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(54) COLOR VIDEO SIGNAL RECORDING AND/OR REPRODUCING SYSTEM



(71) We, NIPPON VICTOR KABUSHIKI KAISHA, of No. 12, 3-Chome, Moriya-Cho, Kanagawa-Ku, Yokohama-City, Kanagawa-Ken, Japan, a Japanese Corporation, do hereby declare the invention for which we pray that a patent may be granted to us and the method by which it is to be performed to be particularly described in and by the following statement:—

The present invention relates generally to color video signal recording and/or reproducing systems, and more particularly to a system capable of recording a color video signal on a recording medium without spaces between adjacent tracks and, moreover, without the occurrence of beat disturbance, and of reproducing the signal thus recorded.

In a conventional video signal recording and reproducing system, in general, when the reproducing head reproduces simultaneously video signals recorded on mutually adjacent video tracks as a consequence of tracking error at the time of reproducing, beat disturbances arise in the reproduced picture. Accordingly, in order to prevent this generation of beat disturbances, video tracks on a recording medium have heretofore been formed by leaving unrecorded parts called "guard bands" between mutually adjacent video tracks.

While the above mentioned generation of beat disturbances decrease with the increasing width of the guard bands, the utilization efficiency of the recording medium conversely becomes poor. Therefore, from the standpoint of improving the utilization efficiency of a recording medium, it is desirable that the guard bands should be very narrow or non-existent.

Accordingly, a system, wherein recording and reproducing are carried out with heads each having an obliquely directed gap so as to make possible reproducing in a manner to prevent the occurrence of beat disturbance even without guard bands, has previously been proposed. In this system, two heads respectively provided with gaps having azimuths which are oppositely inclined with respect to

the direction perpendicular to the scanning direction of the heads, for example, are used to record alternately a video signal on a recording medium with contiguous tracks without guard bands. In the reproducing system, a track which has been recorded by a head having the same azimuth as a reproducing head is reproduced without loss. However, since the contiguous track has been recorded by a head of an azimuth of opposite direction, the reproducing loss is very great. As a result, almost no beat disturbance occurs from the contiguous track.

On one hand, as a system capable of recording and reproducing color video signals with a relative narrow frequency band, a system wherein a color video signal is separated into a luminance signal and a carrier chrominance signal has been proposed. In the proposed system, the luminance signal is frequency modulated, and the carrier chrominance signal is frequency converted to a band lower than the frequency band of the frequency-modulated luminance signal. The resulting frequency-modulated luminance signal and frequency-converted carrier chrominance signal are multiplexed and recorded.

When this proposed system is applied to the aforescribed recording system with azimuth heads, a frequency-modulated luminance signal in a high frequency band can be reproduced without the occurrence of beat disturbance. However, with regard to a frequency-converted chrominance signal in a low frequency band, the reproducing loss due to azimuth is small, and, for this reason, there is the problem of small effect of preventing the generation of beat disturbance due to reproduction of contiguous tracks.

Accordingly, it is a general object of the present invention to provide a novel and useful color video signal recording and/or reproducing system in which the above described problems have been solved.

The present invention provides a color video signal recording system comprising first separation means for separating a luminance

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signal from an input color video signal, means for frequency modulating the luminance signal thus separated and producing as output a frequency-modulated luminance signal, second separation means for separating a carrier chrominance signal from said input color video signal, first signal processing means for frequency converting the carrier chrominance signal thus separated to a band lower than the band of said frequency-modulated luminance signal and also subjecting the carrier chrominance signal to signal processing to cause the phase thereof to advance successively by 90° every horizontal scanning period during a specific period and to cause the phase thereof to be lagged successively by 90° every horizontal scanning period during a successive specific period, and recording means for multiplexing said frequency-modulated luminance signal and said carrier chrominance signal thus signal processed and recording the resulting multiplexed signal successively on a plurality of tracks mutually disposed in parallel on a recording medium, said recording means recording in a manner such that a carrier chrominance signal of a phase advancing successively by 90° and a carrier chrominance signal of a phase lagged successively by 90° are in side-by-side disposition on mutual adjacent tracks. The present invention provides also a color video signal reproducing system for reproducing a signal recorded by the above described recording system and comprising means for reproducing said signal recorded on said recording medium, third separation means for separating the frequency-modulated luminance signal from the signal thus reproduced, means for demodulating said frequency-modulated luminance signal thus separated, fourth separation means for separating the signal processed carrier chrominance signal from said reproduced signal, second signal processing means for carrying out signal processing to restore said signal processed carrier chrominance signal thus separated into the original frequency band by frequency conversion and also to subject the same to phase shifting processing successively by 90° every horizontal scanning period thereby to restore the same to the original carrier chrominance signal not having phase shift successively by 90° , means for delaying by one horizontal scanning period the output signal of said second signal processing means, means for mixing the output signal of said second signal processing means and the output signal of said delay means, and means for mixing the demodulated luminance signal and the output carrier chrominance signal of said mixing means thereby to produce a reproduced color video signal.

Another and more specific object of the invention is to provide a system capable of recording and reproducing a color video signal without generation of beat disturbance on

tracks in mutually contiguous relationship without guard bands therebetween and, moreover, with a relatively narrow frequency band. In the system according to the invention, generation of beat disturbance is prevented with respect also to particularly frequency-converted carrier chrominance signals in spite of recording and reproducing, with the use of heads having azimuths, of the color video signal as a multiplexed signal of the frequency-modulated luminance signal and the frequency-converted carrier chrominance signal.

Still another object of the invention is to provide a system wherein a color video signal is recorded by advancing by 90° the phase of the signal for each horizontal scanning period with respect to one track and lagging by 90° degrees the phase of the signal for each horizontal scanning period with respect to the adjacent track, and the signal thus recorded is reproduced. By this phase relationship in the system according to the invention, crosstalk components between mutually adjacent tracks are cancelled, and beat disturbance does not occur.

A further object of the invention is to provide a system capable of recording and reproducing not only NTSC system color video signals but also PAL system color video signals on closely disposed adjacent tracks without occurrence of beat disturbance.

Other objects and further features of the present invention will be apparent from the following detailed description with respect to preferred embodiments of the invention when read in conjunction with the accompanying drawings, in which:—

Fig. 1 is a block schematic diagram of the recording system of a first embodiment of a color video signal recording and reproducing system according to the present invention;

Fig. 2 is a fragmentary track pattern diagram of one part of a recording medium for a description of a state of recording by the recording system shown in Fig. 1;

Fig. 3 is a block schematic diagram of the reproducing system in the first embodiment of the system of the invention;

Fig. 4 is a block schematic diagram in concrete form showing the essential parts of a second embodiment of the system of the invention;

Fig. 5 is a block schematic diagram showing another embodiment of the essential parts of the system illustrated in Fig. 4;

Fig. 6 is a block schematic diagram of the recording system of a third embodiment of a color video signal recording and reproducing system of the invention;

Fig. 7 is a block schematic diagram of the reproducing system of the third embodiment of the system of the invention; and

Fig. 8 is a diagram for explaining that the moire is caused to be inconspicuous.

One embodiment of a color video signal

recording system according to the invention will first be described with reference to Fig. 1.

An NTSC system color video signal applied to an input terminal 10 of this system is supplied to, for example, a low-pass filter 11 having an upper limit filtering frequency of 3 MHz, a band-pass filter 15 having a filtering band of 3.1 to 4.1 MHz, and a horizontal synchronizing signal separation circuit 17. A luminance signal which has thus passed through the low-pass filter 11 is frequency modulated by a frequency modulator 12. The resulting output frequency-modulated signal, which has a frequency deviation of a band of 3.5 to 4.5 MHz, is sent to a high-pass filter 13 of a lower limit filtering frequency of 1.2 MHz, where the unwanted component of this signal is removed, and is thereafter supplied to a mixer 14.

On the other hand, a carrier chrominance signal which has passed through the band-pass filter 15 is fed to a frequency converter 16, where it is frequency converted by a signal from a frequency converter 20 described hereinafter to a band lower than the band of the above mentioned frequency-modulated luminance signal.

A horizontal synchronizing signal which has been separated by the above mentioned horizontal synchronizing signal separation circuit 17 is frequency multiplied $m/2$ times (where m is an integer) by a frequency multiplier 18. The signal thus multiplied is frequency converted in the frequency converter 20 with a signal from a reference oscillator 19, and the resulting output signal is supplied to the above mentioned frequency converter 16.

Hereinafter, the frequency of the color sub-carrier of the carrier chrominance signal which has passed through the band-pass filter 15 is denoted by f_c (3.579545 MHz in the case of a color video signal of the NTSC system); the frequency of the color sub-carrier of the carrier chrominance signal frequency converted in the frequency converter 16 by f_s ; and the horizontal scanning frequency by f_H (15.734264 KHz in the case of the NTSC system). Here, frequency conversion is carried out in the frequency converter 16 in a manner such that the frequency f_s of the colour sub-carrier which is thus frequency converted assumes the value given by the following equation.

$$f_s = \frac{1}{2} f_H \cdot m \quad (1)$$

In the instant embodiment, $m=88$; that is, the multiplying number of the frequency multiplier 18 is selected at 44, and f_s is selected at 692.308 KHz. Furthermore, the oscillation frequency of the reference oscillator 19 is f_c . In this connection, when m is selected to be

an even number, as in the instant embodiment, the multiplying number of the frequency multiplier 18 becomes an integer, and the organization of the frequency multiplier 18 can be made simple.

The output carrier chrominance signal of the frequency converter 16 is supplied to a phase shifter 22 of a phase shifting circuit 21. In order to facilitate understanding of the principle of operation of the phase shifting circuit 21, it is represented for convenience in Fig. 1 as an organization comprising the phase shifter 22 and a switcher 23. The phase shifter 22 operates to phase shift the input signal by 0° , 90° , 180° , and 270° respectively and to output the resulting signals at fixed contact points a1, a2, a3, and a4. In the switcher 23, the rotatable contact thereof rotates to be switched successively to the fixed contact points by each horizontal scanning period, and, furthermore, its rotational direction is reversed as indicated by arrow X and Y alternately during each field period. As a consequence, from the phase shifting circuit 21, a signal whose phase advances successively by 90° for each horizontal scanning period during a certain field period is derived, while, in the succeeding field period, a signal whose phase is lagged successively by 90° in each horizontal period is derived.

The horizontal synchronizing signal from the horizontal synchronizing signal separation circuit 17 is supplied to a switcher control circuit 31. Furthermore, a signal derived for every vertical scanning period (every field period) from a detector 30 in synchronism with the rotation of a rotating structure 28 described hereinafter is supplied to the switcher control circuit 31. The movable contact of the switcher 23 of the phase shifting circuit 21 is controlled in the above described switching operation by the output signal of the switcher control circuit 31.

The resulting output signal of the phase shifting circuit 21 is sent through a low-pass filter 24, where its unwanted component is removed, and is thereafter supplied to the aforementioned mixer 14, where it is multiplexed with the aforementioned frequency-modulated luminance signal. The resulting multiplexed signal is amplified in a recording amplifier 25 and then supplied to rotating heads 26a and 26b thereby to be alternately recorded for every field on a traveling recording tape 27.

The rotating heads 26a and 26b are mounted on the above mentioned rotating structure 28 at diametrically opposite positions thereon, the rotating structure being driven in rotation by a motor 29. The rotating heads 26a and 26b have azimuth gaps inclined in mutually opposite directions by 6 degrees of angle, for example, from the direction perpendicular to the scanning direction of the heads as indicated in Fig. 2. As

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also indicated in Fig. 2, a track 35a is formed over one field period by the head 26a, and a track 35b is formed over the succeeding one field period by the head 26b in close contact with the track 35a. Thereafter, in the same manner, tracks 35c, 35d, are successively formed alternately by the heads 26a and 26b.

In the case where, for example, a signal produced while the movable contact of the switcher 23 is rotating in the arrow direction X is recorded by the head 26a, and a signal produced while the movable contact is rotating in the arrow direction Y is recorded by the head 26b, a signal whose phase is advanced successively by 90° every horizontal scanning period as indicated at A0, A1, A2, in Fig. 2 is recorded on the track 35a, while, on track 35b, a signal whose phase is lagged successively by 90° every horizontal scanning period as indicated at B0, B1, B2, is recorded.

Then, when the relationship wherein the phase of the signal of the n th horizontal scanning period is advanced by 90° relative to the phase of the signal of the $(n-1)$ th horizontal scanning period is represented by $A_n = A_{n-1} \angle 90^\circ$; the relationship wherein the phase of the signal of the n th horizontal scanning period is lagged by 90° relative to the phase of the $(n-1)$ th horizontal scanning period is represented by $B_n = B_{n-1} \angle -90^\circ$; and, further, the line correlation wherein the signal informations of mutually adjacent horizontal scanning periods are mutually closely alike are considered, the following representation is obtained.

$$\begin{aligned} A_1 &\doteq A_0 \angle 90^\circ, & B_1 &\doteq B_0 \angle -90^\circ \\ A_2 &\doteq A_1 \angle 90^\circ, & B_2 &\doteq B_1 \angle -90^\circ \\ A_3 &\doteq A_2 \angle 90^\circ, & B_3 &\doteq B_2 \angle -90^\circ \end{aligned}$$

$$\begin{aligned} &: & : \\ &: & : \\ &: & : \\ A_n &\doteq A_{n-1} \angle 90^\circ, & B_n &\doteq B_{n-1} \angle -90^\circ \\ &: & : \\ &: & : \end{aligned}$$

In magnetic recording and reproducing, in general, symmetrical distortion is produced, and cross modulation takes place between the frequency-modulated luminance signal and the frequency converted carrier chrominance signal, whereby moiré occurs. Within this moiré component, the largest frequency component is the frequency component $2f_s$ which is twice the color sub-carrier frequency f_s of the frequency converted carrier chrominance signal. Moreover, since this frequency component is a constant frequency, it is conspicuous.

Then, since the phases mutually differ by 90° for every pair of adjacent horizontal scanning periods on one and the same track, the phase of the color sub-carrier frequency f_s of a first horizontal scanning period and the

phase of the moiré frequency component $2f_s$ of a horizontal scanning period adjacent to the first horizontal scanning period differ by twice 90°, that is, 180°. For this reason, these phases have a phase inverted relationship. Consequently, the moiré components are substantially mutually nullified between the signals of mutually adjacent horizontal scanning periods. Therefore, the generation of moiré is effectively prevented in the system of the present invention.

In the system of the present invention, since f_s is selected to be equal to

$$\frac{1}{2} f_H \cdot m,$$

this relationship may be rewritten as $2f_s = f_H \cdot m$, and, with respect to the moiré frequency component, the crests or valleys of the signal become aligned in the vertical direction for every horizontal scanning line as indicated by solid-line circles with respect to horizontal scanning lines $h_1, h_3, h_5, \dots$ and by broken-line circles with respect to horizontal scanning lines $h_2, h_4, \dots$ in Fig. 8. However, as described above, the phase is staggered successively by 90°. Every horizontal scanning period, and, for this reason, the positions of the crests or valleys of the signal are staggered as indicated by solid-line circles with respect to the horizontal scanning lines $h_2, h_4, \dots$. Therefore, as a resultant effect, the moiré frequency component becomes visually inconspicuous.

Next, an embodiment of a system according to the invention for reproducing a signal recorded in the above described manner on a recording tape will be described with reference to Fig. 3.

In this system, the signals recorded on the tracks on the tape 27 are alternately reproduced by the rotating heads 26a and 26b. For this operation, these rotating heads are so controlled that the head 26a scans the tracks 35a, 35c,, while the head 26b scans the tracks 35b, 35d, This control is carried out, as is known, by reproducing one control pulse recorded on the edge of the tape 27 for each revolution of the rotating structure 28.

The signals thus reproduced by the rotating heads 26a and 26b are mixed and amplified by a reproducing amplifier 40 and thereafter supplied to a highpass filter 42 of a lower-limit filtering frequency of 1.2 MHz and to a low-pass filter 47 of an upper-limit filtering frequency of 1.2 MHz. The frequency-modulated luminance signal which has passed through the high-pass filter 42 is passed through a limiter 43 and then supplied to a demodulator 44, where it is demodulated. The luminance signal thus demodulated is sent through a low-pass filter

45, where its unwanted component is removed, and thereafter is supplied to a mixer 46.

On the other hand, the carrier chrominance signal which has passed through the low-pass filter 47 is supplied to a frequency converter 48, where it is frequency converted by a frequency signal from an automatic phase compensation (APC) circuit 49, thereby being restored to its original frequency band.

Here, the color sub-carrier frequency f_s of the frequency converted carrier chrominance signal supplied to the frequency converter 48 is frequency converted by a frequency f_A from the APC circuit 49. The color sub-carrier frequency f_s is thereby restored to the original color sub-carrier frequency f_c by deriving the signal of difference frequency $(f_A - f_s)$. It is to be noted that since the above described frequency conversion is carried out by taking a difference frequency, the carrier chrominance signal is phase inverted in the frequency converter 48, consequently, the signals obtained by reproducing the signals of the tracks 35a, 35c, ... which have been recorded with phases successively advanced by 90° for every horizontal scanning period become signals of phases successively lagged by 90° by undergoing the above described frequency conversion. Similarly, the signals obtained by reproducing the signals of the tracks 35b, 35d, ... which have been recorded with phases successively lagged by 90° every horizontal scanning period are rendered into signals of phases successively advanced by 90° by the above described frequency conversion.

The output carrier chrominance signal of the frequency converter 48 is supplied to a phase shifter 51 of a phase shifting circuit 50. This phase shifting circuit 50 has the same circuit organization as the aforementioned phase shifting circuit 21 and comprises the phase shifter 51 which is the same as the phase shifter 22 and a switcher 52 which is the same as the switcher 23. The switcher 52 has a movable contact for carrying out rotational switching controlled by the output of a switcher control circuit 41, which is supplied with a detection output signal from the rotation detector 30 and with the output of a horizontal synchronizing signal separation circuit 56 for separating a horizontal synchronizing signal from the output reproduced color video signal of the mixer 46.

In an actual circuit, as will be described

hereinafter with reference to Fig. 4, the phase shifting circuit 21 of the recording system and the phase shifting circuit 50 of the reproducing system are substituted by a single phase shifting circuit for undertaking the operations of the two circuits 22 and 51.

The movable contact of the switcher 52 rotates in the arrow direction X, as indicated in Fig. 3, with respect to the signals reproduced from the recording tracks 35a, 35c, ... and having phases successively lagged by 90° by frequency conversion and thereby causes the phases to advance successively by 90° thereby to be restored to their normal state. Similarly, the movable contact of the switcher 52 rotates in the arrow direction Y with respect to signals reproduced from the recording tracks 35b, 35d, ... and having phases successively advanced by 90° by frequency conversion and thereby causes the phases to be lagged successively by 90° thereby to be restored to their normal state.

The carrier chrominance signal whose phase has been thus restored to normal state by the phase shifting circuit 50 is supplied to a mixer 53 and to a one-horizontal-scanning-period (abbreviated 1H) delay line 54. The signal thus delayed by one horizontal scanning period by the 1H delay line 54 is supplied to the mixer 53, where it is mixed with the signal supplied directly from the phase shifting circuit 50. The output carrier chrominance signal of the mixer 53 is supplied, on one hand, to the aforementioned mixer 46 to be mixed with the luminance signal, and the resulting signal is led out as a reproduced color video signal through an output terminal 55. On the other hand, the output carrier chrominance signal of the mixer 53 is supplied to the aforementioned APC circuit 49, which extracts from this carrier chrominance signal a color burst signal and produces as output a signal synchronized with the phase of the color burst signal, this output signal being supplied to the frequency converter 48.

Here, when the head 26a reproduces a signal A3 from the track 35a, for example, a

signal $\overline{A3} \angle 90^\circ$ (where A3 indicates that the signal has been phase inverted by the above mentioned frequency conversion) is produced as output from the phase shifting circuit 50. Here,

$$\overline{A3} \angle 90^\circ \doteq \overline{A2} \angle 90^\circ \angle 90^\circ = A2 \angle -90^\circ \angle 90^\circ = A2.$$

Accordingly, when the head reproduces a signal A_n , a signal $\overline{A_n} \angle 90^\circ = A_{n-1}$ is produced as output from the phase shifting circuit 50. Then, since there is line correlation, the information contents A'_n and A'_{n-1} of

the signals A_n and A_{n-1} have the relationship $A'_n \doteq A'_{n-1}$. On the other hand, in the case where the head 26a is reproducing the signal A_n , a signal A_{n-2} is similarly produced as output from the 1H delay line. As a consequence, from the mixer 53, in this case,

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a signal $(A_n - 1 + A_n - 2)$ is led out, and, in terms of information content, a signal

$$A'_n + A'_{n-1} \div 2A'_n$$

is obtained.

Then, in the case where there is tracking error of the heads, and the head 26a reproduces the track 35b also together with the track 35a, there arises the problem of crosstalk, which will now be described.

It will be assumed, for example, that the head 26a has reproduced simultaneously the

signal B1 of the track 35b also together with the signal A3 of the track 35a. In this case with respect to the signal of the track 35a, a signal $(A_2 + A_1)$, that is, $2A'_3$ in terms of information content, is obtained from the mixer 53 similarly as described above. On the other hand, the phase shifting circuit 50 carries out a similar signal processing with respect to also the signal B1 reproduced at the same

time. For this reason, a signal $B1 \angle 90^\circ$ is obtained from the phase shifting circuit 50.

Then

$$\overline{B1 \angle 90^\circ} = \overline{Bo \angle -90^\circ \angle 90^\circ} = \overline{Bo \angle 90^\circ \angle 90^\circ} = \overline{Bo \angle 180^\circ} = \overline{Bo \angle -180^\circ}$$

Consequently, a signal $Bo \angle -180^\circ$ and a signal Bo are respectively supplied, from the phase shifting circuit 50 and the 1H delay line 54, to the mixer 53. Then,

$$Bo \angle -180^\circ + Bo = 0.$$

Thus, the reproduced signals of the track 35b are mutually nullified in the mixer 53, and the resulting output becomes zero. Therefore, the crosstalk components from adjacent tracks are removed and do not appear in any manner in the resulting output.

In the case where the head 26a reproduces simultaneously the track 35a or 35c while reproducing the track 35b, also, the crosstalk components are similarly removed in an effective manner.

A specific block organization in concrete form of an essential part of a second embodiment of the invention will now be described with reference to Fig. 4. In the instant embodiment of the invention, phase shifting and frequency conversion are carried out simultaneously, and, moreover, a phase shifting circuit and frequency converters are used commonly for both the recording system and the reproducing system.

At the time of recording mode of operation, a carrier chrominance signal separated from an input color video signal by a band-pass filter similar to the band-pass filter 15 shown in Fig. 1 is supplied through an input terminal 60 to a frequency converter 61. In this frequency converter 61, the carrier chrominance signal is frequency converted to a band lower than the frequency-modulated luminance signal by a signal from a frequency converter 62 described hereinafter. The color sub-carrier frequency f_s of the carrier chrominance signal thus frequency converted is indicated by Eq. (1) set forth hereinbefore. The output signal of the frequency converter 61 is led out through an output terminal 63 and, after passing through the low-pass filter 24 and being mixed with the frequency-modulated luminance signal, is recorded by the heads 26a and 26b on the tape 27 similarly as

in the embodiment of the invention described hereinbefore in conjunction with Fig. 1.

At the time of recording mode of operation, the movable contact of a changeover switch 64 is in contact with a fixed contact point R, and a constant voltage is being applied to a voltage-controlled oscillator (VCO) 65. Consequently, the output oscillation frequency f_c of the VCO 65 is constant, and this output is supplied to the frequency converter 62.

On one hand, a horizontal synchronizing signal from the horizontal synchronizing signal separation circuit 17 is supplied through a terminal 66 to an up-down counter 69. A signal from the detector 30 is supplied through a terminal 67 to a flip-flop circuit 68, and a rotating synchronizing signal which is changed over between high level and low level every vertical period is supplied from the flip-flop circuit 68 to the up-down counter 69. As a consequence, the up-down counter 69 counts from 0 to 3 with 2 bits, for example, alternately repeating addition (advancing) and subtraction (lagging, operations of the horizontal synchronizing signal for every vertical period. As a result, the up-down counter 69 operates to add counts one-by-one

$$(00 \rightarrow 01 \rightarrow 10 \rightarrow 11 \rightarrow 00 \rightarrow \dots)$$

every 1H in a certain one vertical period and subtract counts one-by-one

$$(00 \rightarrow 11 \rightarrow 10 \rightarrow 01 \rightarrow 00 \rightarrow \dots)$$

every 1H in the succeeding one vertical period.

Furthermore, the horizontal synchronizing signal introduced through the terminal 66 is supplied to a phase comparator 70, where it is subjected to phase comparison with a signal from a count-down circuit 72. The resulting output error signal of this phase comparator 70 is supplied to a VCO 71 having an oscillation center frequency $4f_s$ to control the output oscillation frequency thereof. The resulting output of this VCO 71 is supplied to

the count-down circuit 72, where its frequency is stepped down $1/176$, for example, to be rendered into the same frequency as the horizontal scanning frequency f_H , and is thereafter supplied to the above mentioned phase comparator 70.

Simultaneously, the output of an oscillation frequency $176 f_H$ of the VCO 71 is supplied to a phase shifter 73, where it is subjected to count down and phase shift and thereby rendered into four kinds of signals of the frequency f_s with phases mutually differing by 90° . These four signals having phase differences 0° , 90° , 180° , and 270° are supplied to a gate circuit 74. This gate circuit 74 is supplied with the output of a decoder 75 which operates in response to the output of the above mentioned up-down counter 69 to activate only one line. The gate circuit 74 operates accordingly to gate successively the four kinds of outputs of the phase shifter 73 every $1H$ period and to supply the same to the frequency converter 62. As a consequence, the frequency converter 62 operates to supply to the above mentioned frequency converter 61 an output of a frequency $(f_c + 44 f_H)$ and of a phase successively shifting by 90° every $1H$ with, moreover, an inversion of phase shifting direction every vertical period.

Accordingly, the carrier chrominance signal of a color sub-carrier frequency f_c introduced through the terminal 60 is frequency converted to a color sub-carrier frequency $f_s (= 44 f_H)$ in the frequency converter 61 and, at the same time, is rendered into a signal of a phase which is successively shifted every $1H$ with, moreover, a phase shifting direction (i.e., advancing phase direction, lagging phase direction) which is alternately changed over every vertical period. As a result, an output signal which is the same as the output of the aforescribed phase shifting circuit 21 is obtained.

Then, at the time of reproducing mode of operation, the movable contact of the switch is placed in contact with a fixed contact point P. A carrier chrominance signal separated from a reproduced signal by the low-pass filter 47 shown in Fig. 3 is supplied through the input terminal 60 to the frequency converter 61. Furthermore, a horizontal synchronizing signal from the horizontal synchronizing signal separation circuit 56 is supplied through the terminal 66 to the up-down counter 69. The output signal of the detector 30 is applied to the terminal 67 similarly as in the recording mode.

The output of the frequency converter 61 is supplied, on the one hand, directly to the mixer 53 and, on the other hand, by way of the $1H$ delay line 54 to the mixer 53 similarly as in the embodiment of the invention illustrated in Fig. 3. The reproduced carrier chrominance signal produced as output by the mixer 53 is led out through an output ter-

minal 76 and supplied to the mixer 46. Furthermore, the output signal of the mixer 53 is supplied to a phase comparator 77 of the APC circuit 49, where it undergoes phase comparison with a signal of the frequency f_c from a reference oscillator 78. The resulting output of the phase comparator 77 is supplied by way of the switch 64 to the VCO 65 to control the oscillation frequency thereof. As a result of the provision of the APC circuit 49, the phase of the color burst signal of the reproduced signal is maintained constant, and a reproduced carrier chrominance signal without a time-base fluctuation component can be obtained. At the time of reproducing mode of operation, the output from the output terminal 63 is not used.

The respective operations of the flip-flop circuit 68, the up-down counter 69, the phase comparator 70, the VCO 71, the count-down circuit 72, the phase shifter 73, the gate circuit 74, and the decoder 75 are the same as in the above described recording mode.

Operations such as that by which a normal reproduced signal is obtained from the reproduced signal of a normal track and the operation by which beat disturbance due to the reproduced signal of an adjacent track is removed are all exactly the same as those described hereinbefore with reference to Fig. 3 and will not be described again.

Another embodiment of the phase shifting circuit part illustrated in Fig. 4 will now be described with reference to Fig. 5.

A horizontal scanning frequency f_H is supplied through a terminal 80 to a monostable multivibrator 81, the resulting output signal of which is supplied to a phase comparator 82 and a $1/2$ count-down circuit 87. The resulting output of the phase comparator 82 is supplied to a VCO 83 to control the oscillation frequency thereof. The resulting oscillation output of this VCO 83 is successively counted down by $1/2$ count-down circuits 84 and 85 and a $1/40$ count-down circuit 86 and is then fed to the above mentioned phase comparator 82. In the instant embodiment, the value of m is selected at 80. The circuit forming the loop including the above mentioned phase comparator 82 through the $1/40$ count-down circuit 86 corresponds to the AFC circuit comprising the phase comparator 70, the VCO 71, and the count-down circuit 72 shown in Fig. 4.

The outputs of the count-down circuits 84, 85, and 87 are respectively supplied to address input terminals A, B, and C of an 8-line data selector 88. The data selector 88 has data input terminals D0 and D1 which are grounded (earthed), data input terminals D2 and D3 to which a voltage $+V$ is applied, data input terminals D4 and D7 to which the output of an inverter 90 is applied, and data input terminals D5 and D6 to which are applied changeover pulses which are switched between

a high level *H* and a low level *L* every vertical period, and which are supplied through a terminal 89.

5 The data selector 88 has an output terminal Q1 at which the content of the data input terminal of the address designated in conformance with binary codes applied to the address input terminals *A*, *B* and *C*, that is; whether of high level or low level, appears. The data selector 88 further has an output terminal

10 Q1 at which an output resulting from inversion of the output of the output terminal Q1 appears. The outputs of these output terminals Q1 and Q1 are passed through an OR

15 gate 91 and led out through an output terminal 92. From this output terminal 92, a signal of a phase which successively advances by 90° in one vertical period and which is successively lagged by 90° in the succeeding one vertical period is successively led out and supplied to the frequency converter 62.

While, in each of the above described embodiments of the invention, the recorded and reproduced color video signal is an NTSC system color video signal, a PAL system color video signal can also be recorded and reproduced by the system of the present invention, as described now with respect to an embodiment thereof. Fig. 6 is a block schematic diagram of a PAL system color video signal recording and reproducing system. In Fig. 6, parts which are the same as corresponding parts in the block systems shown in Figs. 1 and 4 are designated by like reference numerals and characters with subscript *A*, and description of such parts will not be repeated. In a PAL system color video signal, the color sub-carrier frequency is 4.43 MHz, the horizontal scanning frequency is 15.63 KHz, the vertical synchronizing frequency is 50 Hz, and so forth. The frequency relationships of parts for which the above explanation is omitted are, of course, appropriately selected in conformance with the various frequency relations of a PAL system color video signal. For example, the center frequency of the filtering band of the band-pass filter 15A is 4.43 MHz; the output signal frequency of the gate circuit 74A is 688 KHz; the output signal frequency of the horizontal synchronizing signal separation circuit 17A is 15.63 KHz; and the output signal frequency of the flip-flop circuit 68A is 25 Hz.

55 A carrier chrominance signal separated from a PAL system color video signal at the band-pass filter 15A is supplied to a frequency converter 61A and a phase comparator 100. The output of the phase comparator 100 is sent, on the one hand, through a filter 101, where its fluctuation component for every 1H period is removed, and is thereafter supplied to a crystal VCO 102 having an oscillation center frequency of 4.43 MHz to control the oscillation

frequency thereof. The output of the VCO 102 is supplied as a phase comparison signal to the phase comparator 100 and, in addition, is supplied to a balanced modulator 103.

The balanced modulator 103 produces as outputs the frequencies of the sum and difference of the output signals of the gate circuit 74A and the VCO 102. The output sum frequency 5.12 MHz (upper side-band) of this balanced modulator 103 passes through a band-pass filter 105, while the output difference frequency 3.74 MHz (lower side-band) thereof passes through a band-pass filter 106, after which these sum and difference frequencies are respectively supplied to an electronic switcher 107.

On the other hand, the horizontal synchronizing signal from the horizontal synchronizing signal separation circuit 17A is supplied to a flip-flop circuit 104, from which an output which is inverted every 1H period is supplied to the above mentioned electronic switcher 107. The flip-flop circuit 104 is supplied also with the output signal of the phase comparator 100 and is thereby reset. The inverting polarity of the output signal of the flip-flop circuit 104 is caused to always coincide with the inverting polarity of the V-axis of the input PAL system color video signal.

The electronic switcher 107 operates in response to the output of the flip-flop circuit 104 to carry out switching thereby to permit the outputs of the band-pass filters 105 and 106 to pass alternately every 1H period and thus be supplied to the frequency converter 61A. The carrier chrominance signal of a color sub-carrier frequency of 4.43 MHz supplied to the frequency converter 61A is frequency converted by signals of frequencies of 5.12 MHz and 3.74 MHz supplied alternately every 1H period and is delivered as output as a carrier chrominance signal constantly of a color sub-carrier frequency of 688 KHz. In the above described frequency conversion operation, the relationship of taking the difference between the carrier chrominance signal and a signal for frequency conversion is inverted every other 1H period, and, therefore, the carrier chrominance signal is inverted every other 1H period.

In the carrier chrominance signal of a PAL system color video signal, the V-axis direction component undergoes inversion symmetrically with respect to its U-axis every 1H period. Accordingly, as a result of a carrier chrominance signal of the PAL system of this character being frequency converted in the frequency converter 61A, the V-axis direction component thereof is constantly directed in one direction and is converted into an artificial NTSC system signal. By being thus frequency converted by the frequency converter 61A, this signal is simultaneously rendered into a signal

which undergoes phase shifting successively by 90° every 1H and, moreover, undergoes inversion of phase shifting direction alternately every vertical period, similarly as in each of the foregoing embodiments of the invention. Furthermore, the color sub-carrier frequency f_s of the carrier chrominance signal thus frequency converted is

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times (44 times in the instant embodiment) the horizontal scanning frequency f_H and, moreover, is being phase shifted by 90° every 1H. For this reason, moiré is effectively prevented, similarly as in each of the preceding embodiments of the invention.

The output carrier chrominance signal of the frequency converter 61A is multiplexed with the frequency-modulated luminance signal, and the resulting multiplexed signal is recorded with a track pattern as shown in Fig. 2. This recording operation is the same as that of the embodiment of the invention illustrated in Fig. 1.

Next, an embodiment of a reproducing system for reproducing the signal recorded in the above described manner will be described with reference to Fig. 7. In Fig. 7, parts which correspond to parts in the block systems illustrated in Figs. 3 and 4 are designated by like reference numerals with the addition of the subscript A. Such parts will not be described again.

A carrier chrominance signal which has been separated from a reproduced multiplexed signal in the low-pass filter 47A and frequency converted to a lower frequency band is supplied to the frequency converter 61A. In this frequency converter 61A, the carrier chrominance signal is frequency converted by a signal from a band-pass filter 110 described hereinafter into the original band and is then supplied to the mixer 53A and the 1H delay line 54A. The mixer 53A performs an addition in informations, but since the carrier phase of the signal passing through the 1H delay line 54A is of exactly opposite phase, this mixer 53A is constituted by a subtraction circuit.

The output signal of this mixer 53A is supplied to the phase comparator 77A. The output signal of 4.43 MHz of the crystal reference oscillator 78A is phase shifted 45° in a phase shifter 112 and is then supplied to the phase comparator 77A. The above mentioned phase shifter 112 is used since the vector of the burst signal in a PAL system color video signal has an angle of 45° relative to the U-axis. The output of the phase comparator 77A controls the oscillation frequency of the VCO 65A, and the output oscillation frequency 4.43 MHz thereof is supplied to a balanced modulator 111.

This balanced modulator 111 produces as output a sum frequency of 5.12 MHz and a difference frequency of 3.74 MHz of a frequency 688 KHz from the gate circuit 74A and a frequency 4.43 MHz from the VCO 65A. Of these, the frequency of 5.12 MHz is passed through the above mentioned band-pass filter 110 and is supplied to the frequency converter 61A. Here, since the output signal of the balanced modulator 111 is a signal which is phase shifted successively by 90° every 1H period and, moreover, is changed over alternately in phase shifting direction every vertical period, the carrier chrominance signal is restored to a signal without 90° phase shift simultaneously with its frequency conversion by the frequency converter 61A, similarly as in the cases of the preceding embodiments of the invention illustrated in Figs. 3 and 4. Furthermore, as a result of the mixing in the mixer 53A of the output signal of the frequency converter 61A and this signal delayed by 1H period, beat disturbance is effectively eliminated, similarly as in each of the preceding embodiments of the invention.

The output signal of the mixer 53A is supplied to a frequency converter 113 and to an electronic switcher 115. On one hand, the output of the reference oscillator 78A is doubled in a multiplier circuit 114 and is supplied as a signal of 8.86 MHz to the frequency converter 113. As a result of the output carrier chrominance signal of the mixer 53A being frequency converted by the frequency converter 113, a signal of a frequency which is the same 4.43 MHz and of a phase which has been inverted, that is, has a V-axis component which has been inverted, is led out and supplied to the electronic switcher 115.

On the other hand, the horizontal synchronizing signal from the horizontal synchronizing signal separation circuit 56A is supplied to a flip-flop circuit 116, from which an output which is alternately inverted every 1H period is led out to control the switching operation of the electronic switcher 115. The electronic switcher 115 thereby operates to pass alternately every 1H period the output signal of the mixer 53A and the output signal of the frequency converter 113. As a result, from the electronic switcher 115, a carrier chrominance signal wherein the V-axis direction component is inverted every 1H period, that is, one which has been restored to that of the PAL system, is obtained. This output carrier chrominance signal is mixed in the mixer 46A with the demodulated luminance signal, and a reproduced PAL system color video signal is led out through the output terminal 55A.

In accordance with the color video signal recording and reproducing system according to the invention, an NTSC system color video signal which has been recorded on a recording

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tape can be reproduced as a PAL system color video signal, and, furthermore, a PAL system color video signal which has been recorded can be reproduced as an NTSC system color video signal.

Further, this invention is not limited to these embodiments but various variations and modifications may be made without departing from the scope of the invention.

WHAT WE CLAIM IS:—

1. A color video signal recording system comprising:

first separation means for separating a luminance signal from an input color video signal;

means for frequency modulating the luminance signal thus separated and producing as output a frequency-modulated luminance signal;

second separation means for separating a carrier chrominance signal from said input color video signal;

first signal processing means for frequency converting the carrier chrominance signal thus separated to a band lower than the band of said frequency-modulated luminance signal and also subjecting the carrier chrominance signal to signal processing to cause the phase thereof to advance successively by 90° every horizontal scanning period during a specific period and to cause the phase thereof to be lagged successively by 90° every horizontal scanning period during a successive specific period; and

recording means for multiplexing said frequency-modulated luminance signal and said carrier chrominance signal thus signal processed and recording the resulting multiplexed signal successively on a plurality of tracks mutually disposed in parallel on a recording medium,

said recording means recording in a manner such that a carrier chrominance signal of a phase advancing successively by 90° and a carrier chrominance signal of a phase lagged successively by 90° are in side-by-side disposition on mutual adjacent tracks.

2. A color video signal recording system as claimed in claim 1 in which said first signal processing means carries out signal processing in a manner such that said phase advancement and phase lag are interchanged every vertical period, and said recording means records signals each of one field in each track.

3. A color video signal recording system as claimed in claim 1 in which said first signal processing means comprises: means for carrying out said frequency conversion of said separated carrier chrominance signal; and phase shifting means for carrying out said phase advancement successively by 90° and said phase lag successively by 90° with respect

to said frequency-converted carrier chrominance signal alternately every specific period.

4. A color video signal recording system as claimed in claim 1 in which said first signal processing means comprises: means for forming a signal for frequency conversion which carries out alternately said advancement successively by 90° and said lag successively by 90° every said specific period; and means for frequency converting said separated carrier chrominance signal by means of said signal for frequency conversion.

5. A color video signal recording system as claimed in claim 4 in which said input color video signal is an NTSC system color video signal, and said means for forming a signal for frequency conversion forms a signal for frequency conversion of a single constant frequency.

6. A color video signal recording system as claimed in claim 1 in which said input color video signal is a PAL system color video signal in which the V-axis direction component is inverted relative to the U-axis every horizontal scanning period, and said first signal processing means carries out signal processing in a manner to cause said V-axis direction component to be inverted relative to the U-axis every other horizontal scanning period and to cause the V-axis direction components to be aligned in one direction in every horizontal scanning period.

7. A color video signal recording system as claimed in claim 6 in which said first signal processing means comprises: means for forming a signal for frequency conversion which carries out alternately said advancement successively by 90° and said lag successively by 90° every vertical period, and which, moreover, has a frequency changed over every horizontal scanning period at a frequency ($f'c + f's$) and a frequency ($f'c - f's$) (where $f'c$ is a colour sub-carrier frequency of said filtered carrier chrominance signal, and $f's$ is a color sub-carrier frequency of said carrier chrominance signal which has been frequency converted); and first frequency conversion means for frequency converting said separated carrier chrominance signal of the color sub-carrier frequency $f'c$ into a carrier chrominance signal of a color sub-carrier frequency $f's$.

8. A color video signal reproducing system for reproducing a signal recorded by the recording system as claimed in claim 1, said reproducing system comprising:

means for reproducing said signal recorded on said recording medium;

third separation means for separating the frequency-modulated luminance signal from the signal thus reproduced;

means for demodulating said frequency-modulated luminance signal thus separated;

fourth separation means for separating the



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tape can be reproduced as a PAL system color video signal, and, furthermore, a PAL system color video signal which has been recorded can be reproduced as an NTSC system color video signal.

Further, this invention is not limited to these embodiments but various variations and modifications may be made without departing from the scope of the invention.

WHAT WE CLAIM IS:—

1. A color video signal recording system comprising:

first separation means for separating a luminance signal from an input color video signal;

means for frequency modulating the luminance signal thus separated and producing as output a frequency-modulated luminance signal;

second separation means for separating a carrier chrominance signal from said input color video signal;

first signal processing means for frequency converting the carrier chrominance signal thus separated to a band lower than the band of said frequency-modulated luminance signal and also subjecting the carrier chrominance signal to signal processing to cause the phase thereof to advance successively by 90° every horizontal scanning period during a specific period and to cause the phase thereof to be lagged successively by 90° every horizontal scanning period during a successive specific period; and

recording means for multiplexing said frequency-modulated luminance signal and said carrier chrominance signal thus signal processed and recording the resulting multiplexed signal successively on a plurality of tracks mutually disposed in parallel on a recording medium,

said recording means recording in a manner such that a carrier chrominance signal of a phase advancing successively by 90° and a carrier chrominance signal of a phase lagged successively by 90° are in side-by-side disposition on mutual adjacent tracks.

2. A color video signal recording system as claimed in claim 1 in which said first signal processing means carries out signal processing in a manner such that said phase advancement and phase lag are interchanged every vertical period, and said recording means records signals each of one field in each track.

3. A color video signal recording system as claimed in claim 1 in which said first signal processing means comprises: means for carrying out said frequency conversion of said separated carrier chrominance signal; and phase shifting means for carrying out said phase advancement successively by 90° and said phase lag successively by 90° with respect

to said frequency-converted carrier chrominance signal alternately every specific period.

4. A color video signal recording system as claimed in claim 1 in which said first signal processing means comprises: means for forming a signal for frequency conversion which carries out alternately said advancement successively by 90° and said lag successively by 90° every said specific period; and means for frequency converting said separated carrier chrominance signal by means of said signal for frequency conversion.

5. A color video signal recording system as claimed in claim 4 in which said input color video signal is an NTSC system color video signal, and said means for forming a signal for frequency conversion forms a signal for frequency conversion of a single constant frequency.

6. A color video signal recording system as claimed in claim 1 in which said input color video signal is a PAL system color video signal in which the V-axis direction component is inverted relative to the U-axis every horizontal scanning period, and said first signal processing means carries out signal processing in a manner to cause said V-axis direction component to be inverted relative to the U-axis every other horizontal scanning period and to cause the V-axis direction components to be aligned in one direction in every horizontal scanning period.

7. A color video signal recording system as claimed in claim 6 in which said first signal processing means comprises: means for forming a signal for frequency conversion which carries out alternately said advancement successively by 90° and said lag successively by 90° every vertical period, and which, moreover, has a frequency changed over every horizontal scanning period at a frequency ($f'c+f's$) and a frequency ($f'c-f's$) (where $f'c$ is a colour sub-carrier frequency of said filtered carrier chrominance signal, and $f's$ is a color sub-carrier frequency of said carrier chrominance signal which has been frequency converted); and first frequency conversion means for frequency converting said separated carrier chrominance signal of the color sub-carrier frequency $f'c$ into a carrier chrominance signal of a color sub-carrier frequency $f's$.

8. A color video signal reproducing system for reproducing a signal recorded by the recording system as claimed in claim 1, said reproducing system comprising:

means for reproducing said signal recorded on said recording medium;

third separation means for separating the frequency-modulated luminance signal from the signal thus reproduced;

means for demodulating said frequency-modulated luminance signal thus separated;

fourth separation means for separating the



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signal processed carrier chrominance signal from said reproduced signal;

second signal processing means for carrying out signal processing to restore said signal processed carrier chrominance signal thus separated into the original frequency band by frequency conversion and also to subject the same to phase shifting processing successively by 90° every horizontal scanning period thereby to restore the same to the original carrier chrominance signal not having phase shift successively by 90°;

means for delaying by one horizontal scanning period the output signal of said second signal processing means;

means for mixing the output signal of said second signal processing means and the output signal of said delay means; and

means for mixing the demodulated luminance signal and the output carrier chrominance signal of said mixing means thereby to produce a reproduced color video signal.

9. A color video signal reproducing system as claimed in claim 8 for reproducing a signal recorded by the recording system as claimed in claim 2, in which said second signal processing means carries out in every vertical period alternately the signal processing of phase advancement and phase lag with respect to the carrier chrominance signal which has been separated by the fourth separation means.

10. A color video signal reproducing system as claimed in claim 8 for reproducing a signal recorded by the recording system as claimed in claim 3, in which said second signal processing means comprises: means for frequency converting said carrier chrominance signal which has been separated and signal processed thereby to restore the same to the original band; and phase shifting means for carrying out the signal processing of phase advancement and phase lag with respect to said carrier chrominance signal thus frequency converted into said original band with the same timing as the phase shifting means of said first signal processing means.

11. A color video signal reproducing system as claimed in claim 8 for reproducing a signal recorded by the recording system as claimed in claim 4, in which said second signal processing means comprises: means for forming a signal for frequency conversion for carrying out alternately said phase advancement successively by 90° and said phase lag successively by 90° every said specific period; and means for frequency converting said separated carrier chrominance signal by means of said signal for frequency conversion.

12. A color video signal reproducing system as claimed in claim 11 in which said means for forming the signal for frequency conversion forms said signal for frequency conversion of a single constant frequency.

13. A color video signal reproducing system

as claimed in claim 8 for reproducing a signal recorded by the recording system as claimed in claim 6, in which said second signal processing means carries out signal processing further to cause said V-axis direction component to be inverted with relative to the U-axis every other horizontal scanning period and to restore the same to a PAL system wherein the V-axis direction component is inverted relative to the U-axis every other horizontal scanning period.

14. A color video signal reproducing system as claimed in claim 8 for reproducing a signal recorded by the recording system as claimed in claim 6, in which said second signal processing means comprises: means for forming a signal for frequency conversion of a frequency ($f'c + f's$) for carrying out said phase advancement successively by 90° and said phase lag successively by 90° alternately every vertical period; second frequency conversion means for frequency converting said carrier chrominance signal which has been separated and signal processed into the original frequency $f'c$ by means of said signal for frequency conversion; converting means for phase inverting the output of said mixing means and converting the same into a signal wherein the V-axis direction component undergoes inversion relative to the U-axis; and means for deriving alternately the output of said mixing means and the output of said converting means every horizontal scanning period.

15. A color video signal recording and reproducing system comprising:

first separation means for separating a luminance signal from an input color video signal;

means for frequency modulating the luminance signal thus separated and producing as output a frequency-modulated luminance signal;

second separation means for separating a carrier chrominance signal from said input color video signal;

Signal processing means operating in a recording mode of operation to frequency convert the carrier chrominance signal thus separated into a band which is lower than the band of said frequency-modulated luminance signal and also to carry out signal processing of said carrier chrominance signal to cause the phase thereof to advance successively by 90° every horizontal scanning period within a specific period and to be lagged successively by 90° every horizontal scanning period within a succeeding specific period;

means for multiplexing said frequency-modulated luminance signal and said signal processed carrier chrominance signal and recording the resulting multiplexed signal successively on a plurality of tracks disposed parallelly side-by-side on a recording medium, said recording means thus recording to cause

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the carrier chrominance signal advanced in phase successively by 90° and the carrier chrominance signal lagged in phase successively by 90° to be aligned on mutually adjacent tracks;

5 means for reproducing said signal recorded on said recording medium;

10 third separation means for separating said frequency-modulated luminance signal from the signal thus reproduced;

means for demodulating said frequency-modulated luminance signal thus separated;

15 fourth separation means for separating the signal processed carrier chrominance signal from said reproduced signal;

said signal processing means operating in a reproducing mode of operation to frequency convert the carrier chrominance signal which has been separated by said fourth separation means and has been signal processed thereby to restore the same to the original frequency band and also to carry out phase shift processing successively by 90° every horizontal

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scanning period, thereby to restore the same to the original carrier chrominance signal not having a phase shift successively by 90° ;

25 means for delaying by one horizontal scanning period the output signal of said second signal processing means;

means for mixing the output signal of said second signal processing means and the output signal of said delaying means; and

30 means for mixing the demodulated luminance signal and the output carrier chrominance signal of said mixing means and deriving the resulting signal as a reproduced color video signal.

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16. A color video signal recording and/or reproducing system substantially as described with reference to the accompanying drawings.

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