame;
   une source (405,1406) pour produire un signal d'indication de mouvement (Ydif);
   un premier moyen combineur (415) couplé au premier filtre en peigne (404'), au second filtre en peigne (404) et à ladite source (405,1406) pour combiner les premier (Vd) et second (Vdf) signaux de détail vertical audit premier signal de luminance (Yd) en une fonction dudit signal d'indication de mouvement (Ydif) pour produire le premier signal vidéo (Yb);
   un second moyen combineur (410) couplé au second filtre en peigne (404) pour combiner le second signal de détail vertical (Vdf) au second signal de luminance (Ydf) pour produire le second signal vidéo (Ya); et
   un moyen (119, 430, 433, 439) pour visualiser les premier et second signaux vidéo de façon non entrelacée.

2. Appareil selon la revendication 1, où le premier moyen combineur (415) combine les premier et second signaux de détail vertical (Vd, Vdf) au premier signal de luminance (Yd) en une fonction du signal d'indication de mouvement (Ydif) de telle sorte que dans des conditions de mouvement relativement faible , le premier signal vidéo (Yb) comporte le premier signal de luminance (Yd) et le premier signal de détail vertical (Vd) et dans des conditions de mouvement relativement élevé , le premier signal vidéo comporte le premier signal de luminance (Yd) et le second signal de détail vertical (Vdf).

3. Appareil selon la revendication 2, où la source précitée (405, 1406) comprend un moyen (405) pour former la différence (Vdif) entre les premier et second signaux de luminance (Yfd-Yd) comme signal

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d'indication de mouvement (Ydif).

4. Appareil selon la revendication 1, 2 ou 3, où la source précitée (505, 1406) comprend un filtre passe-bas (1406) pour limiter la largeur de bande du signal d'indication de mouvement (Ydif) à une gamme de fréquence en dessoous d'une gamme de fréquence donnée du signal de chrominance.

5. Appareil selon la revendication 1, 2, 3 ou 4, où le premier moyen combineur (415) combine additionnellement le signal d'indication de mouvement précité (Ydif) au premier signal de luminance (Yd) en une fonction du signal d'indication de déplacement (Ydif).

6. Appareil selon la revendication 5, lorsque dépendante directement ou indirectement de la revendication 3, où :
dans des conditions de mouvement faible, le premier signal vidéo (Yb) consiste au moins en une extension principale de composantes du signal de détail vertical et de luminance dérivées de la même trame que le premier signal de luminance (Yd); et
dans des conditions de mouvement relativement rapide, le premier signal vidéo (Yb) consiste au moins en une extension principale de composantes du signal de détail vertical et de luminance dérivées de la même trame que le second signal vidéo (Ya).

7. Appareil selon la revendication 6, où le premier moyen comineur comprend un additionneur (415), un premier moyen à gain contrôlable (418,419) pour coupler le premier signal de détail vertical (Vd) à l'additionneur, un second moyen à gain contrôlable (420, 421) pour coupler le second signal de détail vertical (Vdf) à l'additionneur, et un troisième moyen à gain contrôlable (416) pour coupler le signal d'indication de mouvement (Ydif) à l'additionneur, les gains des moyens à gain contrôlable (416, 418, 419, 420, 421) étant contrôlables en fonction du signal d'indication de mouvement (Ydif).

8. Appareil selon la revendication 7, où le moyen de formation de différence (405) soustrait le premier signal de luminance (Yd) du second signal de luminance (Ydf), le premier moyen à gain contrôlable (418, 419) a un gain de -A.J., le second moyen à gain contrôlable (420, 421) a un gain de +A.K et le troisième moyen à gain contrôlable (416) a un gain de K, où A est une constante, J et K sont des fonctions du signal d'indication de mouvement, et J varie dans un sens opposé à K en fonction du signal d'indication de mouvement (Ydif).

9. Appareil selon l'une des revendications précédentes, où la source précitée (405, 1406) comprend un moyen (406) pour amener le moyen combineur à fonctionner en fonction du signal d'indication de mouvement sur une base d'élément d'image par élément d'image.

10. Appareil selon l'une des revendications 1 à 7, où la source précitée (405, 1406), comprend un moyen (406) pour amener le moyen combineur à fonctionner en fonction du signal d'indication de mouvement sur une base de ligne par ligne.

11. Appareil selon l'une des revendications 1 à 7, où la source précitée (405, 1406) comprend un moyen (406) pour amener le moyen combineur à fonctionner en fonction du signal d'indication de mouvement sur une base d'image par image.

Ansprüche

1. Fernsehgerät, bei welchem aus einem eintreffenden Fernsehsignal (130), das durch einen verschachtelten Abtastprozeß erzeugt wurde, ein erstes (Yb) und ein zweites (Ya) Videosignal derart erzeugt werden, daß ihre Videozeilen Bildinformation zur Wiedergabe in einem nichtverschachtelten Video-Display ergeben, mit:
einem auf das eintreffende Fernsehsignal (130) ansprechenden ersten Zeilenkammfilter (404') zum Erzeugen eines ersten Leuchtdichtesignals (Yd) und eines ersten Vertikaldetailsignales (V_d), die beide aus dem eintreffenden Fernsehsignal (130) gewonnen werden;
einem Verzögerungselement (400) zum Verzögern des eintreffenden Fernsehsignales um im wesentlichen eine Teilbilddauer dieses Signals;
einem auf das teilbildverzögerte Fernsehsignal (200) ansprechenden zweiten Zeilenkammfilter (404)

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zum Erzeugen eines teilbildverzögerten zweiten Leuchtdichtesignales (Yfd) und eines teilbildverzögerten zweiten Vertikaldetailsignales (Vdf), die beide aus dem teilbildverzögerten Fernsehsignal gewonnen werden;
einer Quelle (405, 1406) zum Erzeugen eines bewegungsanzeigenden Signales (Ydif);
einer ersten Kombiniereinrichtung (415), die mit dem ersten Kammfilter (404'), dem zweiten Kammfilter (404) und der Quelle (405, 1406) gekoppelt ist, um das erste (Vd) und das zweite (Vdf) Vertikaldetailsignal mit dem ersten Leuchtdichtesignal (Yd) als Funktion des bewegungsanzeigenden Signales (Ydif) zur Erzeugung des ersten Videosignales (Yb) zu kombinieren;
einer zweiten Kombiniereinrichtung (410), die mit dem zweiten Kammfilter (404) gekoppelt ist, um das zweite Vertikaldetailsignal (Vdf) mit dem zweiten Leuchtdichtesignal (Ydf) zum Erzeugen des zweiten Videosignals (Ya) zu kombinieren; und
einer Einrichtung (119, 430, 433', 439) zur Wiedergabe des ersten und des zweiten Videosignales in nichtverschachtelter Weise.

2. Gerät nach Anspruch 1, bei dem die erste Kombiniereinrichtung (415) das erste und das zweite Vertikaldetailsignal (Vd, Vdf) mit dem ersten Leuchtdichtesignal (Yd) als Funktion des bewegungsanzeigenden Signales (Ydif) derart kombiniert, daß das erste Videosignal (Yb) bei Verhältnissen mit relativ geringer Bewegung das erste Leuchtdichtesignal (Yd) und das erste Vertikaldetailsignal (Vd) enthält und das erste Videosignal bei Verhältnissen mit relativ starker Bewegung das erste Leuchtdichtesignal (Yd) und das zweite Vertikaldetailsignal (Vdf) enthält.

3. Gerät nach Anspruch 2, bei dem die Quelle (405, 1406) Mittel (405) zum Bilden der Differenz (Vdif) zwischen dem ersten und dem zweiten Leuchtdichtesignal (Yfd-Yd) als bewegungsanzeigendes Signal (Ydif) enthält.

4. Gerät nach Anspruch 1, 2 oder 3, bei dem die Quelle (405, 1406) ein Tiefpaßfilter (1406) zum Begrenzen der Bandbreite des bewegungsanzeigenden Signals (Ydif) auf einen Frequenzbereich unter dem eines vorgegebenen Farbartsignalfrequenzbereiches enthält.

5. Gerät nach Anspruch 1, 2, 3 oder 4, bei dem die erste Kombiniereinrichtung (415) zusätzlich das bewegungsanzeigende Signal (Ydif) mit dem ersten Leuchtdichtesignal (Yd) als Funktion des bewegungsanzeigenden Signales (Ydif) kombiniert.

6. Gerät nach Anspruch 5, bei direkter oder indirekter Abhängigkeit vom Anspruch 3, bei dem:
das erste Videosignal (Yb) unter Bedingungen relativ geringer Bewegung mindestens in überwiegendem Maße Leuchtdichte-und Vertikaldetailsignalkomponenten enthält, die vom selben Teilbild wie das erste Leuchtdichtesignal (Yd) gewonnen wurden, und
das erste Videosignal (Yb) unter Verhältnissen mit relativ starker Bewegung zumindest in überwiegendem Maße Leuchtdichte- und Vertikaldetailsignalkomponenten enthält, die vom gleichen Teilbild wie das zweite Videosignal (Ya) gewonnen wurden.

7. Gerät nach Anspruch 6, bei dem die erste Kombiniereinrichtung einen Addierer (415), eine erste Einrichtung (418, 419) mit steuerbarem Verstärkungsgrad zum Koppeln des ersten Vertikaldetailsignals (Vd) auf den Addierer, eine zweite Einrichtung (420, 421) mit steuerbarem Verstärkungsgrad zum Koppeln des zweiten Vertikaldetailsignals (Vdf) auf den Addierer, und eine dritte Einrichtung (416) mit steuerbarem Verstärkungsgrad zum Koppeln des bewegungsanzeigenden Signals (Ydif) auf den Addierer enthält, wobei die Verstärkungsgrade der Einrichtungen (416, 418, 419, 420, 421) mit steuerbarem Verstärkungsgrad als Funktionen des bewegungsanzeigenden Signales (Ydif) steuerbar sind.

8. Gerät nach Anspruch 7, bei dem die differenzbildenden Mittel (405) das erste Leuchtdichtesignal (Yd) vom zweiten Leuchtdichtesignal (Ydf) subtrahiert, die erste Einrichtung (418, 419) mit steuerbarem Verstärkungsgrad den Verstärkungsgrad -A.J aufweist, die zweite Einrichtung (420, 421) mit steuerbarem Verstärkungsgrad, den Verstärkungsgrad +A.K aufweist und die Einrichtung (416) mit steuerbarem Verstärkungsgrad den Verstärkungsgrad K aufweist, wobei A eine Konstante ist, J und K Funktionen des bewegungsanzeigenden Signales sind und J sich im entgegengesetzten Sinne wie K als Funktion des bewegungsanzeigenden Signales (Ydif) ändert.

9. Gerät nach einem der vorhergehenden Ansprüche, bei dem die Quelle (405, 1406) Mittel (406) enthält,

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um die Kombiniereinrichtungen zu veranlassen, als Funktion des bewegungsanzeigenden Signals pixelweise zu arbeiten.

10. Gerät nach einem der Ansprüche 1 bis 7, bei dem die Quelle (405, 1406) Mittel (406) enthält, um die Kombiniereinrichtungen zu veranlassen, als Funktion des bewegungsanzeigenden Signales zeilenweise zu arbeiten.

11. Gerät nach einem der Ansprüche 1 bis 7, bei dem die Quelle (405, 1406) Mittel (406) enthält, um die Kombiniereinrichtungen zu veranlassen, als Funktion des bewegungsanzeigenden Signales teilbildweise zu arbeiten.

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