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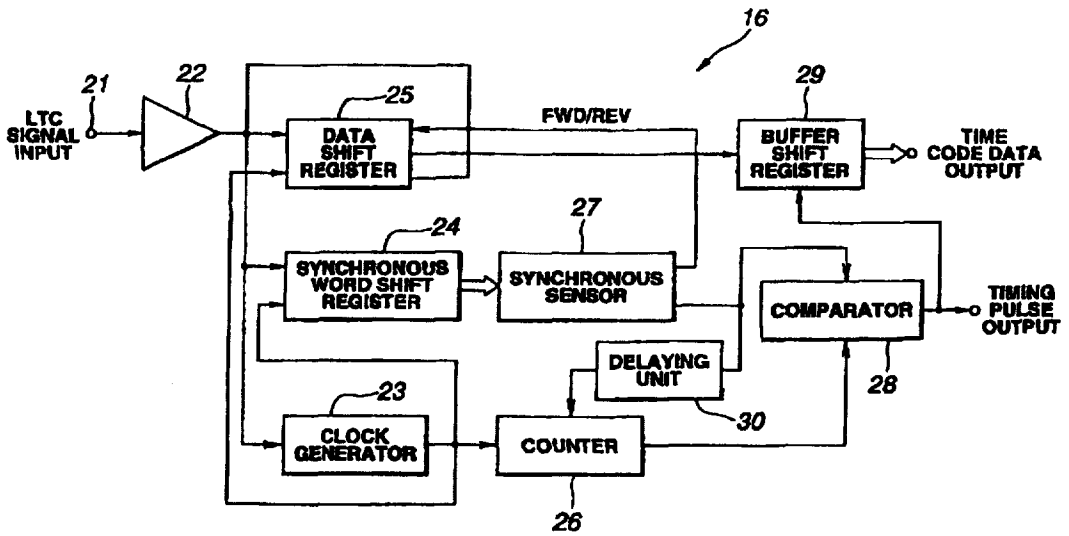

(57) Abstract

A method and apparatus for converting picture information. A time code is processed by generating information on whether or not a location is proper to edition when converting picture information of a predetermined system into picture information of another system, and writing the information to time code data accompanied with the picture information of another system. The picture information is converted from a first system to a second. An information reading apparatus reads information about sequential distribution of each frame for generating a field picture in a process of converting picture information of a first system into picture information of a second system whose frame number unit is different from that of the first system by sequentially distributing each frame inside of a predetemined frame number unit of the picture information at plural patterns for generating a field picture. A derived frame removing apparatus removes a derived frame from picture information of a second system. Picture information is transmitted after converting picture information of a first system into picture information of a second system. A procedure for converting picture information of a first system into picture information of a second system is recorded on a recording medium.

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PICTURE INFORMATION CONVERTING METHOD AND APPARATUS

BACKGROUND OF THE INVENTION

1. FIELD OF THE INVENTION

The present invention relates to a method and an apparatus for processing a time code used for an editing operation in converting picture information of a predetermined system into that of another system. Further, the present invention relates to an apparatus for converting picture information such as a pull-down converter which is arranged to convert the picture information imaged on a cinema film into the picture information of an NTSC system, for example, an apparatus for scanning sequence information given when pulling down the picture information, an apparatus for removing a mixed frame which is arranged to remove the derived frame of NTSC system picture information generated from different kinds of picture information on the cinema film, a method for transmitting picture information which is arranged to transmit the pull-down converted picture information, and a recording medium which records a program for executing the pull-down conversion through the software.

2. BACKGROUND

For broadcasting or producing a video software package of picture information imaged on a cinema film that is originally planned to be released to the public in a theater, the picture information is frequently converted into a standard video signal of an NTSC (National Television System Committee) system or PAL (Phase Alternating by Line) system.

For this purpose, there has been considered a system arranged to use a telecine apparatus served as a picture scanning device, which is illustrated in Fig.1. As an example, the description will be oriented to the conversion of the picture information captured on the cinema film into a video signal of the NTSC system.

Normally, the cinema film 1 is imaged at a rate of 24 frames per second. To obtain a video signal of the NTSC system, that is, a video signal having 525 scan lines / field frequency of 59.94 Hz, the telecine apparatus 2 operates to reproduce the picture information imaged on the cinema film 1 at a rate of 24 frames per second (precisely, 24 / 1.001 = 23.97602398), which is the same as the

imaging speed. Then, a field frequency converting unit 3 operates to perform the so-called 3 : 2 pull-down process.

As shown in Fig.2, the so-called 3 : 2 pull-down process is a process that is executed to do interlaced scanning for the cinema film for converting an even field (E) of the film into an even field (E) of the video signal and for the cinema film for converting an odd field (O) of the film into an odd field (O) of the video signal. One frame of the cinema film is composed of two of the same fields with no time lag. Hence, the field frequency converting unit 3 operates to output the video signal of the NTSC system without any unfavorable time lag. Four frames on the input side are converted into one frame on the output side. No unfavorable condition takes place in the field order inside of the frame. Hence, no watcher feels the reproduced picture unnatural.

In order to reproduce as a frame still the video signal of the NTSC system obtained as mentioned above, the motion of the reproduced picture is often made unfavorable, because the picture of a field of the same frame of the video signal is different from the picture of its adjacent field of the same frame unless a reproducing start point is properly selected.

In Fig.2, setting a reproducing start point to 02 frame (F) of the video signal, the 02 frame is produced from the fields of 01 frame and 02 frame, between which fields a time lag exists. As a result, a watcher feels the motion of the reproduced picture unnatural.

Further, setting a reproducing start point to the 03 frame (F) of the video signal, the 03 frame is produced from the fields of 02 frame and 03 frame, between which fields a time lag exists. As a result, a watcher feels the motion of the reproduced picture unnatural as well.

That is, in Fig.2, the 02 frame or the 03 frame of the video signal is composed of two fields, which are produced from the different film frames from each other. In the picture with large motion, as a difference between two fields is made larger, the image reproduced from the video signal frames is made more vague and thereby lower in quality.

Hence, the direct frame such as 00F, 01F, 04F of the video signal, which is composed of the same film frame, may be set as a reproducing point. However, conventionally, if an operator wants to know the information about the 3 : 2 pull-down process, in particular, if the subject frame is a direct frame or a derived frame of 02 frame or 03 frame of the video signal, the operator has no other means except stopping the film and watching a still picture for judgement. This places a large burden on the operator.

Further, in case that the reproducing machine provided in the editing system executes the 3 : 2 pull-down process, the operator has to determine if the editing point is the derived frame or the direct frame. It means that the operator has no other means except stopping the film and watching a still picture for judgement as well.

When being inputted with the video signal for working a picture through the use of a computer, it is necessary to remove the derived frame from the film, because the computer processes only the direct frame. Also in this case, the process is executed for determining if the subject frame is a derived one or a direct one based on a difference between two fields composing one picture. This process therefore makes the video input unit complicated and costly.

SUMMARY OF THE INVENTION

The present invention is made for overcoming the foregoing shortcoming. It is an object of the present invention to provide a time code processing method and apparatus for generating a time code for automatically determining a proper start point to the edition.

Further, the present invention is made for overcoming the foregoing shortcoming. It is an object of the present invention to provide a picture information converting apparatus which is arranged to automatically add to picture information pull-down sequence information about an arranging sequence of a field picture for the purpose of simplifying the operator's editing operation.

Moreover, the present invention is made for overcoming the foregoing shortcoming. It is an object of the present invention to provide an information scanning apparatus which is arranged to automatically scan the pull-down sequence information for the purpose of simplifying the operator's editing operation.

The present invention is also made for overcoming the foregoing shortcoming. It is an object of the present invention to provide a derived frame removing apparatus which is arranged to automatically remove the derived frame for the purpose of the operator's editing operation and reducing the cost of the video input device without wasting a volume of a recording medium.

The present invention is also made for overcoming the foregoing shortcoming. It is an object of the present invention to provide a picture information transmitting method which is arranged to automatically add the pull-down sequence information to the picture information when transmitting the picture information for the purpose of simplifying the operator's operation after receiving the picture information.

The present invention is also made for overcoming the foregoing shortcoming. It is an object of the present invention to provide a recording medium which records as a program a sequence of automatically adding the pull-down sequence information to the picture information for the purpose of simplifying the operator's operation.

According to an aspect of the invention, a time code processing method takes the steps of generating information if a location is suitable to the edition when converting picture information of a predetermined system into picture information of a different system and writing the generated information to the time code data accompanied with the picture information of the different system. Hence, this method

enables to generate the time code for automatically determining a suitable start point to the edition.

According to another aspect of the invention, a time code processing apparatus includes means for generating editing location information and time code generating means for writing the editing location information to time code data accompanied with the picture information of another system. Hence, the apparatus enables to generate the time code for automatically determining a suitable start point to the edition.

According to another aspect of the invention, a picture information converting apparatus includes converting means for converting picture information of a first system into picture information of a second system by sequentially distributing each frame of a predetermined number of frames contained in the picture information at plural patterns for generating a field picture, and writing means for writing information about sequential distribution of each frame for generating the field picture in an auxiliary recording area of the picture information of the second system sent from the converting means, and controlling means for controlling the converting means and the writing means.

The controlling means operates to derive the information about sequential distribution of each frame for generating the field picture through an operation and supply the information to the converting means and the writing means. Hence, the writing means enables to write the information about sequential distribution of each frame for generating the field picture in the auxiliary recording area of the picture information of the second system.

The converting means operates to derive the information about sequential distribution of each frame for generating the field picture through an operation. The controlling means may operate to scan the information about sequential distribution of each frame for generating the field picture from the converting means and then supply the information to the writing means.

In any case, the converting means performs the 3 : 2 pull-down process or 3 : 2 : 3 : 2 : 2 pull-down process, for example, based on the information about sequential distribution of each frame for generating the field picture for converting the picture information of the first system into that of the second system.

Further, the control means operates to supply to the writing means the information for indicating a derived frame of the picture information of the second system whose field picture is composed of two different frames of the first system picture information as the information about sequential distribution of each frame for generating the field picture. The editing process through the use of the second system picture information determines the information for indicating the derived frame as an improper frame.

Hence, since an editing operator can visually recognize a character generated by a character

generating means according to the information for indicating a derived frame, the operator's editing operation is made simpler.

Further, the character generating means may generate a character corresponding to the information about two or three sequential distributions of each frame of the first system picture information as the information about sequential distribution of each frame for generating the field picture.

According to an aspect of the invention, an information reading apparatus includes separating means for separating the information about sequential distribution of each frame for generating the field picture from the second system picture information and sensing means for sensing the information about sequential distribution of each frame for generating the field picture separated from the separating means.

The information about sequential distribution of each frame for generating the field picture indicates a derived frame contained in the second system picture information, the field picture of the derived frame composed of two different frames of the first system picture information.

The editing process through the use of the second system picture information determines the information for indicating the derived frame as an improper frame to the edition.

Hence, since an editing operator can visually recognize the character generated by the character generating means according to the information for indicating the derived frame, the operator's editing operation is made simpler.

According to an aspect of the invention, a derived frame removing apparatus includes separating means for separating information for indicating the derived frame from the second system picture information, sensing means for sensing the information for indicating the derived frame separated by the separating means, and removing means for removing the derived frame from the second picture information based on the information for indicating the location of the derived frame detected by the detecting means.

The editing process through the use of the second system picture information determines the information for indicating the derived frame, contained in the second system picture information, as an improper frame to the edition. Hence, the removal of the derived frame through the removing means makes the operator's editing operation simpler without wasting the volume of the recording medium.

According to an aspect of the invention, the picture information transmitting method includes the steps of converting the first system picture information into a second system picture information whose unit of frame number is different from that of the first system picture information by sequentially distributing each frame at a unit of a predetermined number of frames, writing the information about sequential distribution of each frame for generating the field picture in the auxiliary recording area of the second system picture information, and transmitting the second system picture information.

The information about sequential distribution of each frame for generating the field picture is the

information for indicating the derived frame contained in the second system picture information, the field picture of the derived frame composed of two different frames of the first system picture information. The editing process through the use of the second system picture information determines the information for indicating the derived frame as an improper frame to the edition.

Hence, since an operator visually can recognize the character generated by the character generating means according to the information for indicating the derived frame after receiving the second picture information containing the information for indicating the derived frame, the editing operation is made simpler.

According to an aspect of the invention, a recording medium records a procedure having a converting process of converting the first system picture information into the second system picture information whose unit of a frame number is different from that of the first system picture information by sequentially distributing each frame within a unit of a predetermined number of frames of the picture information at plural patterns and writing means for writing the information about sequential distribution of each frame for generating the field picture in the auxiliary recording area of the second system picture information from the converting means.

The information about sequential distribution of each frame for generating the field picture is the information for indicating the derived frame contained in the second system picture information, the field picture of the derived frame composed of two different frames of the first system picture information. The editing process through the use of the second system picture information determines the information for indicating the derived frame as an improper frame to the edition.

Hence, since the editing operator can visually recognize the character generated by the character generating means according to the information for indicating the derived frame, the operator can simply perform the proper editing operation.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig.1 is a block diagram showing a system for converting picture information imaged on a cinema film for converting the picture information into a standard video signal of an NTSC system;

Fig.2 is an explanatory view showing a 3 : 2 pull-down process executed by a field frequency converter included in the system shown in Fig.1;

Fig.3 is a block diagram showing an arrangement of a system for editing picture information according to a first embodiment of the present invention;

Fig.4 is a block diagram showing an adapter that is a component of the system for editing picture information;

Fig.5 is a view showing a format of an LTC treated by the adapter;

Fig.6 is a view showing a format of a VITC treated by the adapter;

Fig.7 is a block diagram showing a time code reader that is a component of the adapter;

Fig.8 is a block diagram showing a CPU that is a component of the adapter;

Fig.9 is a block diagram showing a concrete arrangement of a system converter that is a component of the adapter;

Fig.10 is an explanatory view showing an operation of a field frequency converting unit that is a component of the system converter;

Fig.11 is a block diagram showing another concrete arrangement of the system converter that is a component of the adapter;

Fig.12 is an explanatory view showing an operation of a field frequency converting unit that is a component of another concrete arrangement of the system converter;

Fig.13 is a block diagram showing a time code generator that is a component of the adapter;

Fig. 14 is a block diagram showing a video and an audio processing systems of a D-1 video player to be used in a modify digital video tape player composing the system for editing picture information;

Fig.15 is a block diagram showing a servo system of a D-1 video player to be used in a modify digital video tape player composing the system for editing picture information;

Fig-16 is a block diagram showing a PLL circuit that is a component of the servo system;

Fig. 17 is a block diagram showing a video and an audio processing systems of a D-1 video recorder to be used in a modify digital video tape recorder composing the system for editing the picture information;

Fig.18 is a block diagram showing a transformed arrangement of the system for editing picture information according to the first embodiment of the invention;

Fig.19 is a block diagram showing an arrangement of a system for editing picture information according to a second embodiment of the invention;

Fig.20 is an explanatory view showing a concrete example of the pull-down sequence information;

Fig.21 is a block diagram showing a detailed arrangement of a pull-down converter that is a component of the system for editing picture information shown in Fig.19;

Fig.22 is an explanatory view showing the 3 : 2 pull-down process;

Fig.23 is a view showing a display example on a monitor for displaying picture data having a character "D" added thereto, the character generated by pull-down sequence information;

Fig.24 is a block diagram showing a detailed arrangement of a derived frame reader that is a component of the system for editing picture information shown in Fig.19;

Fig.25 is a block diagram showing a detailed arrangement of a derived frame removing apparatus that is a component of the system for editing picture information shown in Fig.19;

Fig.26 is a block diagram showing a transformed arrangement of the system for editing picture information shown in Fig.19;

Fig.27 is an explanatory view showing a 3 : 2 : 3 : 2 : 2 pull-down process; and

Fig.28A through 28F are collectively referred to as and show an example of information about sequential distribution of each frame for generating the field picture.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Later, the description will be oriented to the embodiments of a method and an apparatus for processing a time code, a picture information converting apparatus, an information reading apparatus, and a derived frame removing apparatus.

At first, the embodiment of the method and the apparatus for processing a time code will be described with reference to Figs.3 to 18. This is a first embodiment.

The first embodiment of the invention concerns with a picture information editing system 5 as shown in Fig.3 that is executed to edit the converted picture information with a converted time code obtained by the method and the apparatus for processing a time code.

The picture information editing system 5 is arranged to edit a video signal of an NTSC system having 525 scan lines / field frequency of 59.94 Hz (called an NTSC system video signal of 525 / 59.94 or another figure). The NTSC system video signal is produced by converting the picture information imaged on a cinema film at a rate of 25 frames per second into a video signal having 625 scan lines / field frequency of 50 Hz through the effect of a telecine apparatus and then converting the video signal into the NTSC system video signal of 525 / 59.94.

The editing system 5 includes a modified digital video tape player 6 for variably reproducing a video signal of 625 / 50 recorded on a video tape, an adapter 7 for converting the variably reproduced video signal into a video signal of 525 / 59.94, mapping a time code, writing a No-good mark indicating an improper location to edition to time code data of an improper frame to an editing point, and outputting the time code data, a digital video tape recorder 8 for recording the NTSC system video signal of 525 / 59.94 and the time code with the mark hit thereon on a video tape cassette 9, and an editor 10 for editing the video signal of 525 / 59.94 with the time code recorded on the video tape cassette 9 by the digital video tape recorder 8.

The modified digital video tape player 6 may be a video tape recorder of a D-1 format (called a D-1 video tape recorder), for example. The D-1 video tape recorder for this purpose needs a variable reproducing speed, the detail of which will be described below.

The arrangement of the adapter 7 will be described with reference to Fig.4. The adapter 7 includes a VITC reader 14 for reading a vertical interval time code (called VITC) from the video signal sent from the modify digital video tape player 6, a system converter 15 for converting a scan line number and a field frequency into the NTSC system video signal of 525 / 59.94 on the VITC and feeding field sequence information used in converting the field frequency, a time code reader 16 for reading a longitudinal time code (called LTC), a CPU 17 for generating converted time code data of the NTSC system video signal based on the LTC data read by the time code reader 16 and generating information about an improper editing location indicating an improper location to an editing point based on the field sequence information, a time code generator 18 for writing a No-good mark indicating an improper editing location to a binary group which is user's bits of a converted time code data format for generating the converted time code, and a control interface 19 for feeding reproducing speed information n% from the modified digital video tape recorder 6 to the CPU 17.

For editing picture information, it is essential to grasp the location of a video tape. For this purpose, a time code is used. The time code contains the LTC to be recorded lengthwise on the video tape and the VITC to be inserted into the vertical interval.

As shown in Fig.5, the LTC is composed of 80 bits (00 to 79) containing the first to eighth binary groups as time information and user's bits of 64 bits per frame and synchronous word bits of 16 bits. The time information contains a 24-hour system code format in which a time digit is 00 to 23 hours, a minute digit is 00 to 59 minutes and a second digit is 00 to 59 seconds. For the PAL system video signal, the frame value may have 25 numbers ranging from 00 to 24 frames. For the NTSC system video signal, the frame value may have 30 frames ranging from 00 to 29 frames. The modifying system is a self-clock type width modulation called as a biphase mark, in which a clock inversion (transition) takes place at the start point for each bit period, when a bit value is "1", a transition takes place in a center of a period, and when a bit value is "0", no transition takes place in the center of the period.

As shown in Fig.6, the VITC is composed of 90 bits containing the LTC of 64 bits, four synchronous bits added to each group of eight bits, and a CRC code of eight bits. The transition takes place only when the change between the adjacent bit cells takes place such as "1" to "0" or "0" to "1". In this case, the modifying system takes a binary signal format. No transition takes place when no change takes place between the adjacent bit cells.

The system 5 for editing picture information according to the first embodiment may use a time code containing both of the LTC and VITC. Herein, the description will be oriented to the editing system arranged to use the LTC.

The LTC added to the video signal of 625 / 50 fed from the modifier digital video tape player 6 is supplied to a time code reader 18. The time code reader 16 operates to extract a clock signal from the LTC. The time code reader 16 operates to decode the LTC and output the time code data and the binary bit.

The circuit arrangement of the time code reader 16 will be shown in Fig.7. The LTC to which the biphase mark signal is added is supplied to a clock generator 23, a synchronous word shift register 24 and a data shift register 25 through a buffer 22 from an input terminal 21. The clock generator 23 operates to extract a clock signal from the biphase mark signal and supply the clock signal to the synchronous word shift register 24, the data shift register 25 and a counter 26.

The synchronous word shift register 24 operates to read the biphase mark signal on the timing on which the clock from the clock generator 23 is input. Then, the register 24 enables a synchronous sensor 27 to sense the synchronous word bit having a synchronous portion of 12 consecutive "1's". The synchronous sensor 27 operates to sense if two bits following the synchronous word bits are "00" or "01" and supply a read direction signal of FWD / REV to the data shift register 25.

The data shift register 25 operates to read the biphase mark signal in response to the read

direction signal from the synchronous sensor 27.

The counter 26 operates to count eighty clocks generated by the clock generator 23. When the counter 26 counts eight clocks, a comparator 28 operates to compare the counted clocks with the synchronous signal in light of the timing and then output a timing pulse for reading data if it determines the input data is a correct data group. At a time, the time code data of 64 or 32 bits is output from a buffer shift register 29. The time code data is supplied from the time code reader 16 to the CPU 17.

The LTC is supplied as the time code to the CPU 17. The CPU 17 operates to generate the converted time code data on this LTC and supply it to the time code generator 18. The CPU 17 is also inputted with the field sequence information from the system converter 15. This field sequence information indicates how the picture fields are re-ordered when the system converter 15 converts the field frequency. The CPU 17 operates to generate information for indicating an improper location to the editing point with this field sequence information.

The circuit arrangement of the CPU 17 will be shown in Fig.8. The CPU 17 includes a total frame number converter 31 for converting the time code data sent from the time code reader 16 into a total frame number x, a total frame number calculator 32 for calculating a total frame number y of the converted time code data for the time code data from the total frame number x, a converted time code data generator 33 for generating the converted time code data from the total frame number y, and an improper editing location information generator 34 for generating information about an improper editing location from the field sequence information.

The total frame number converter 31 operates to convert the time code data AhBmCsDF consisting of the read time (h) minute (m) second (s) frame (F) a total frame number x derived by the expression of (60A + B) x 60) + C) x 25 + D. The total frame number calculator 32 operates to calculate the total frame number y from the total frame number x based on the expression of Y / 30 = x / 25 / (1 + n / 100) , where n is reproducing speed information indicating how much the reproduoing speed is varied as compared with the recording speed in the modify digital video tape player 6. The reproducing speed information is obtained through the effect of a control interface 19. For example, if the reproducing speed of the modify digital video tape player 6 is made equal to the recording speed, n is 0 (%).

The converted time code data generator 33 operates to generate the converted time code data consisting of a time-minute-second frame from the total frame number y obtained by the foregoing expression.

The improper editing location information generator 34 operates to determine whether or not the system-converted picture frame is composed of the different frames on the source side based on the field

sequence information. If the frame is composed of the different frames, that is, a time lag takes place between the frame, the improper editing location information is generated.

The improper editing location information is supplied to a time code generator 18 together with the converted time code data and then is written to the user's bits of the time code of the improper frame to the edition.

Later, the description will be oriented to a concrete operation of writing the improper editing location information to the binary bit group if the reproducing speed information n is almost 0 % or -4 %.

At first, the description will be oriented to how the modify digital video tape player 6 performs the 0 % reproduction in which the reproducing speed information n is almost 0 %. Precisely, the 0 % reproduction is 0.01 % reproduction with 625 scan lines / field frequency of 49.95 Hz.

As shown in Fig.9, the system converter 15 includes a scan line number converter 35 for converting a scan line number of the video signal of 625 / 49.95 into 525 scan lines and a field frequency converter 36 for converting a field frequency of the video signal into 59.94 Hz.

The scan line number converter 35 operates to interpolate 625 scan lines into 525 scan lines. This converter 35 performs a vertical filtering operation about 625 scan lines from 576 active lines to 486 active lines, for deriving 525 scan lines. The vertical resolution appears in 625 scan lines is higher than that appearing in 525 scan lines. Hence, no loss of the vertical resolution disappears in the re-sampling process, which results in enhancing the quality of the resulting picture.

The field frequency converter 36 operates to convert the field frequency of 49.95 Hz into 59.94 Hz by making the frequency of 49.95 Hz 6/5 time. This operation is the so-called 3 : 2 : 3 : 2 : 2 pull-down process.

The so-called 3 : 2 : 3 : 2 : 2 pull-down process will be described with reference to Fig.10. The interlaced scan is executed for the video signal having a field frequency of 49.95 Hz so that an even field (E) on an input side 36a is converted into an even field (E) on an output side 36b and an odd field (O) on the input side 36a is converted into an odd field (O) on the output side 36b. The video signal on the input side 36a has no time lag within the same frequency. Hence, the video signal converted to the signal on the input side 36a is not unfavorable on time. Five frames on the input side are converted into one frame on the output side. However, since no unfavorable condition takes place in the field sequence inside of the frame, a watcher does not feel the motion of the picture unnatural.

The information about the conversion of the sequence of the picture fields is supplied as field sequence information to the CPU 17. This field sequence information is used for generating the conversion time code data and the improper editing location information by the CPU 17.

The converted time code data is composed of an iteration of loops each completed at least within a period shown in Fig.10. In this case, the mapping to the five frames of 625 / 49.95 and the six frames of 525 / 59.94 makes it possible to constantly and uniquely define the converted time code on the target side against the time code on the source side. Hence, the time code on the source side is made equal to the time code on the target side second by second.

The improper editing location is indicated as a No-good mark to a 02 frame on the side of 525 / 59.94

composed of the 01 and the 02 frames on the side of 625 / 49.95. These frames with the No-good mark indicated thereto are considered as improper frames and distinguished from the other frames.

Next, the description will be oriented to the -4 % reproduction of the modify digital video tape player 6 if the reproducing speed information n is -4 %. In the -4 % reproduction, the video signal recorded at a rate of 25 frames per second is reproduced at a rate of 25 frames per second. That is, the video signal recorded with 625 / 50 is reproduced with 625 / 48 (actually, 47.95).

In this case, as shown in Fig.11, the system converter 15 includes a scan line converter 38 for converting the scan line number of the video signal of 625 / 47.95 into 525 and a field frequency converter 39 for converting the field frequency of the video signal into 59.94 Hz.

The scan line converter 38 operates to interpolate 625 scan lines into 525 lines. The scan line converter performs a vertical filtering operation about 625 scan lines for converting 576 active lines into 486 active lines. As a result, the converter 38 produces 525 scan lines. The vertical resolution appearing in the case of 625 scan lines is higher than that in the case of 525 scan lines. In the re-sampling process, therefore, no loss takes place in the vertical resolution, which may result in offering the high quality of the picture.

In order to convert the field frequency of 47.95 Hz into 59.95 Hz by making it 5/4 time, the field frequency converter 39 performs the so-called 3 : 2 pull-down process.

The so-called 3 : 2 pull-down process will be described with reference to Fig.12. The interlaced scan is executed for the video signal of the field frequency of 47.95 Hz so that an even field (E) on an input side 39a is converted into an even field (E) on an output side 39b and an odd field (O) on the input side 39a is converted into an odd field (O) on the output side 39b. The video signal on the input side 39a has no time lag within the same frame. Hence, the video signal converted into the signal on the output side 30b does not have any unfavorable condition on time. Four frames on the input side 4 are converted into one frame on the output side. However, since no unfavorable condition takes place in the field sequence inside of the frame, a watcher does not feel the motion of the picture unnatural.

The information about the conversion of the picture sequence on a field unit is supplied as field sequence information from the field frequency converter 39 to the CPU 17. This sequence information is used in the CPU 17 for generating the converted time code data and the improper editing location information.

In this case, a loop in which the head of a frame coincides with the head of another frame is executed repetitively for four frames of the video signal of 625 / 47.95 and five frames of the video signal of 525 / 59.94. In case that the normal advance rules are kept, the slip of one frame per second takes place in the converted time code.

Hence, a value of n = -4 is represented in the foregoing operation expression executed by the total frame number calculator 32 provided in the CPU 17. That is, after a value of y is calculated from the expression of $y / 30 = x / 25 / (1 + (-4) / 100)$, the CPU 17 enables the converted time code data generator 33 to generate the converted time code data.

That is, since the CPU 10 performs the absolute mapping function, the time code can be uniquely defined even if the modify digital video tape player 6 performs the reproduction of n (= -4)% variable speed.

The improper editing location information is indicated as a No-good mark to the 02 frame on the side of 525 / 59.94 composed of the 01 and the 02 frames on the side of 625 / 47.95 and the 03 frame on the side of 525 / 59.94 composed of the 02 and the 03 frames on the side of 625 / 47.95. These frames with the No-good mark indicated thereto are recognized as improper frames to the edition and are distinguished from the other frames.

The time code generator 18 receives the converted time code data and the improper editing location information and supplies the converted time code, which has a function of distinguishing the improper frames to the edition from the other frames.

The circuit diagram of the time code generator 18 will be shown in Fig.13. The clock pulses generated in a clock generator 41 on an external synchronous or an internal reference signals are supplied to a serializing counter 42 and a time code counter 43. The time code counter 43 receives the converted time code data from the CPU 17.

Then, the time code counter 43 realizes the new location of the converted time code for the NTSC system video signal. The time code for the NTSC system is supplied to the serializing circuit 44. The serializing circuit 44 receives the user's bits from a binary bit buffer 45 and the synchronous signals from a synchronous word generator 46.

The binary bit buffer 45 receives the improper editing location information. Then, the improper editing location information specified as the user's bits by the binary bit buffer 45 is written in the binary group of the format shown in Fig.5 through the effect of the serializing circuit 44.

Then, the serializing circuit 44 operates to output the converted time code having the improper editing location information written therein to the binary group.

Along the foregoing operation, the converted time code having the improper editing operation information written therein is supplied from the adapter 7 to the digital video tape recorder 8. The system-converted video signal is supplied from the adapter 7 to the digital video tape recorder 8. The digital video tape recorder 8 operates to record the system-converted video signal and the system-converted time code on the video tape cassette 9.

The modify digital video tape player 6 used in the picture information editing system 1 may be a D-1 format video tape recorder as mentioned above. The D-1 video tape player is a video tape player normalized on the so-called 4 : 2 : 2 component coding system for CCIR. Rec. 601.

The schematic arrangement of the video and audio processing system of the D-1 video tape player will be shown in Fig.14.

The digital signal recorded on a magnetic tape 50 of the video tape cassette is reproduced with a reproducing head 51 and then is amplified by a reproduction amplifier 52. The reproduced output of the reproduction amplifier 52 is supplied to a synchronicity / ID sensing circuit 53.

The synchronicity / ID sensing circuit 53 operates to sense a synchronous signal and an ID from the reproduced output, delimit the signal, and clarify a block number.

A de-scrambling circuit 54 operates to de-scramble the reproduced output and supply the de-scrambled

reproduced signal to an inner decoder 55. The inner decoder 55 executes an error correction with inner codes added to the reproduced signal and then supplies the corrected signal to a data separating circuit 56.

The data separating circuit 57 operates to separate the signal into a digital video signal and an audio video signal and supply the digital video signal to an intra-sector de-shuffling circuit 57 and the digital audio signal to a de-shuffling circuit 62. The intra-sector de-shuffling circuit 57 operates to de-shuffle the digital video signal over sectors and then supply component digital video signals Y, Cb and Cr to an outer decoder 58.

The outer decoder 58 operates to supply the digital video signals Y, Cb and Cr whose errors are corrected with the outer codes to a D/A converter 61 through an inter-sector de-shuffling circuit 59 and a source decoder 60. The D/A converter 61 operates to convert the digital video signals Y, Cb and Cr into analog component video signals Y, B-Y and R-Y and then output those analog signals.

On the other hand, the de-shuffling circuit 62 operates to de-shuffle the digital audio signal separated by the data separating circuit 56. The de-shuffled digital audio signal is error-corrected by the outer decoder 63. Then, the error-corrected signal is supplied to a D/A converter 66 through a post-processing circuit 64 and an audio conceal circuit 65. The D/A converter 66 operates to convert the digital audio signal into an analog audio signal and then output R- and L-channel audio signals as an example.

Further, the modify digital video tape player 6 provides a servo system arranged as shown in Fig. 15 and operates to reproduce the video signal of 625 / 50 recorded on the magnetic tape 50 of the video tape cassette with the field frequency of 47.95 Hz.

A synchronous signal separating circuit 71 operates to extract a horizontal synchronous signal from the input reference signal and supply it to a phase locked loop (PLL) circuit 72. This PLL circuit 72 provides a voltage controlled oscillator (called VCO) whose LC is variable as mentioned below. The VCO enables to vary a frequency of an oscillating clock by changing a C value according to the reference signal. The PLL circuit 72 operates to supply the clocks to a vertical synchronous (SYNC) generator 73. The vertical synchronous signal generated by the VSYN generator 73 is supplied to a drum servo system 74 and a capstan servo system 80.

The drum servo system 74 includes a phase comparator 76 for comparing in a phase a drum rotation pulse (PG) with the vertical synchronous signal. The phase comparator 76 supplies a phase control signal to an inverted input terminal of an operation amplifier 77. The operational amplifier 77 receives a speed control signal sensed by a speed sensor 79 from a frequency generating (FG) pulse sent from a drum motor 75 as well. The operated output of the operational amplifier 77 is amplified by a driving amplifier 78 and then is supplied to a drum motor 75. The amplified signal is used for correcting the number of rotations and the slippage of the rotation phase of the drum motor 75.

The capstan servo system 80 also includes a phase comparator 82 for comparing in a phase a signal derived by dividing the reproduced control signal by a frequency divider 85 with the vertical synchronous signal. The phase comparator 82 supplies the phase control signal to an inverted input terminal of an operational amplifier 83. The operational amplifier 83 also receives a speed control signal sensed by a speed

sensor 86 from a frequency generating (FG) pulse from a capstan motor 81. The operated output of the operational amplifier 73 is amplified by a drive amplifier 84 and then is supplied to a capstan motor 81. This signal is used for correcting the number of rotations and the slippage of the rotation phase of the capstan motor 81.

The arrangement of the PLL circuit 72 will be shown in Fig.16. The PLL circuit 72 includes a phase comparator 91, a low-pass filter 92, a VCO 93, and a frequency divider 94.

The phase comparator 91 operates to compare in a phase a horizontal synchronous signal separately extracted by the synchronous signal separating circuit 71 with a clock derived by dividing the frequency of the output clock of the VCO at a predetermined dividing rate.

The low-pass filter 92 operates to supply the output to the VCO 93. This VCO 93 enables to switch the generating clock from 47.95 Hz to 49.95 Hz, for example, by changing the C value.

Hence, the modify digital video tape player 6 enables to reproduce the video signal of 625 / 49.95 from the video signal of 625 / 50.

Further, the digital video tape recorder 8 may be a D-1 video tape recorder. The schematic arrangement of the video and the audio processing system of the D-1 video tape recorder will be shown in Fig.17.

The component video signals Y, B-Y and R-Y are converted into the corresponding digital video signals Y, Cb and Cr by the A/D converter 101. These digital video signals Y, Cb and Cr are supplied to a source coding circuit 102.

The source coding circuit 102 operates to encode the digital video signals Y, Cb and Cr with weight sequence codes. This is a coding process for converting 8-bit codes ranged in the sequence of decimal magnitude into the codes ranged in the sequence of weight. This process makes it possible to reduce the adverse effect of the error not sensed by the error correcting codes and left on the screen. The digital video signals Y, Cb and Cr encoded by the source coding circuit 102 are supplied to an inter-sector shuffling circuit 103.

The inter-sector shuffling circuit 103 passes the inter-sector shuffling operation to the digital video signals Y, Cb and Cr. An outer encoder 104 located at a later stage may sense an error but may not correct it with the error correcting codes (ECC). In this case, the error may be processed by the modification so that it is made less conspicuous. However, if the pixels to be modified are concentrated on an area of the screen, the degrade of the picture quality cannot be neglected. To overcome it, the inter-sector shuffling circuit 103 operates to replace the occurrence sequence of the video codes with the sequence of the recording codes among sectors. The inter-sector shuffling circuit 103 operates to supply the shuffled output to the outer encoder 104.

The outer encoder 104 adds an ECC to the shuffled output. Concretely, the shuffled output is delimited into blocks each having a predetermined length. Then, a 2-word Reed-Solomon product code (checking code) for an outer code is generated by a predetermined operation and is added to each block. The encoded output of the outer encoder 104 is supplied to an intra-sector shuffling circuit 105.

The intra-sector shuffling circuit 105 performs a shuffling process among the sectors of the encoded output. Concretely, the codes located two-dimensionally after the outer checking code is generated are re-arranged within the same two-dimensional block as randomly as possible.

On the other hand, the analog audio signal such as the Rand L-channel signals are converted into the digital audio signal by the A/D converter 106. This digital audio signal is supplied to a pre-processing circuit 107 in which the pre-process is executed. Then, the pre-processed signal is supplied to a block circuit 108.

The blocking circuit 108 operates to block the audio signal and supply the block signal to an outer encoder 109. The outer encoder 109 operates to add an ECC to the audio signal and supply the resulting signal to a shuffling circuit 100. The shuffling circuit 100 operates to shuffle the signal.

The shuffled video output from the intra-sector shuffling circuit 105 and the shuffled audio output from the shuffling circuit 110 are applied to a multiplex circuit 111.

The multiplex circuit 111 operates to time-divisionally multiplex the video shuffled output and the audio shuffled output. The multiplexed output is supplied to an inner encoder 112.

The inner encoder 112 operates to add a common inner code that is a kind of the ECC to the multiplexed output. The encoded output is supplied from the inner encoder 112 to a synchronicity / ID adding circuit 113.

The audio and the video signals are composed on a common format called a synchronous block. The synchronicity / ID adding circuit 113 operates to add to two inner code blocks an ID pattern indicating a synchronous pattern and a block number and output it as one synchronous block to a scrambling circuit 114.

The scrambling circuit 114 operates to supply the scrambled output as recording current to a head 116 through a recording amplifier 115 and a rotary transformer. With the head 116, the scrambled output is digitally recorded on a magnetic tape 117 in such an unsaturated manner as suiting to high-density recording.

The digital video tape recorder such as the D-1 video tape recorder realizes higher picture and audio quality of the recording signal and a higher dubbing characteristic than the analog video tape recorder. The quality of the picture reproduced from the digitally recorded data mainly depends on parameters for coding and is hardly influenced by the recording and reproducing characteristic. For example, the waveform distortion of the reproduced picture is made to be only the distortion given by an analog circuit before and after the A/D and the D/A conversions. The distortion and the noise appearing when recording or reproducing the data are made to be the erroneous reproduced codes. Those erroneous codes are factors to degrading the picture quality. However, if an error rate is equal to or less than a certain value, the use of the error correcting codes makes it possible to correct or modify the erroneous codes. As will be understood from the aforementioned grounds, the digital recording may offer a higher picture quality than the analog recording. In particular, the advantage of the digital recording is distinguishable in dubbing.

As set forth above, the adapter 7 provided in the picture information editing system 5 operates to write to the system-converted video signal the improper editing location information such as the No-good mark indicating a frame composed of frames having different video signals before the system conversion and then output the converted time code. Then, the digital video tape recorder 8 operates to record the system-

converted video signal and the converted time code having the improper editing location information written therein on the video tape cassette 9 for edition. The editor 10 distinguishes the improper editing location information in the data recorded on the video tape cassette 9 for edition when it edits the data. Hence, the picture information editing system 5 enables to automatically distinguish a proper start point to the edition. Of course, the digital video tape player and the digital video tape recorder are used for reproducing and recording the data. Hence, no degraded change of the picture quality takes place between the video signals before and after the system conversion.

The adapter 7 of the editing system 5 has been described on the use of the LTC as the time code. In place, the VITC read by the VITC reader 14 may be used as the time code. This VITC contains even the field information such as odd fields or even fields as shown in Figs.2, 10 and 12.

That is, the VITC operates to supply the field information containing the odd fields and the even fields to the CPU 17. The CPU 17 enables to promptly establish a target time code even if a source time code is at any location inside of the sequence by obtaining the time code and the field information from the VITC on the picture allocated to the target time code.

The time code with the VITC makes it possible to specify a field within the frame. Hence, the No-good mark indicated at a frame unit as shown in Figs.10 and 12 is allowed to be written at a field unit. The editing start point may be changed from the odd field to the even field.

Further, according to a transformation of the first embodiment, a system for editing picture information shown in Fig. 18 may be considered.

In the system 120, the editor 10 is executed to directly edit the converted video signal with the converted time code generated by the adapter 7 and then record the edited result on the video tape cassette 11 through the effect of the digital video tape recorder 8. The arrangement of each component is the same as described above. Hence, the description thereabout is left off the specification.

The picture information system 5 enables the CPU 17 to generate the improper editing location information. In place, the system 5 enables the CPU 17 to generate the proper editing location information.

In turn, the description will be oriented to an apparatus for converting picture information, an apparatus for reading information, and an apparatus for removing a derived frame according to a second embodiment of the invention with reference to Figs.19 to 25.

The second embodiment of the invention, as shown in Fig.19, concerns with a picture information editing system 130 having a pull-down converter 138 and a derived frame reader 143. The converter 138 corresponds to a concrete arrangement of a picture information converter. The reader 143 corresponds to a concrete arrangement of an information reader.

The picture information editing system 130 operates to convert the picture information on a cinema film 131 imaged at a unit of 24 frames per second (Fps) into an NTSC system video signal of 525 / 59.94 and edit the video signal of 525 / 59.94.

The picture information editing system includes a telecine apparatus 132 for performing 25-Fps reproduction (termed PB in Fig.19) with respect to the picture information on the cinema film 131 imaged at

24 Fps and converting the picture information into a video signal of 625 / 50, a digital video tape recorder (VTR) 133 for recording the video signal of 625 / 50 converted by the telecine apparatus 132 in a video tape cassette 134 at the same scan line number / field frequency, a modify digital VTR 135 for reproducing the picture data of 625 / 50 recorded in the video cassette tape 134 by the digital VTR 133 at a field frequency of 47.952 Hz (precisely, 60/1.001 x 4/5 = 47.95204795. . . , however, which will be described as 47. 952 below.), a pull -down converter 138 for sequentially distributing each frame of a four-frame unit of the picture data of 625 / 47.95 obtained by the modify digital VTR 135 at two patterns for generating a field picture, performing a 3 : 2 pull-down process for converting the field picture into picture data having a field frequency 59.94 Hz (precisely, 60/1.001 = 59.94005994 .... which will be described as 59.94 below) whose frame unit is five frames, adding to the picture data a predetermined mark for indicating that the picture data is composed of a derived frame formed of fields of different frames of the cinema film based on the information about the sequential distribution of each frame for generating the field picture used in the 3 : 2 pull-down process, that is, the pull-down sequence information, supplying the resulting information to a monitor 139 (to be discussed below), and inserting the pull-down sequence information to an auxiliary recording area of the picture data before outputting the picture data, the monitor 139 for displaying the picture data containing the predetermined mark sent from the pull-down converter 138 and the picture data containing no mark so that an operator can check the picture data, an editor 140 for performing a predetermined editing process with respect to the picture data after the operator checks the picture data containing the predetermined mark displayed on the monitor 139 and the picture data containing no mark and determines if the picture data is proper to an editing point, a digital VTR 141 for recording / reproducing the picture data edited by the editor 140 on or from the video tape cassette 142, a derived frame reader 143 for reading the pull-down sequence information inserted to the auxiliary recording area when reproducing the picture data containing the pull-down sequence information recorded on the auxiliary recording area of the video tape cassette 142 by the digital VTR 141 and for adding to the picture data the predetermined mark for indicating it is the derived frame before outputting the picture data, and a monitor 144 for displaying the picture data containing the predetermined mark or no mark supplied from the derived frame reader 143.

At the previous stage of the pull-down converter 138 is provided a scan line number converter 137 composing an NTSC converter 136 in combination with the pull-down converter 138. The scan line number converter 137 operates to convert the scan line number of the video signal of 625 / 47.952 obtained by the modify digital VTR 135 into 525.

The scan line number converter 137 performs a vertical filtering operation about 625 scan lines from 576 active lines to 486 ones for deriving 525 scan lines. The vertical resolution given if 625 scan lines are provided is higher than the vertical resolution given if 525 scan lines are provided. This prevents the loss of the vertical resolution in the re-sampling process, which may result in enhancing

the picture quality.

As described above, the pull-down sequence information used when the pull-down converter 138 performs a 3 : 2 pull-down process corresponds to the information about the sequential distribution of each frame for generating the field picture used in the 3 : 2 pull-down process.

As an example, the pull-down sequence information is the information for indicating the subject frame is a derived frame composed of fields of the different two cinema film frames. In place, it may be the information for indicating the head or the location of the five-frame sequence of the subject frame to be edited. Concretely, it is the information about two or three sequential distributions of each frame of the picture information of the cinema film, the detail of which will be described below.

As described above, the pull-down sequence information is inserted to the auxiliary recording area of the picture data. The auxiliary recording area may be a user's bit of the LTC whose format is shown in Fig.5, a UB of the VITC whose format is shown in Fig.6, or a user's bit of a video index or an audio AUX. The operator selectively operates to insert and record the pull-down sequence information in the user's bit (UB) of the LTC or the VITC or the user's bit of the video index or the audio AUX. The video index means a portion of a chroma line where the user's information can be written. The portion does not correspond to the picture to be recorded on the tape. If the audio AUX has a non-use portion where the user's information can be written, the portion may be used as the auxiliary recording area.

The pull-down converter 138 is operated to insert the pull-down sequence information on the auxiliary recording area of the picture data according to the user's arbitrary selection. For example, when the pull-down sequence information indicates the picture frame to be processed is the derived frame composed of fields of different cinema film frames, "D" is inserted on the auxiliary recording areas of the frames c and d as shown in [1] of Fig.20. As shown in [2] of Fig.20, when the pull-down sequence information indicates the subject picture frame is located at the head of the sequence, for example, "S" may be inserted on the auxiliary recording area of the frame a.

In the case of using "D" for indicating the derived frame as the pull-down sequence information, the pull-down converter 138 operates to generate the character "D" for the "D" and add it to the picture data corresponding to the pull-down converted output and then output the resulting data to the monitor 139.

The detail of the pull-down converter 138 will be described below with reference to Fig.21.

The pull-down converter 138 includes a pull-down processing unit 145 for performing a 3 : 2 pull-down process as shown in Fig.22 for converting the picture data having a field frequency of 47.952 Hz into the picture data having a field frequency of 59.94 Hz by rearranging the sequence of the field pictures for changing the frame unit from four frames into five frames, an additional

information inserting unit 147 for writing the information about the arranging sequence of the field pictures, that is, the pull-down sequence information in the auxiliary recording area of the picture data having the field frequency of 59.94 Hz sent from the pull-down sequence processing unit 145, a central processing unit (CPU) 146 for supplying the pull-down sequence information to the pull-down processing unit 145 and the additional information inserting unit 147 for controlling the operation of the units 145 and 147, a character generator 148 for generating the "D" mark from the pull-down sequence information under the control of the CPU 146, and a memory 149 for saving a program and operational data.

Under the control of an external controller 150, the pull-down converter 138 performs the pull-down process,the insertion of the pull-down process, and the generation of the "D" mark on the program in the memory 149 executed by the CPU 146. That is, the pull-down processing unit 145 performs the 3 : 2 pull-down process as shown in Fig.22 for supplying the picture data, which corresponds to the output to be pulled down, to the additional information inserting unit 147. The CPU 146 grasps the sequence information used for the 3 : 2 pull-down process. Hence, the CPU 146 operates to control the character generating unit 148 based on the pull-down sequence information, add the "D" mark to the picture data, and derive the output for the monitor 139. The CPU 146 further controls the additional information inserting unit 147 and insert the additional information containing the pull-down sequence information on the auxiliary recording area of the picture data sent from the pull-down processing unit 145.

The pull-down converter 138 operates to supply to the monitor 139 the picture data containing the character "D" generated on the pull-down sequence information. The monitor 139 operates to add the "D" mark to the time code TC "23 : 59 : 59 : 29" and display the "TC : 23 : 59 : 59 : 29D" together with the picture data as shown in Fig.23.

Hence, the operator, who edits the picture data of 525 / 59.94 through the effect of the editor 140, can check the pull-down sequence information with the "D" mark appearing on the monitor 139. As mentioned above, the frame of the picture data containing the "D" mark added thereto is the derived frame composed of different frames of the cinema film. Hence, the operator can use the direct frame as an editing point without using the "D" mark added frame as the editing point. Conventionally, the operator has been required to stop the film and watch a still picture for determining if the subject frame is the derived frame or the direct frame. The present system for editing the picture information operates to automatically indicate the subject frame is the derived frame. This operation makes the editing work easier and the burden on the operator lighter.

Next, when the editor 140 selects the editing point and records the edited picture data, the picture data, which is depicted as a real line output in Fig.23, and the pull-down sequence information inserted to the auxiliary recording area, both of which are supplied from the pull-down converter 138, are recorded on the video cassette tape 142 through the effect of the digital VTR 141.

When the digital VTR 141 reproduces the data from the video tape cassette 142 in a still mode, a shuffle mode or a normal mode, the derived frame reader 143 operates to read the pull-down sequence information from the additional information recorded on the auxiliary recording area of the picture data and send it to the monitor 144 so that the monitor 144 can display the "D" mark as shown in Fig.21.

The detail of the derived frame reader 143 will be described with reference to Fig.24. The derived frame reader 143 includes an additional information separating unit 145 for separating the additional information containing the pull-down sequence information from the picture data of 525 / 59.94 reproduced by the digital VTR 141, an additional information reader 146 for reading the additional information separated by the separating unit 145, a CPU 147 for sensing the pull-down sequence information from the additional information read by the reader 146, a character generating unit 148 for generating the "D" mark from the pull-down sequence information under the control of the CPU 147, and a memory 149 for saving a program or operational data.

The derived frame reader 143 operates to sense the pull-down sequence information inserted to the video data of 525 / 59.94 through the effect of the CPU 147, generate the "D" mark by using the pull-down sequence information, and add the mark to the monitoring output for the monitor 144.

As shown in Fig.23, the monitor 144 operates to add the "D" mark to the time code TC "23 : 59 59 : 29" and display the indication of "TC : 23 : 59 : 59 : 29D" together with the picture data. It goes without saying that the indication is one example.

Hence, the derived frame reader 143 enables to read the pull-down sequence information from the picture data to be edited that is recorded on the video tape cassette 142, for example and add the "D" mark to the monitoring output based on the pull-down sequence information.

The introduction of the derived frame reader 143 introduced into the input portion of the video data as shown in Fig.25 results in forming the derived frame remover 150.

The derived frame remover 150 is composed of the derived frame reader 143 whose arrangement has been described with reference to Fig.24, a derived frame removing unit 151 for removing the derived frame, and a frame memory 152. The remover 150 operates to put the picture data from which the derived frame is removed into a hard disk drive (HDD) 153 of a personal computer, for example.

The derived frame removing unit 151 operates to remove the derived frame stored in the frame memory 152 based on the pull-down sequence sensed by the CPU 147, concretely in this case, the information for indicating the location of the derived frame.

The picture data to be transferred from the frame memory 152 to the HDD 153 is composed of purely direct frames. It means that the derived frames are removed from the picture data.

The picture information editing system 160 as shown in Fig.26 is provided as a transformation of the second embodiment.

This picture information editing system 160 operates to convert the picture information imaged on the cinema film 9 at 25 Fps into an NTSC system video signal of 525 / 59.94 and edit this video signal of 525 / 59.94.

This picture information editing system 160 is different from the picture information editing system 130 shown in Fig.19 in the respect that the cinema film 161 imaged at 25 Fps is reproduced at 25 Fps by the telecine apparatus 132, the picture data reproduced by the modify digital VTR 162 contains the field frequency of 49.95 Hz (precisely, 50 / 1.001 = 49-95004995 ... , which will be described as 49.95 below), and the pull-down converter 165 of the NTSC converter 163 performs a pull-down process of 3 : 2 : 3 : 2 : 2, that is , the pull-down process is 6/5 time as great as that of the second embodiment. The other components are the same as those of the system shown in Fig.19 and thus are not described herein.

The detail arrangement of the pull-down converter 165 is the same as that shown in Fig.21. The pull-down processing unit 145 performs a pull-down process of 3 : 2 : 3 : 2 : 2 as shown in Fig.27.

The pull-down process of 3 : 2 : 3 : 2 : 2 is executed to scan the cinema film at an interlaced mode so that the even fields of the film are converted into the even fields of the video signal and the odd fields of the film are converted into the odd fields of the video signal. One frame of the cinema film is composed of two same fields between which no time lag appears. The converted NTSC video signal is proper on time.

That is, as shown in Fig.27, the pull-down process of 3 : 2 : 3 : 2 : 2 is executed to produce six frames (a, b, c, d, e, f) of video data from five frames (A, B, C, D, E) of a cinema film. However, no unfavorable condition takes place in the field sequence inside of the frame, so that no watcher feels the motion of the picture unnatural.

However, the c frame and the d frame (marked as X) are produced from the pictures of the fields between which a time lag appears, which are derived from the B and the C frames and the C and the D frames. Hence, even on the same frame, a watcher feels the motion of the reproduced picture unnatural.

The pull-down converter 165 provided in the picture information editing system operates to insert the pull-down sequence information as the additional information to the auxiliary recording area of the picture data through the effect of an additional information inserting unit 147.

For example, the pull-down sequence information for indicating that the picture frame to be processed is a derived frame composed of different frames of the cinema film, that is, "D" is inserted to the auxiliary recording area of the frames c and d. The pull-down sequence information of "S" for indicating the head of the sequence may be inserted to the auxiliary recording area of the frame a.

The pull-down converter 165 operates to supply to the monitor 139 the picture data containing the character "D" generated by using the pull-down sequence information. As shown in Fig.21, the monitor 139 operates to add the "D" mark to the time code TC "23 : 59 : 59 : 29" and display the indication of "TC : 23 :

59 : 59 : 29D" together with the picture data.

When the operator edits the picture data of 525 / 59.94 with the editor 140, the operator can check the pull-down sequence information through the "D" mark appearing on the monitor 139. The frame of the picture data containing the "D" frame added thereto is a derived frame formed of different frames of the cinema film as mentioned above. Hence, not the frame with the "D" mark but the direct frame may be used as an editing point. Conventionally, an operator has been required to stop the moving picture and watch a still picture for determining if the frame is a derived one or a direct one. This picture information editing system 160 enables to automatically display that the frame is the derived one, so that the system makes the editing operation easier and the burden on the operator lighter.

Herein, the description will be oriented to the information about the sequential distribution of each frame for generating the field picture, that is, the information about two or three sequential distribution of each frame of the picture information of the cinema film, which corresponds to the pull-down sequence information with reference to Fig.28. The description concerns with the example that the information can be written in the VITC so that the character can be added at a field unit.

Fig.28A denotes four frames (02 to 05 frames) of the cinema film. Fig.28B denotes five frames (02 to 06 frames) of an NTSC image.

Fig.28C denotes a mark D for indicating the derived frame, which is added to each field. Herein, the 03 and 04 frames of the NTSC image are the derived ones. The mark D is added to each of a pair of fields of the 03 and 04 frames.

Fig.28D denotes a T mark added at the head of the film frame contained in the information about two or three sequential distributions of each of the picture information of the film. In the edition intended not to break the film frame, it can be used for limiting the selection of an IN point. Only the field with the T mark can be selected as an IN point. Or, only the field one before the T mark can be selected as an OUT point.

Fig. 28E denotes a T_1 mark which is located at the head of the film frame and can be used when a joint is done at a top field F_1 of the information about two or three sequential distributions of each frame of the picture information of the cinema film in the edition intended not to break the film frame. Only the field with the T_1 mark is selected as an IN point.

Fig. 28F denotes a T_2 mark which is located at the head of the film frame and can be used when a joint is done at a bottom field F_2 of the information about the two or three sequential distribution of each frame of the picture information of the cinema film in the edition intended not to break the film frame. Only the field with the T_2 mark can be selected as an IN point.

Fig.28G denotes a C_3 mark for indicating succession of three video fields produced from the same film frame of the information about the two or three sequential distribution of each frame of the picture information of the cinema film. When the C_3 mark is found, three video fields produced from the same film frame come in succession. When no C_3 mark is found, only two video fields produced from the same film frame come in succession. This is effectively used for a speed-variable reproduction such as a slow-motion reproduction as in the telecine apparatus except a periodic sequence, for example, a repetition of 3 : 2 process

such as 3 : 2 pull-down process. Further, this is effective in filtering a video signal through the use of video fields in the process of noise removal or compression.

Fig.28H denotes a C_2 mark which indicates succession of two video fields produced from the same film frame of the information about the two or three sequential distribution of each frame of the picture information of the cinema film. When the C_2 mark comes, it means the succession of two video fields produced from the same film frame. When no C_2 mark comes, it means the succession of only three video fields.

Fig.28I denotes an E mark which represents the same field (overlapped field) appearing when three video fields are produced from one film frame of the information about two or three sequential distribution of each frame of the picture information of the cinema film. This may be used for simplifying the hardware / software provided in a field remover of an instrument for removing an overlapped field, such as an MPEG 2 encoder.

As set forth above, the system of this embodiment enables to add various kinds of marks indicated at Figs.28C to 28I to the video field based on the information about the sequential distribution of each frame for generating the field picture. This function makes it possible to reduce the burden of the operator about various kinds of editions.

The arrangement of the digital VTR or the modify digital VTR is the same as that described with reference to Figs.14 to 16.

In addition, the concrete arrangement of the picture information transmitting method may refer to an apparatus for transmitting the NTSC picture data containing the pull-down sequence information output from the pull-down converter 138 through a transmission path (not shown), which is included in the picture information editing system 130 shown in Fig.19. This apparatus is arranged to have all the components of the pull-down converter and a transmitting unit newly added thereto.

This arrangement makes it possible to automatically add the pull-down sequence information to the picture information before the picture information is transmitted. Hence, this function makes it easy for the operator who receives the data to edit the data.

The recording medium according to an embodiment of the present invention is arranged to record a program including the steps of generating a field picture by sequentially distributing each frame inside of a four-frame unit of the picture information of the cinema film and converting the picture information into an NTSC video signal whose frame number unit is five and writing on the auxiliary recording area of the NTSC video signal the information about sequential distribution of each frame for generating the field picture, that is, the pull-down sequence information.

The method for processing a time code according to the present invention is arranged to generate the information for indicating if the subject frame is proper to edition when converting a predetermined system picture information into another system picture information and write the information to the time code data accompanied with another system picture information. This method thus enables to generate the time code for automatically discriminating the proper starting point to the edition.

The apparatus for processing a time code according to the present invention is arranged to write the information generated by means for generating information about the editing location in the time code data accompanied with another system picture information through the effect of means for generating a time code. This apparatus thus enables to generate the time code for automatically discriminating a proper starting point to the edition.

The apparatus for converting picture information according to the invention is arranged to automatically add the pull-down sequence information to the picture information. This apparatus thus makes it easier for the operator to do the editing operation.

The apparatus for reading information according to the invention is arranged to automatically read the pull-down sequence information. This apparatus thus makes it easier for the operator to do the editing operation.

The apparatus for removing a derived frame according to the invention is arranged to automatically remove the derived frame. Hence, this apparatus makes it easier for the operator to do the editing operation and possible to prevent the waste of the recording medium volume and to reduce the cost of the relevant picture input device.

The method for transmitting picture information according to the invention is arranged to automatically add the pull-down sequence information to the picture information. This method makes the operation of the operator who receives the picture information simpler.

Further, the recording medium according to the invention is arranged to record a program containing a procedure of automatically adding the pull-down sequence information to the picture information. Hence, the recording medium makes the operator's operation simpler.

WHAT IS CLAIMED IS:

1. A method for processing a time code comprising the steps of:

generating information indicating whether or not a location is proper to edition when converting picture information of a predetermined system into picture information of another system; and

writing said information to time code data accompanied with said picture information of another system.

2. The method for processing a time code as claimed in claim 1, wherein said time code data is recorded lengthwise.

3. The method for processing a time code as claimed in claim 1, wherein said time code data concerns with a vertical blanking interval.

4. An apparatus for processing a time code when converting picture information of a predetermined system into picture information of another system, comprising:

means for generating information indicating whether or not a location is proper to edition; and

means for generating a converted time code by writing said information from said means onto time code data accompanied with said picture information of another system.

5. The apparatus for processing a time code as claimed in claim 4, wherein said time code data is recorded lengthwise.

6. The apparatus for processing a time code as claimed in claim 4, wherein said time code data concerns with a vertical blanking interval.

7. A picture information converting apparatus for converting picture information of a first system into picture information of a second system, comprising:

converting means for converting the picture information of said first system into the picture information of said second system whose frame number unit is different from that of said first system by sequentially distributing each frame inside of a predetermined frame number unit of said picture information at plural patterns for generating a field picture;

writing means for writing information about sequential distribution of each frame for generating said field picture on an auxiliary recording area of said second system picture information sent from said converting means; and

control means for controlling said converting means and said writing means.

8. The picture information converting apparatus as claimed in claim 7, wherein the picture information of said first system corresponds to picture information imaged on a cinema film and the picture information of said second system corresponds to an NTSC video signal.

9. The picture information converting apparatus as claimed in claim 7, wherein said converting means performs a 3 : 2 pull-down process or a 3 : 2 : 3 : 2 : 2 pull-down process for converting the picture information of said first system into the picture information of said second system.

10. The picture information converting apparatus as claimed in claim 7, wherein said control means operates to supply to said writing means information indicating a derived frame contained in the picture information of said second system, a field picture of said derived frame composed of two different frames of the picture information of said first system, as the information about sequential distribution of each frame for generating said field picture.

11. The picture information converting apparatus as claimed in claim 10, wherein the information indicating the derived frame contained in the picture information of said second system is recognized to be improper to edition in the process of editing the picture information of said second system.

12. The picture information converting apparatus as claimed in claim 7, wherein said control means operates to supply to said writing means the information about two or three sequential distribution of each frame of the picture information of said first system as the information about sequential distribution of each frame for generating said field picture.

13. The picture information converting apparatus as claimed in claim 6, further comprising generating means for generating a character based on the information about sequential distribution of each frame for generating said field picture supplied from said control means.

14. The picture information converting apparatus as claimed in claim 7, wherein said writing means operates to write the information about sequential distribution of each frame for generating said field picture onto a video index of the picture information of said second system, a lengthwise time code, or a user's bit of a time code about vertical blanking interval.

15. An information reading apparatus for reading information about sequential distribution of each frame for generating a field picture in a process of converting picture information of a first system into picture information of a second system whose frame number unit is different from that of said first system by sequentially distributing each frame inside of a predetermined frame number unit of the picture information

at plural patterns for generating a field picture, comprising:

separating means for separating the information about sequential distribution of each frame for generating said field picture from the picture information of said second system; and

sensing means for sensing the information about sequential distribution of each frame for generating said field picture separated by said separating means.

16. The information reading apparatus as claimed in claim 15, further comprising means for generating a character based on the information about sequential distribution of each frame for generating said field picture sensed by said sensing means.

17. The information reading apparatus as claimed in claim 15, wherein the picture information of said first system is imaged on a cinema film and the picture information of said second system is an NTSC video signal.

18. The information reading apparatus as claimed in claim 15, wherein said picture information converting process performs a 3 : 2 pull-down process or a 3 : 2 : 3 : 2 : 2 pull-down process.

19. The information reading apparatus as claimed in claim 15, wherein the information about sequential distribution of each frame for generating said field picture is information for indicating a derived frame contained in the picture information of said second system, a field picture of said derived frame composed of two different frames of the picture information of said first system.

20. The information reading apparatus as claimed in claim 19, wherein the information indicating a derived frame contained in the picture information of said second system is recognized to be improper to edition in the process of editing the picture information of said second system.

21. The information reading apparatus as claimed in claim 15, wherein the information about sequential distribution of each frame for generating said field picture is the information about two or three sequential distribution of each frame of the picture information of said first system.

22. A derived frame removing apparatus for removing a derived frame from picture information of a second system by using the information for indicating said derived frame contained in the picture information of said second system, the field picture of said derived frame composed of two different frames of picture information of a first system as information about sequential distribution of each frame for generating a field picture in the process of converting the picture information of said first system into the picture information of said second system whose frame number unit is different from that of the picture information of said first system by sequentially distributing each frame inside of a predetermined frame number unit of

the picture information of said first system at plural patterns for generating the field picture, comprising:

separating means for separating the information indicating said derived frame from the picture information of said second system;

sensing means for reading and sensing the information indicating said derived frame separated by said separating means; and

removing means for removing said derived frame from the picture information of said second system based on the information indicating the location of said derived frame sensed by said sensing means.

23. The derived frame removing apparatus as claimed in claim 22, wherein the picture information of said first system is recorded on a cinema film and the picture information of said second system is an NTSC video signal.

24. The derived frame removing apparatus as claimed in claim 22, wherein the process of converting picture information is a 3 : 2 pull-down process or a 3 : 2 : 3 : 2 : 2 pull-down process.

25. The derived frame removing apparatus as claimed in claim 22, wherein the information indicating the derived frame contained in the picture information of said second system is recognized to be improper to edition in the editing process of the picture information of said second system.

26. A method for transmitting picture information after converting picture information of a first system into picture information of a second system, comprising the steps of:

converting the picture information of said first system into the picture information of said second system whose frame number unit is different from that of said first system by sequentially distributing each frame inside of a predetermined frame number unit at plural patterns for generating a field picture;

writing information about sequential distribution of each frame for generating said field picture on an auxiliary recording area of the picture information of said second system, and

transmitting the picture information of said second system.

27. A recording medium for recording a procedure of converting picture information of a first system into picture information of a second system, said procedure having the steps of:

converting the picture information of said first system into the picture information of said second system whose frame number unit is different from that of said first system by sequentially distributing each

frame inside of a predetermined frame number unit of the picture information of said first system for generating a field picture; and

writing information about sequential distribution of each frame for generating said field picture on an auxiliary recording area of the picture information of said second system sent from said converting step.

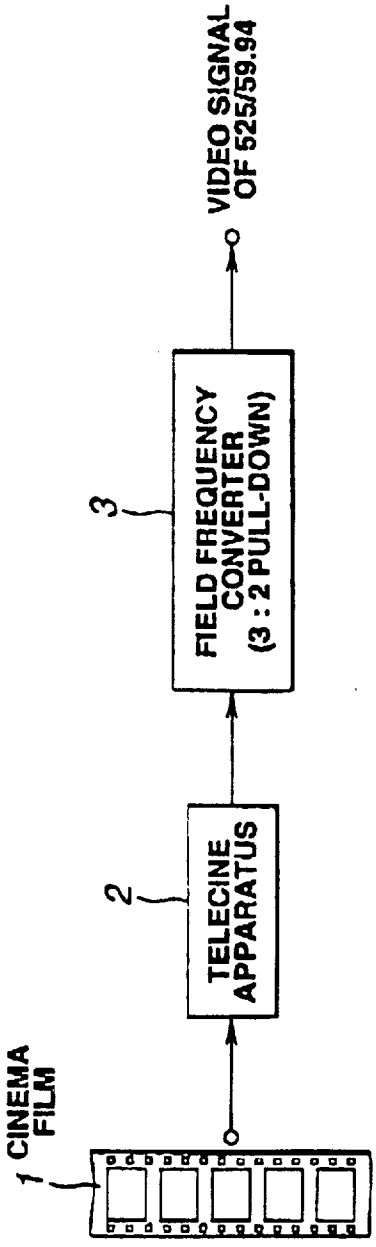
1 CINEMA FILM
2 TELECINE APPARATUS
3 FIELD FREQUENCY CONVERTER (3 : 2 PULL-DOWN)
VIDEO SIGNAL OF 525/59.94

FIG.1

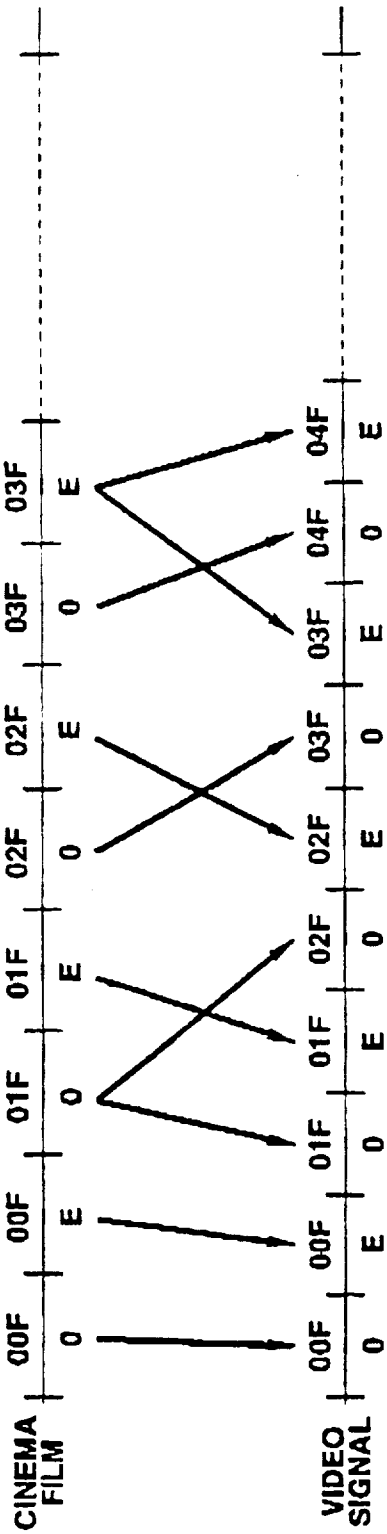
CINEMA FILM
VIDEO SIGNAL
00F
0
00F
E
01F
0
01F
E
02F
0
02F
E
03F
0
03F
E
00F
0
00F
E
01F
0
01F
E
02F
0
02F
E
03F
0
03F
E
04F
0
04F
E

FIG.2

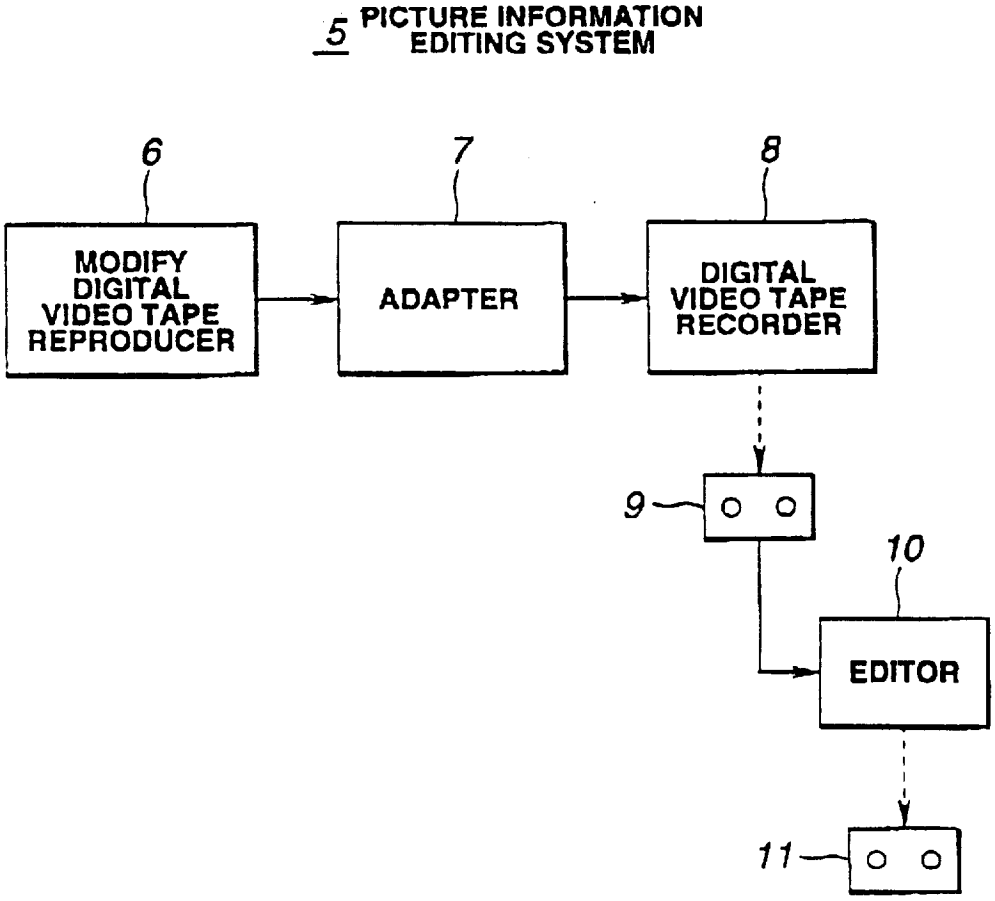
5 PICTURE INFORMATION EDITING SYSTEM
6
7
8
MODIFY DIGITAL VIDEO TAPE REPRODUCER
ADAPTER
DIGITAL VIDEO TAPE RECORDER
9
10
EDITOR
11

FIG.3

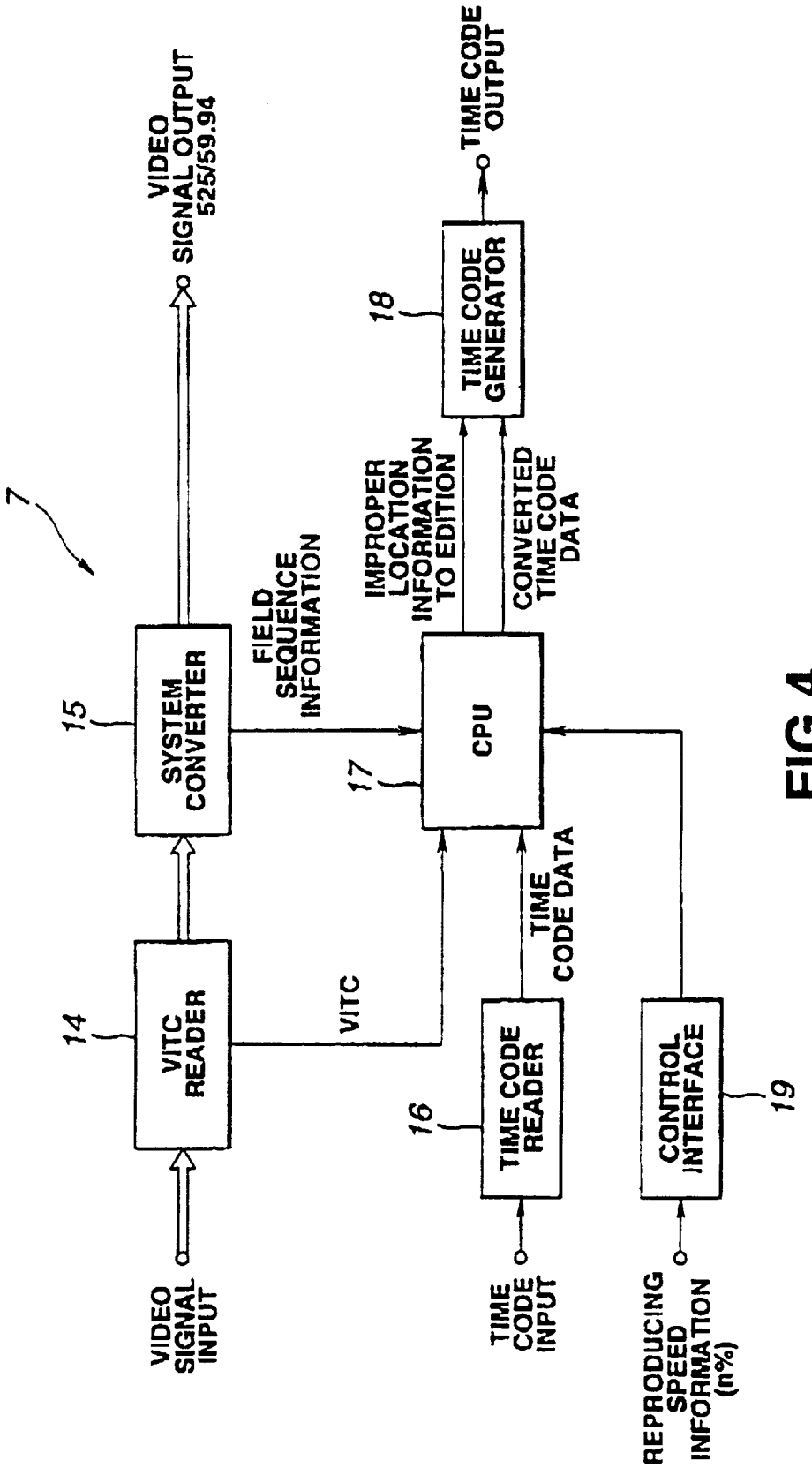
7
VIDEO SIGNAL OUTPUT 525/59.94
TIME CODE OUTPUT
18
TIME CODE GENERATOR
IMPROPER LOCATION INFORMATION TO EDITION
CONVERTED TIME CODE DATA
FIELD SEQUENCE INFORMATION
15
SYSTEM CONVERTER
CPU
17
14
VITC READER
VITC
TIME CODE DATA
16
TIME CODE READER
CONTROL INTERFACE
19
VIDEO SIGNAL INPUT
TIME CODE INPUT
REPRODUCING SPEED INFORMATION (n%)

FIG.4

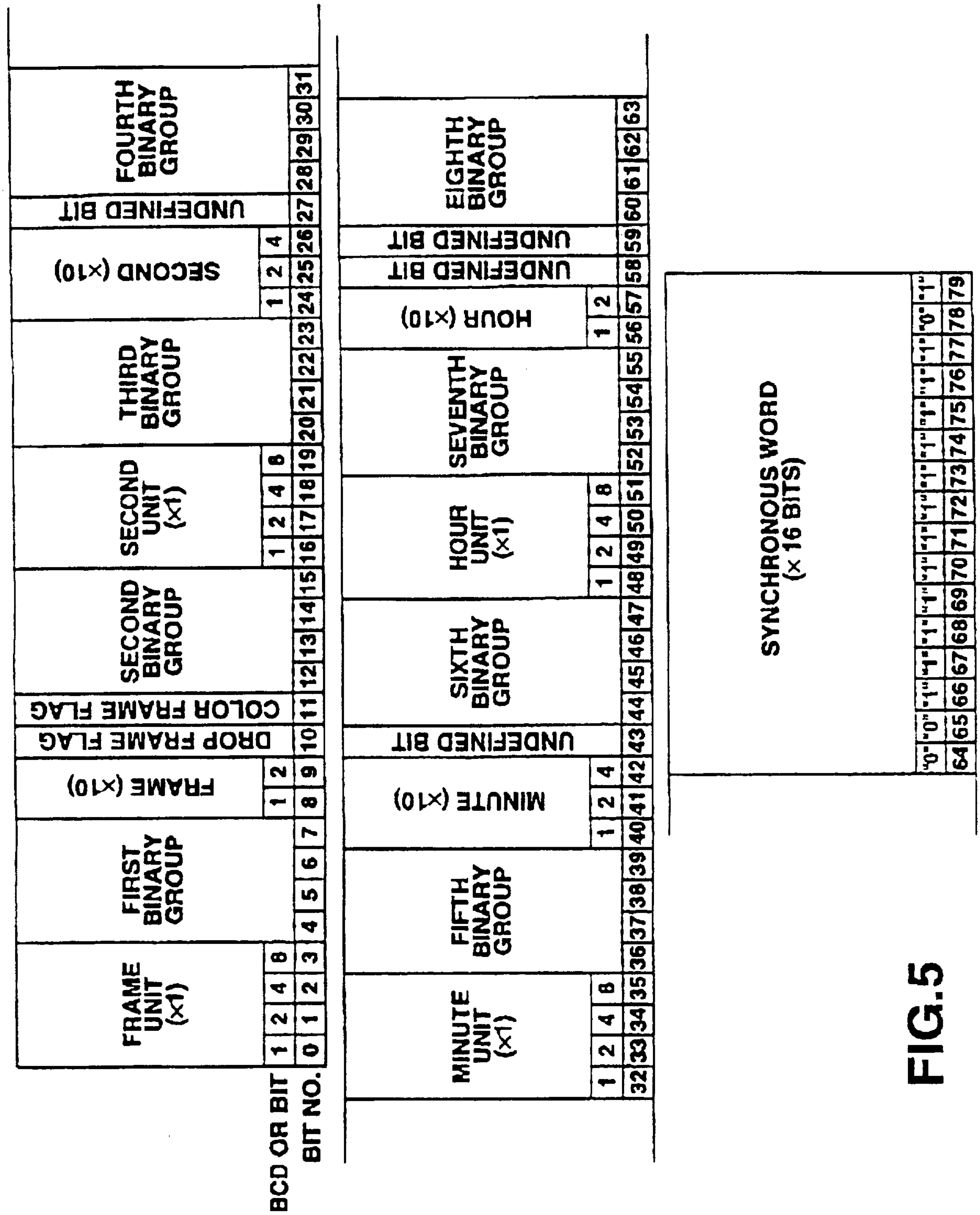
BCD OR BIT
BIT NO.
FRAME UNIT (×1)
FIRST BINARY GROUP
FRAME (×10)
DROP FRAME FLAG
COLOR FRAME FLAG
SECOND BINARY GROUP
SECOND UNIT (×1)
THIRD BINARY GROUP
SECOND (×10)
UNDEFINED BIT
FOURTH BINARY GROUP
MINUTE UNIT (×1)
FIFTH BINARY GROUP
MINUTE (×10)
UNDEFINED BIT
SIXTH BINARY GROUP
HOUR UNIT (×1)
SEVENTH BINARY GROUP
HOUR (×10)
UNDEFINED BIT
UNDEFINED BIT
EIGHTH BINARY GROUP
SYNCHRONOUS WORD (× 16 BITS)

FIG.5

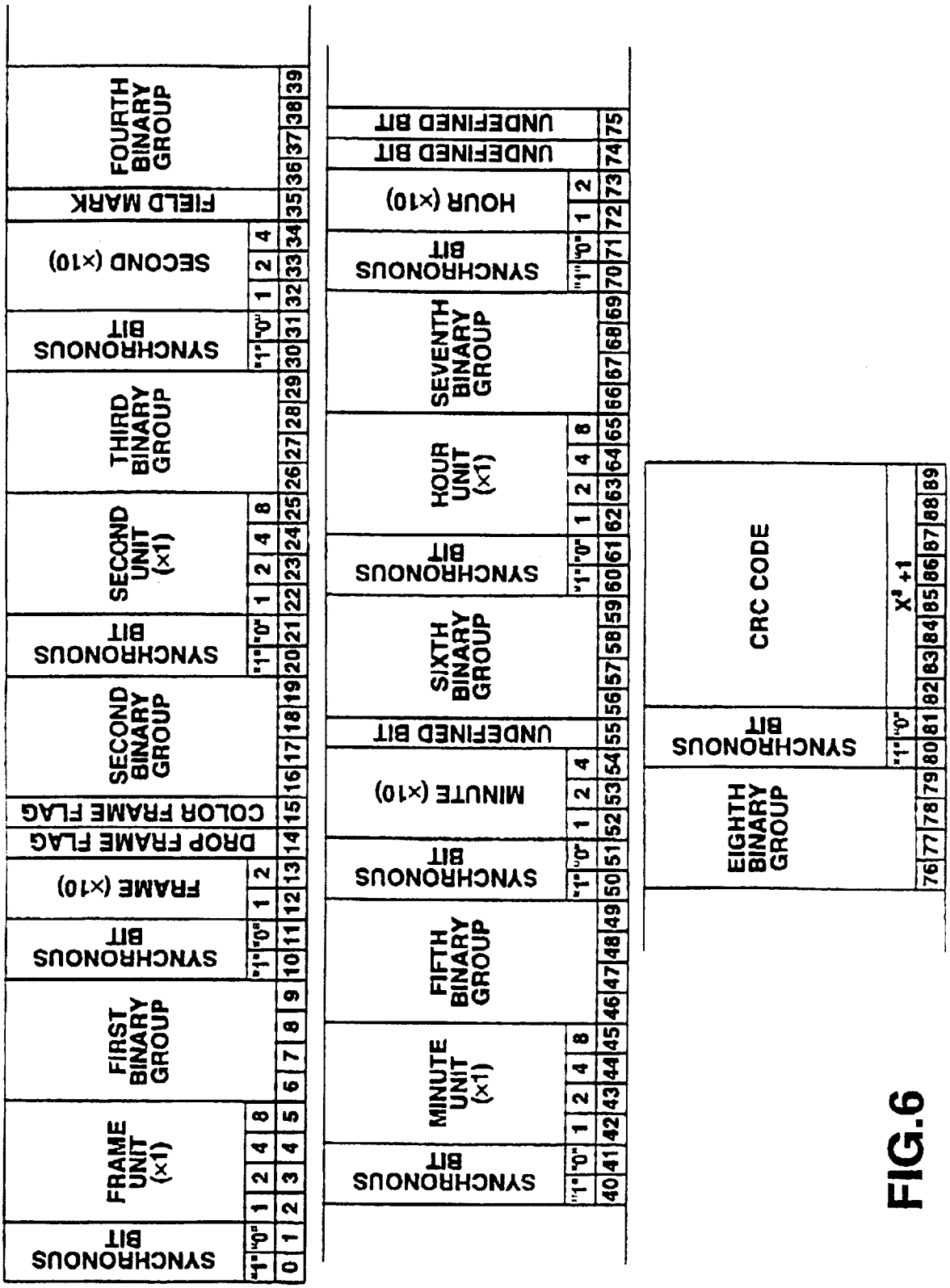
SYNCHRONOUS BIT
FRAME UNIT (×1)
FIRST BINARY GROUP
SYNCHRONOUS BIT
FRAME (×10)
DROP FRAME FLAG
COLOR FRAME FLAG
SECOND BINARY GROUP
SYNCHRONOUS BIT
SECOND UNIT (×1)
THIRD BINARY GROUP
SYNCHRONOUS BIT
SECOND (×10)
FIELD MARK
FOURTH BINARY GROUP
SYNCHRONOUS BIT
MINUTE UNIT (×1)
FIFTH BINARY GROUP
SYNCHRONOUS BIT
MINUTE (×10)
UNDEFINED BIT
SIXTH BINARY GROUP
SYNCHRONOUS BIT
HOUR UNIT (×1)
SEVENTH BINARY GROUP
SYNCHRONOUS BIT
HOUR (×10)
UNDEFINED BIT
UNDEFINED BIT
EIGHTH BINARY GROUP
SYNCHRONOUS BIT
CRC CODE
X³ +1

FIG.6

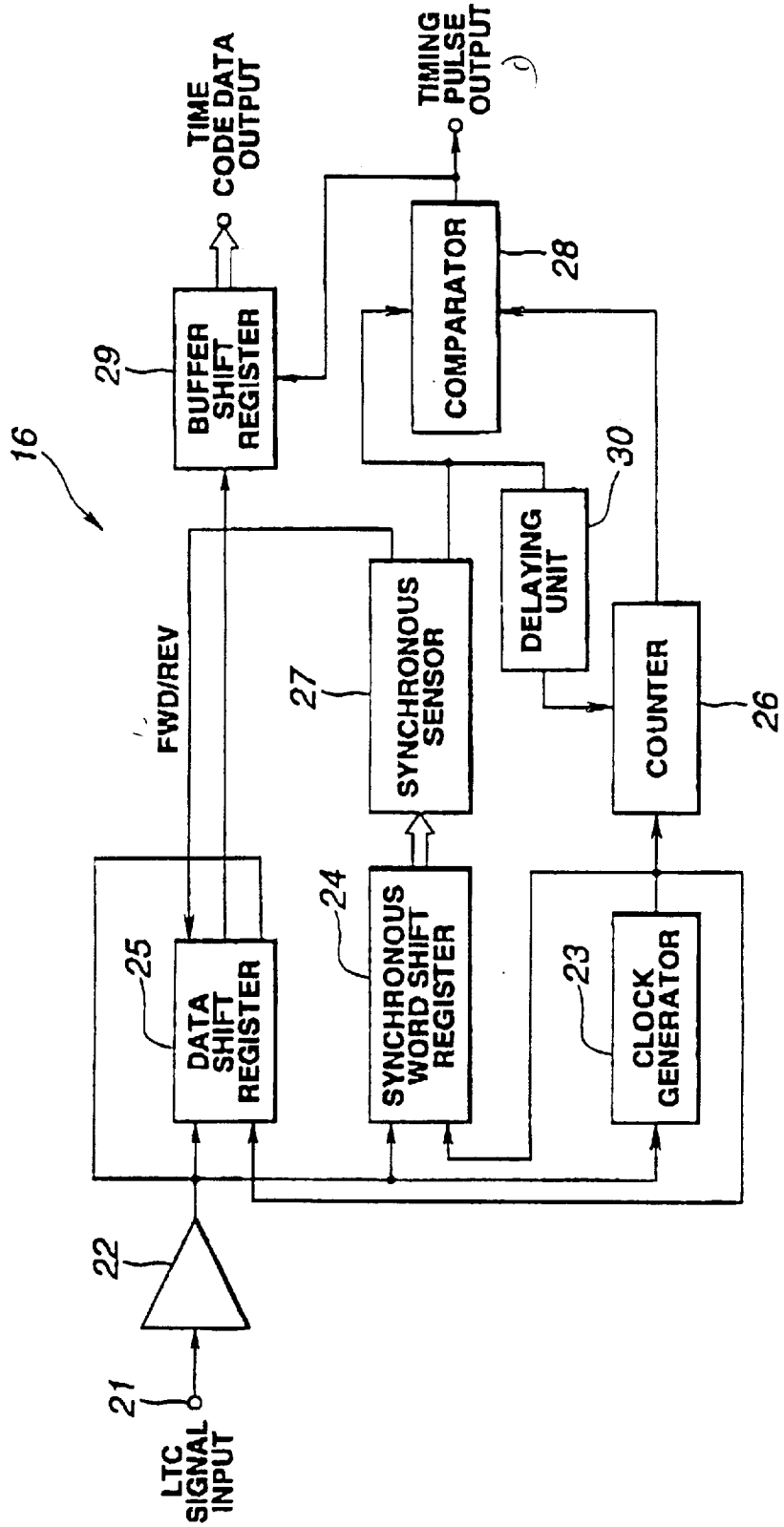
16
LTC SIGNAL INPUT
21
22
DATA SHIFT REGISTER
25
SYNCHRONOUS WORD SHIFT REGISTER
24
SYNCHRONOUS SENSOR
27
FWD/REV
BUFFER SHIFT REGISTER
29
TIME CODE DATA OUTPUT
COMPARATOR
28
TIMING PULSE OUTPUT
DELAYING UNIT
30
CLOCK GENERATOR
23
COUNTER
26

FIG.7

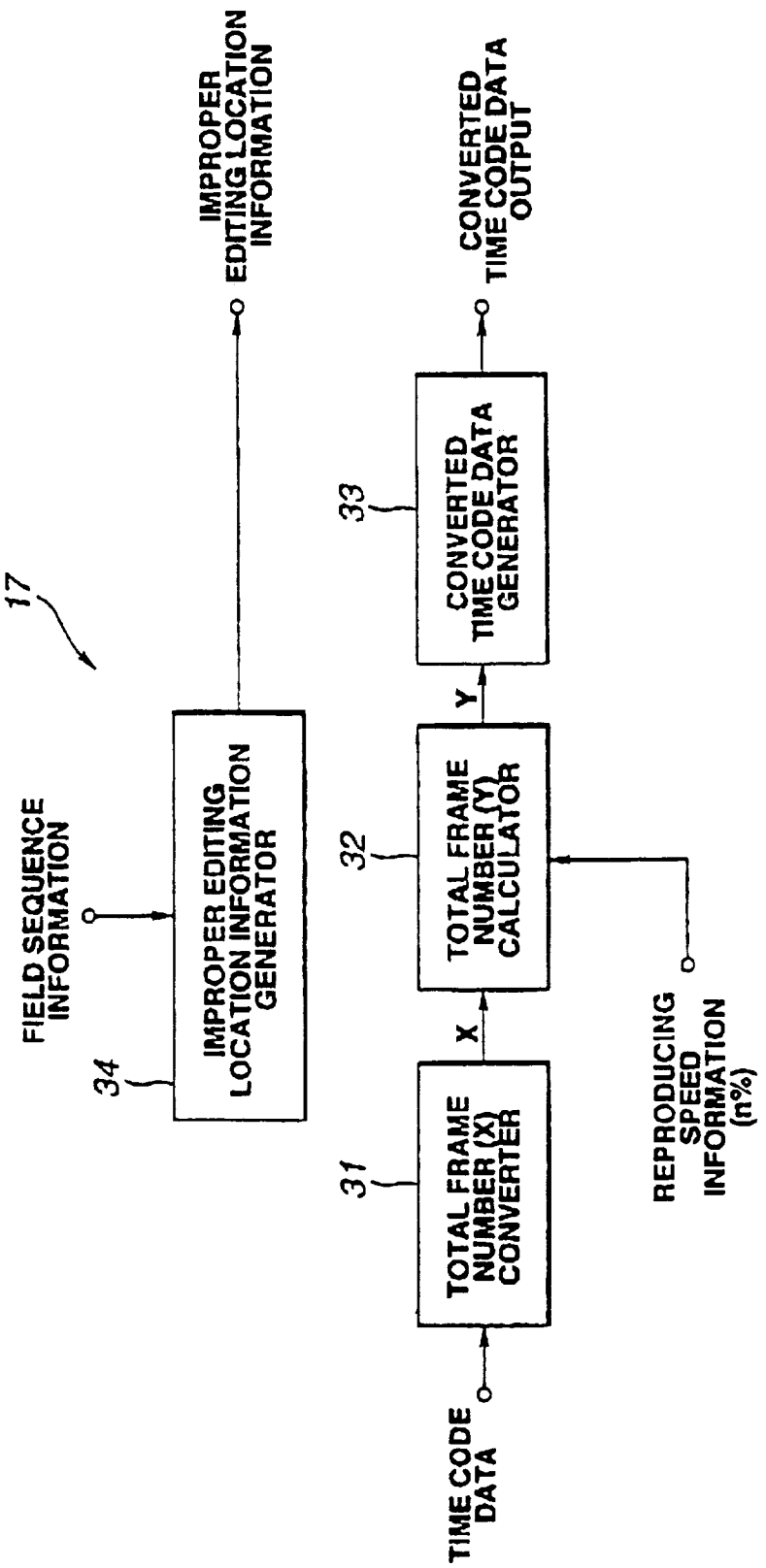
17
FIELD SEQUENCE INFORMATION
34
IMPROPER EDITING LOCATION INFORMATION GENERATOR
IMPROPER EDITING LOCATION INFORMATION
32
TOTAL FRAME NUMBER (Y) CALCULATOR
Y
33
CONVERTED TIME CODE DATA GENERATOR
CONVERTED TIME CODE DATA OUTPUT
X
31
TOTAL FRAME NUMBER (X) CONVERTER
TIME CODE DATA
REPRODUCING SPEED INFORMATION (n%)

FIG.8

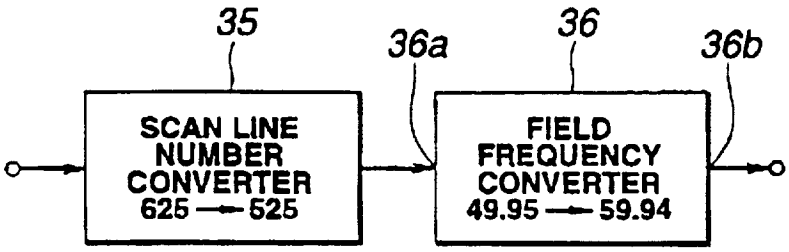
35
36a
36
36b
SCAN LINE NUMBER CONVERTER 625 → 525
FIELD FREQUENCY CONVERTER 49.95 → 59.94

FIG.9

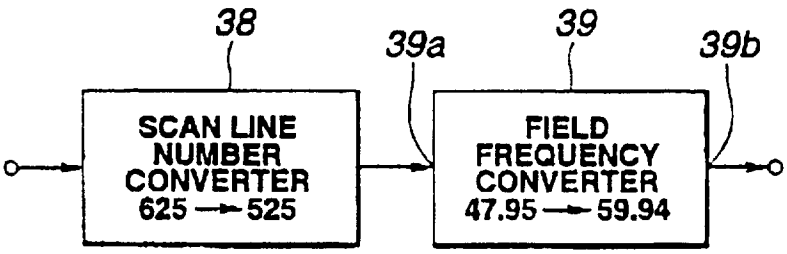
38
39a
39
39b
SCAN LINE NUMBER CONVERTER 625 → 525
FIELD FREQUENCY CONVERTER 47.95 → 59.94

FIG.11

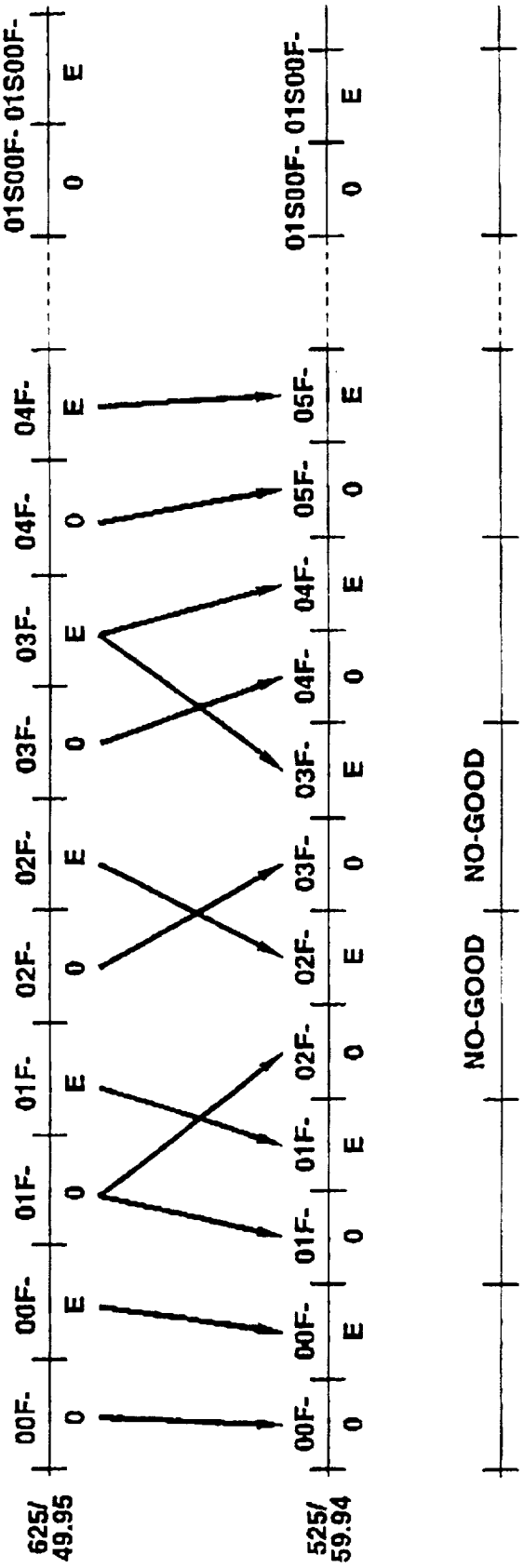
625/
49.95
525/
59.94
00F-
0
00F-
E
01F-
0
01F-
E
02F-
0
02F-
E
03F-
0
03F-
E
04F-
0
04F-
E
01S00F-
0
01S00F-
E
NO-GOOD
NO-GOOD

FIG.10

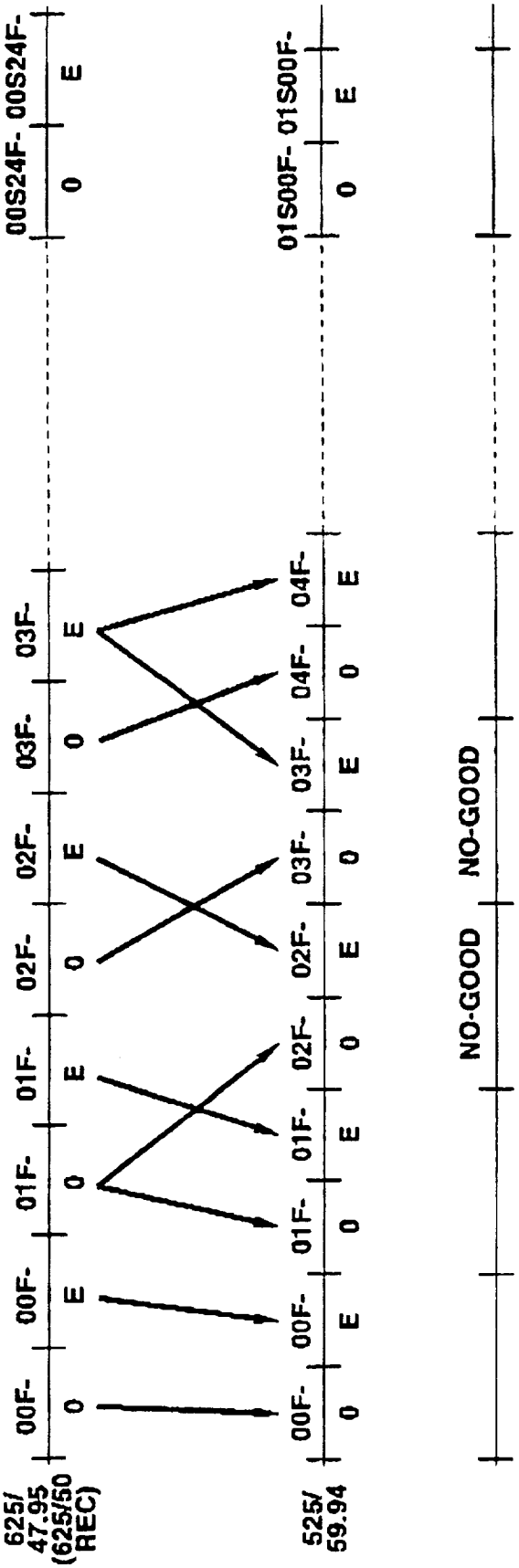
625/
47.95
(625/50
REC)
525/
59.94
00F-
00F-
01F-
01F-
02F-
02F-
03F-
03F-
00S24F-
01S00F-
04F-
NO-GOOD
NO-GOOD
0
E

FIG.12

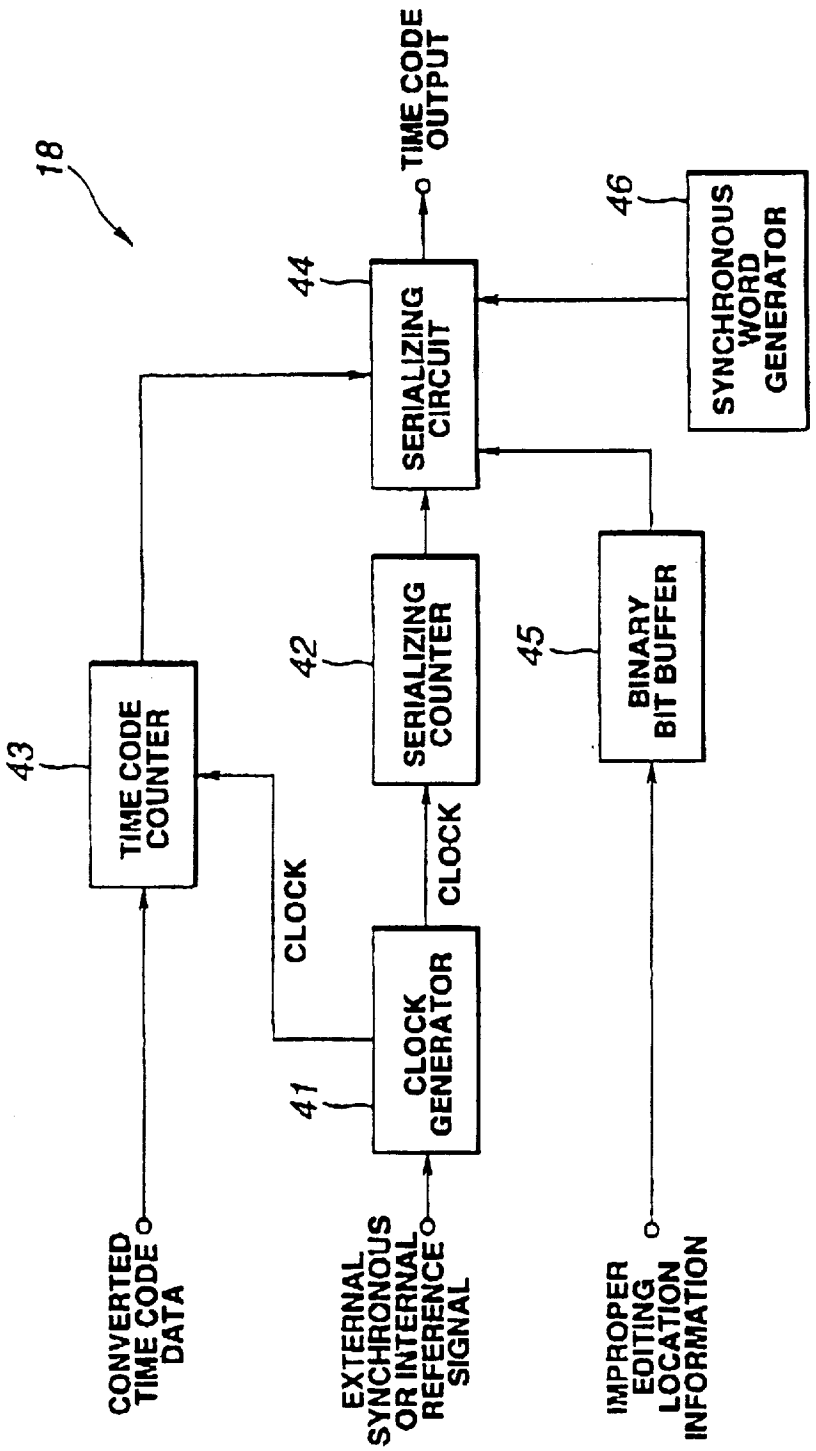
18
TIME CODE OUTPUT
44
SERIALIZING CIRCUIT
46
SYNCHRONOUS WORD GENERATOR
42
SERIALIZING COUNTER
45
BINARY BIT BUFFER
43
TIME CODE COUNTER
CLOCK
CLOCK
41
CLOCK GENERATOR
CONVERTED TIME CODE DATA
EXTERNAL SYNCHRONOUS OR INTERNAL REFERENCE SIGNAL
IMPROPER EDITING LOCATION INFORMATION

FIG.13

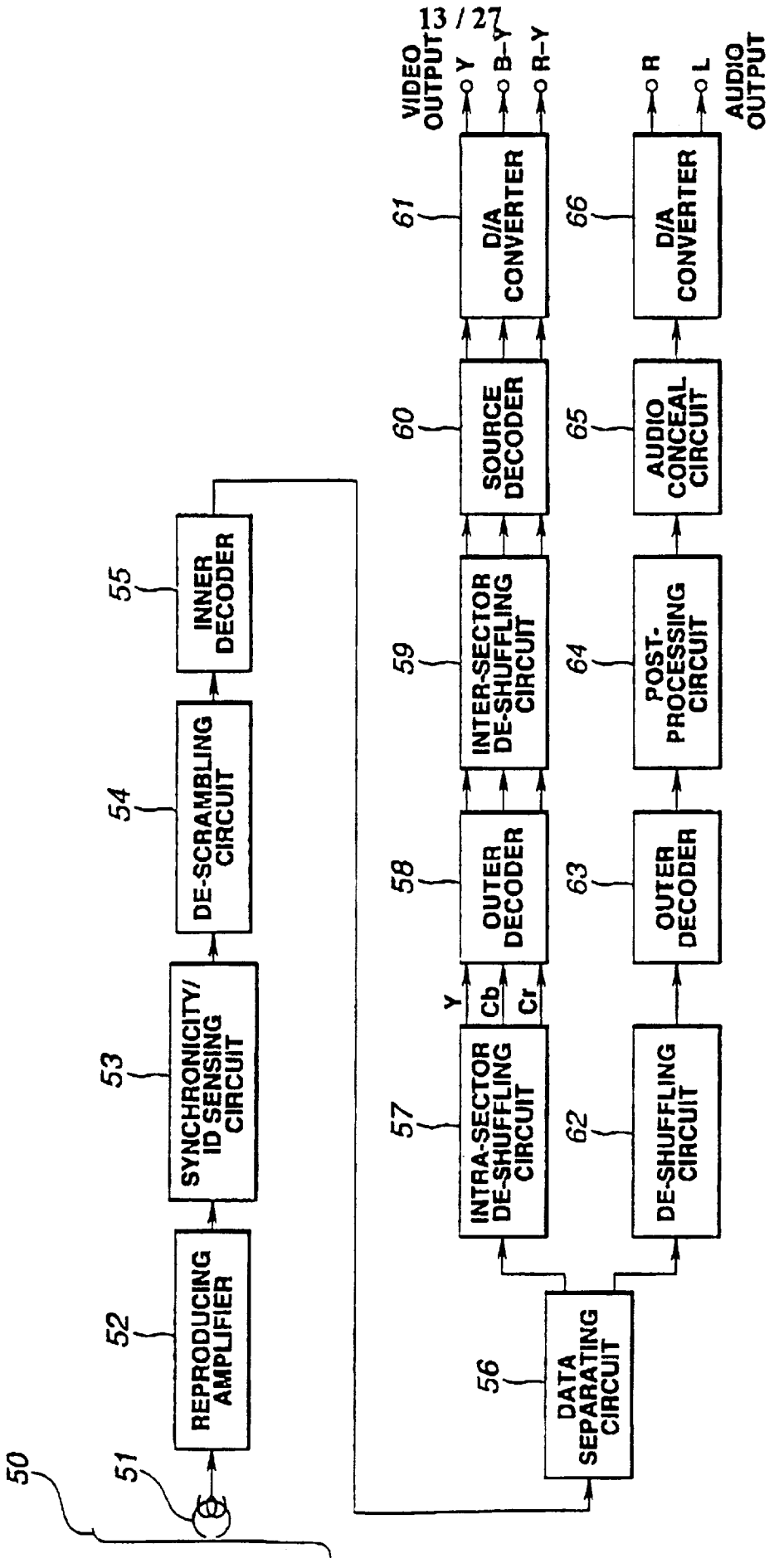
50
51
52
REPRODUCING AMPLIFIER
53
SYNCHRONICITY/ ID SENSING CIRCUIT
54
DE-SCRAMBLING CIRCUIT
55
INNER DECODER
56
DATA SEPARATING CIRCUIT
57
INTRA-SECTOR DE-SHUFFLING CIRCUIT
Y
Cb
Cr
58
OUTER DECODER
59
INTER-SECTOR DE-SHUFFLING CIRCUIT
60
SOURCE DECODER
61
D/A CONVERTER
VIDEO OUTPUT
Y
B-Y
R-Y
62
DE-SHUFFLING CIRCUIT
63
OUTER DECODER
64
POST-PROCESSING CIRCUIT
65
AUDIO CONCEAL CIRCUIT
66
D/A CONVERTER
R
L
AUDIO OUTPUT

FIG.14

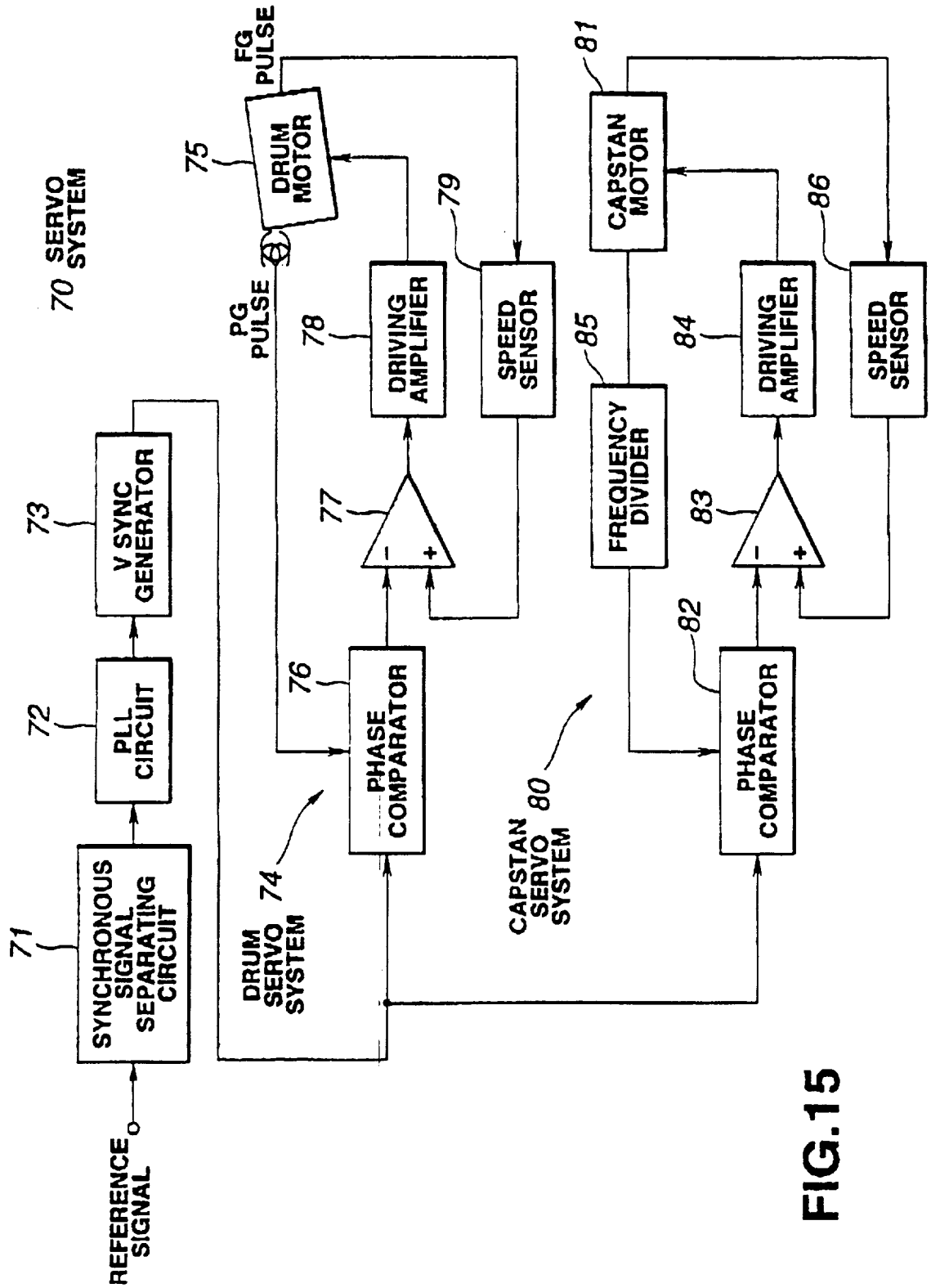
REFERENCE SIGNAL
71
SYNCHRONOUS SIGNAL SEPARATING CIRCUIT
72
PLL CIRCUIT
73
V SYNC GENERATOR
70 SERVO SYSTEM
75
DRUM MOTOR
FG PULSE
PG PULSE
78
DRIVING AMPLIFIER
79
SPEED SENSOR
77
76
PHASE COMPARATOR
74
DRUM SERVO SYSTEM
81
CAPSTAN MOTOR
86
DRIVING AMPLIFIER
SPEED SENSOR
85
FREQUENCY DIVIDER
84
83
82
PHASE COMPARATOR
80
CAPSTAN SERVO SYSTEM

FIG.15

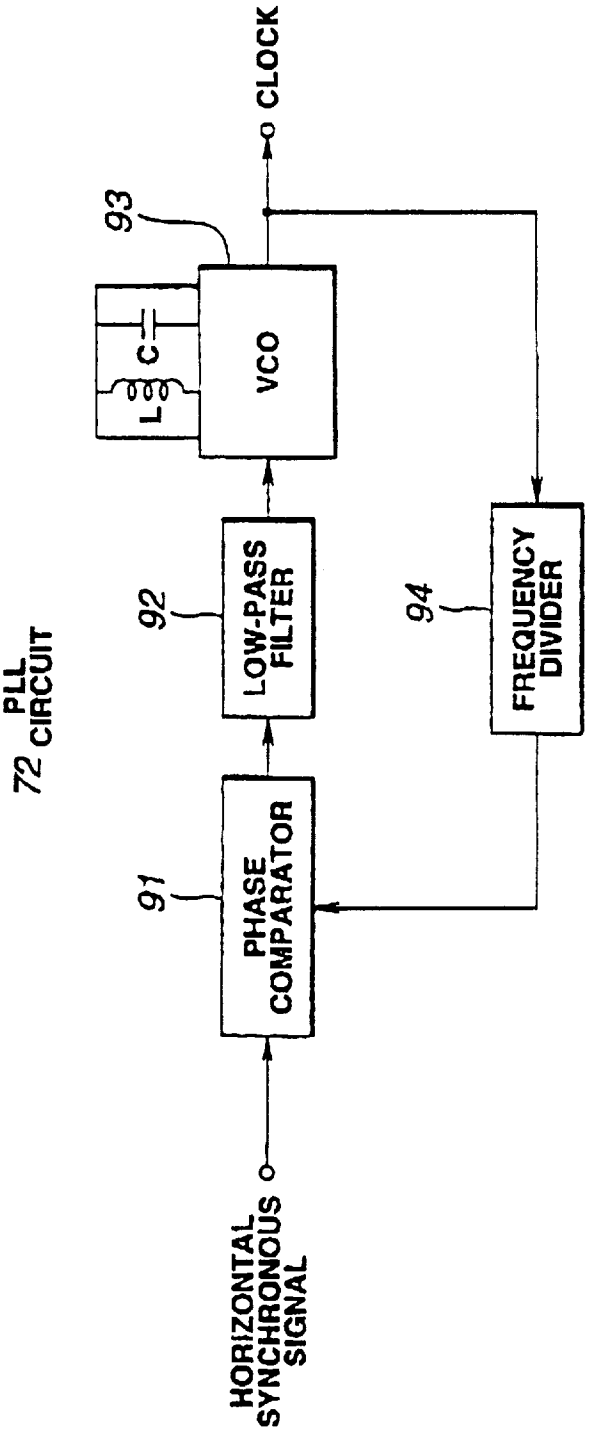
72 PLL CIRCUIT
HORIZONTAL SYNCHRONOUS SIGNAL
91
PHASE COMPARATOR
92
LOW-PASS FILTER
93
VCO
L
C
CLOCK
94
FREQUENCY DIVIDER

FIG.16

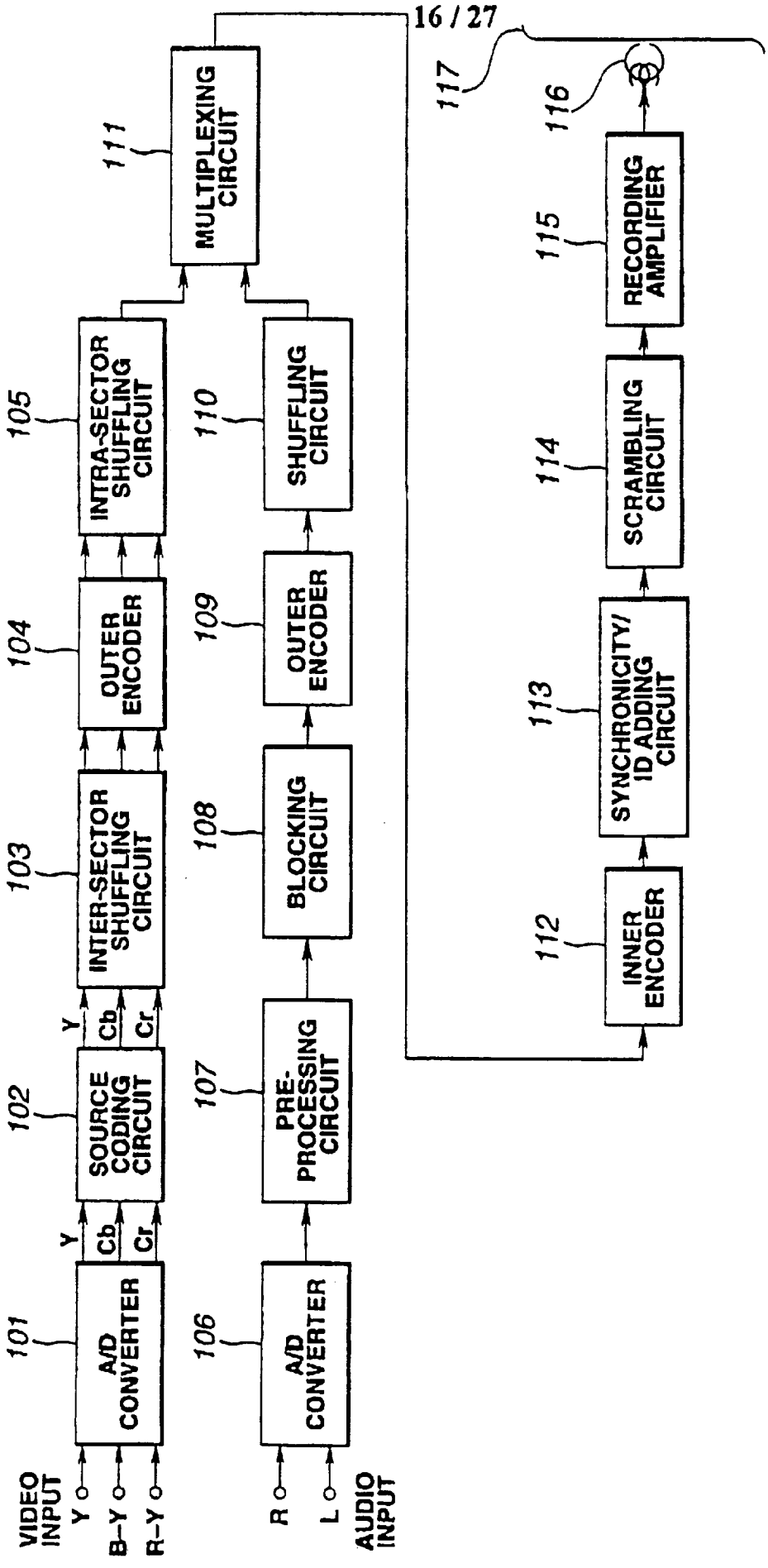
VIDEO INPUT
Y
B-Y
R-Y
AUDIO INPUT
R
L
101
A/D CONVERTER
Y
Cb
Cr
102
SOURCE CODING CIRCUIT
103
INTER-SECTOR SHUFFLING CIRCUIT
104
OUTER ENCODER
105
INTRA-SECTOR SHUFFLING CIRCUIT
106
A/D CONVERTER
107
PRE-PROCESSING CIRCUIT
108
BLOCKING CIRCUIT
109
OUTER ENCODER
110
SHUFFLING CIRCUIT
111
MULTIPLEXING CIRCUIT
112
INNER ENCODER
113
SYNCHRONICITY/ ID ADDING CIRCUIT
114
SCRAMBLING CIRCUIT
115
RECORDING AMPLIFIER
116
117

FIG.17

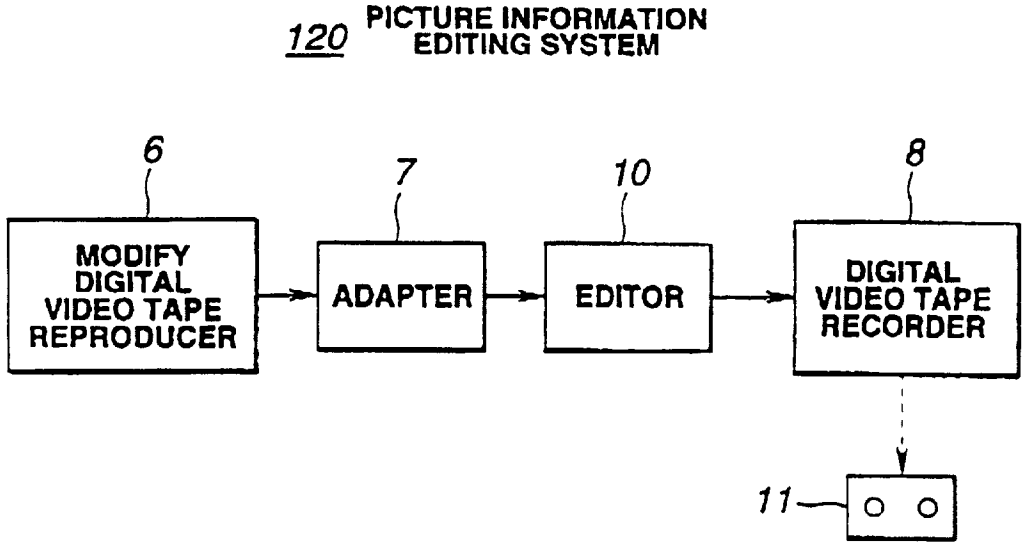
120 PICTURE INFORMATION EDITING SYSTEM
6
7
10
8
MODIFY DIGITAL VIDEO TAPE REPRODUCER
ADAPTER
EDITOR
DIGITAL VIDEO TAPE RECORDER
11

FIG.18

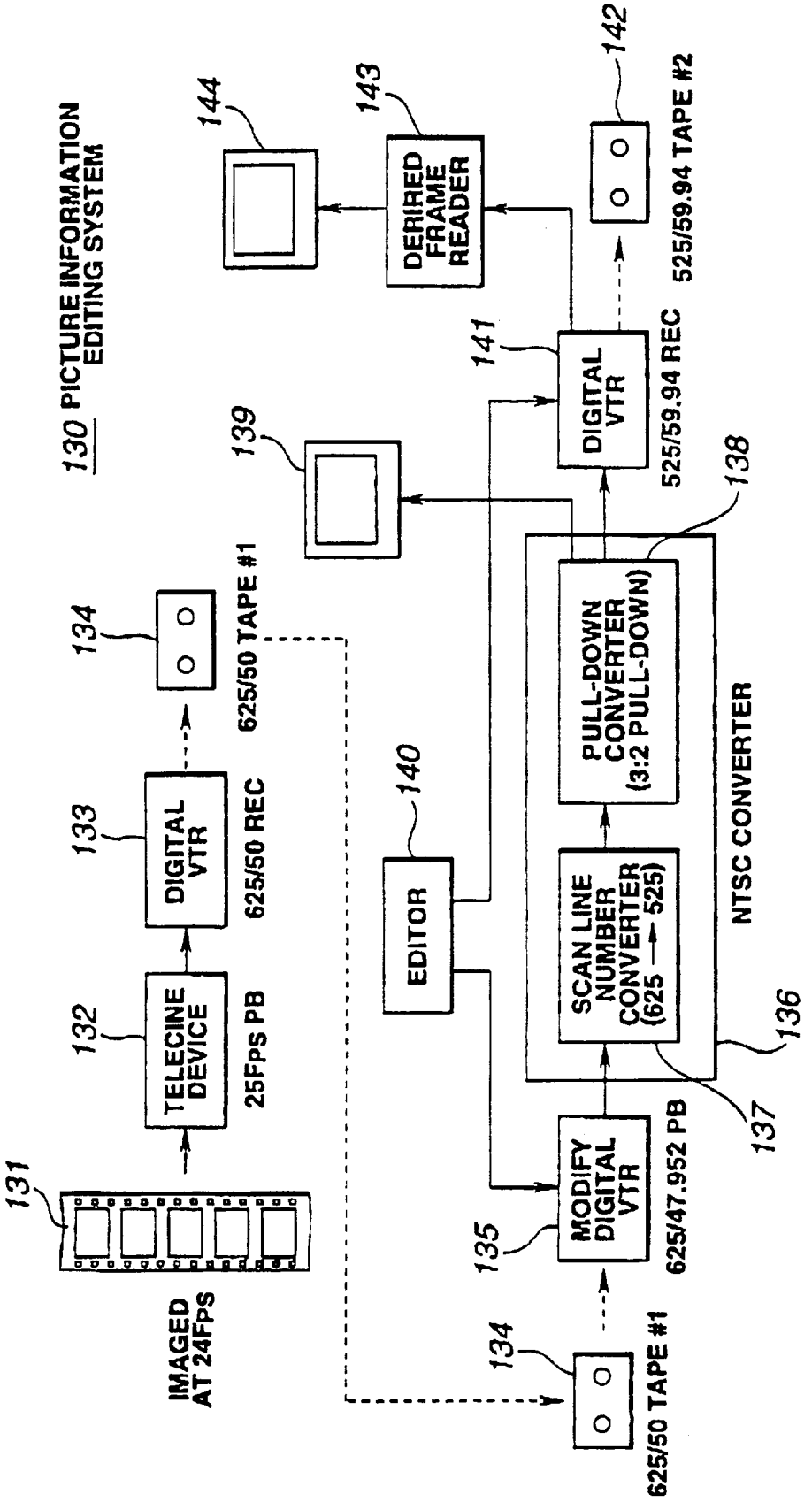
130 PICTURE INFORMATION EDITING SYSTEM
131
IMAGED AT 24FPS
132
TELECINE DEVICE
25FPS PB
133
DIGITAL VTR
625/50 REC
134
625/50 TAPE #1
139
140
EDITOR
141
DIGITAL VTR
525/59.94 REC
142
525/59.94 TAPE #2
143
DERIRED FRAME READER
144
138
PULL-DOWN CONVERTER (3:2 PULL-DOWN)
SCAN LINE NUMBER CONVERTER (625 → 525)
NTSC CONVERTER
136
137
135
MODIFY DIGITAL VTR
625/47.952 PB
134
625/50 TAPE #1

FIG.19

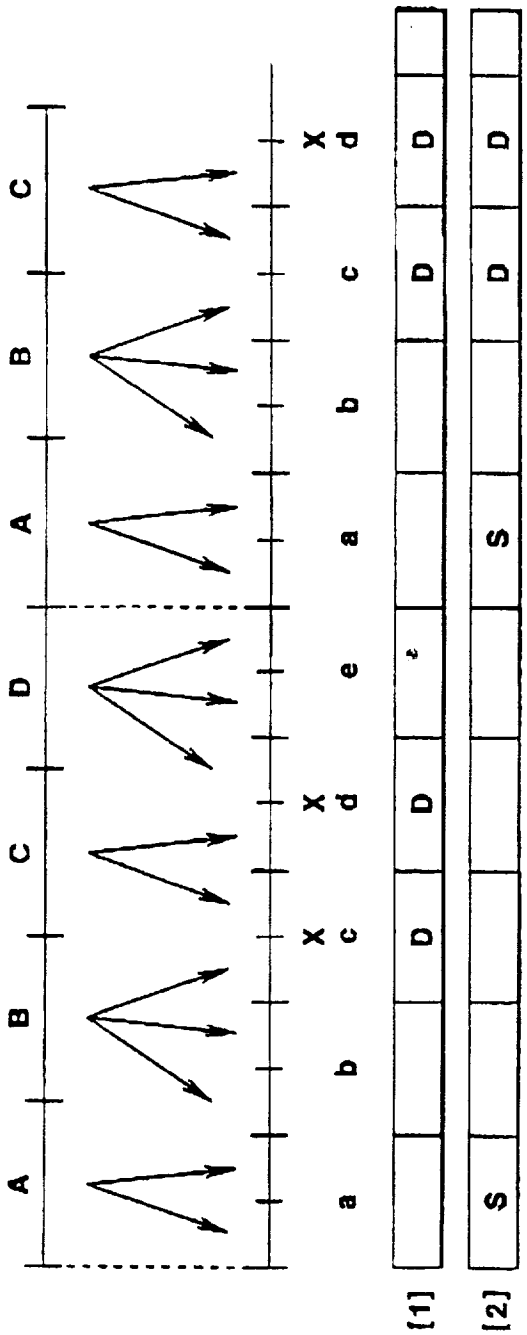

FIG.20

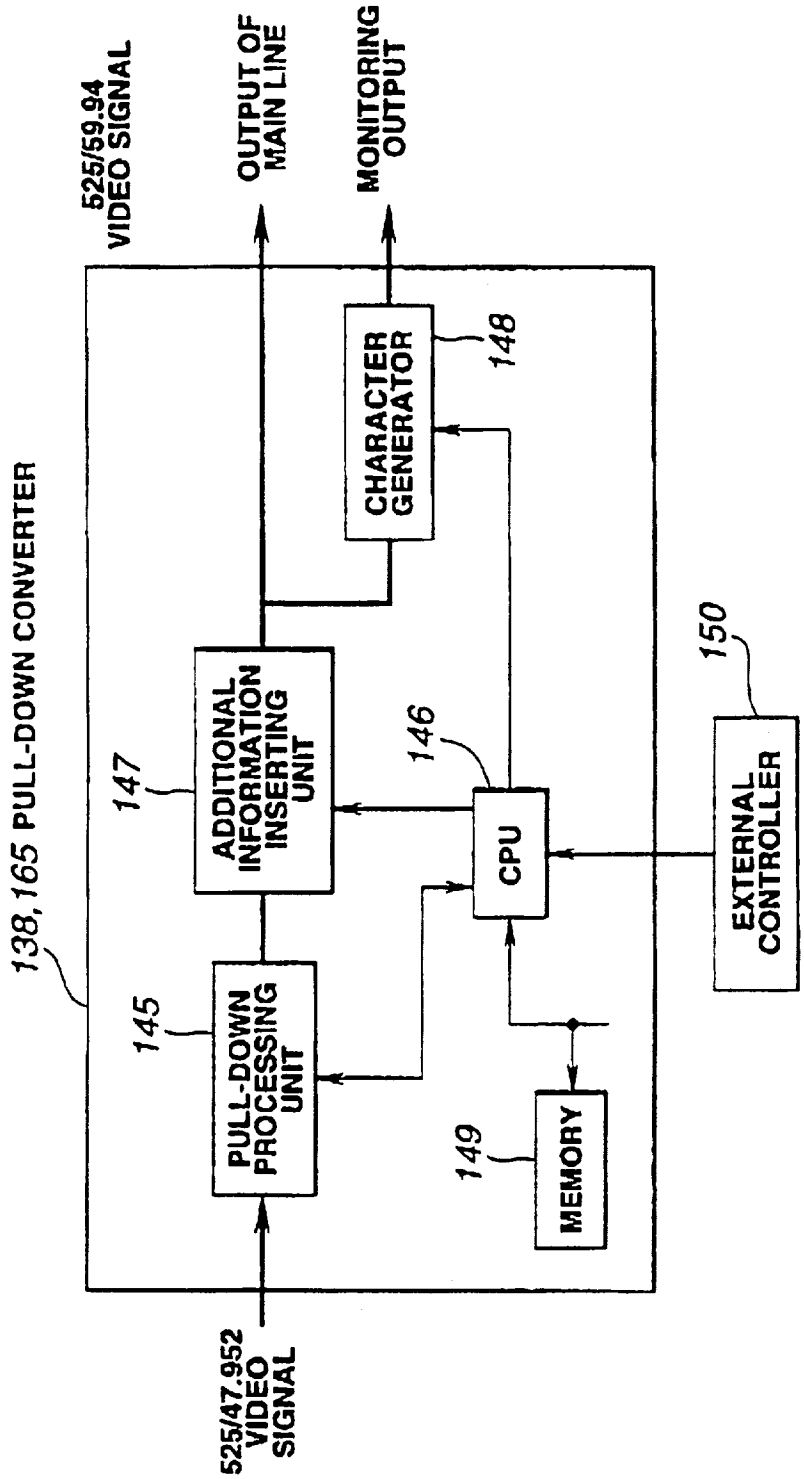
525/59.94 VIDEO SIGNAL
OUTPUT OF MAIN LINE
MONITORING OUTPUT
138,165 PULL-DOWN CONVERTER
CHARACTER GENERATOR
148
ADDITIONAL INFORMATION INSERTING UNIT
147
146
CPU
150
EXTERNAL CONTROLLER
145
PULL-DOWN PROCESSING UNIT
149
MEMORY
525/47.952 VIDEO SIGNAL

FIG.21

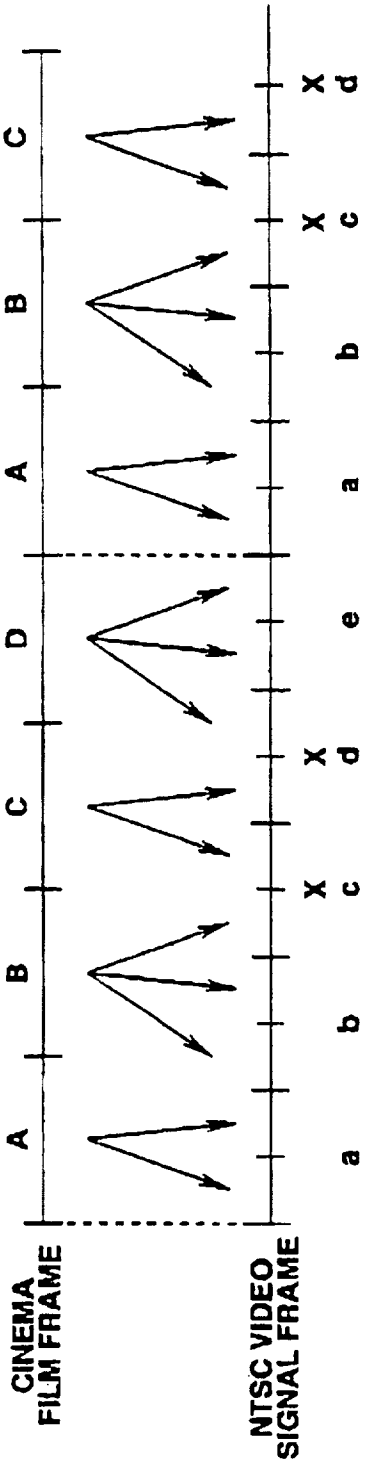

FIG.22

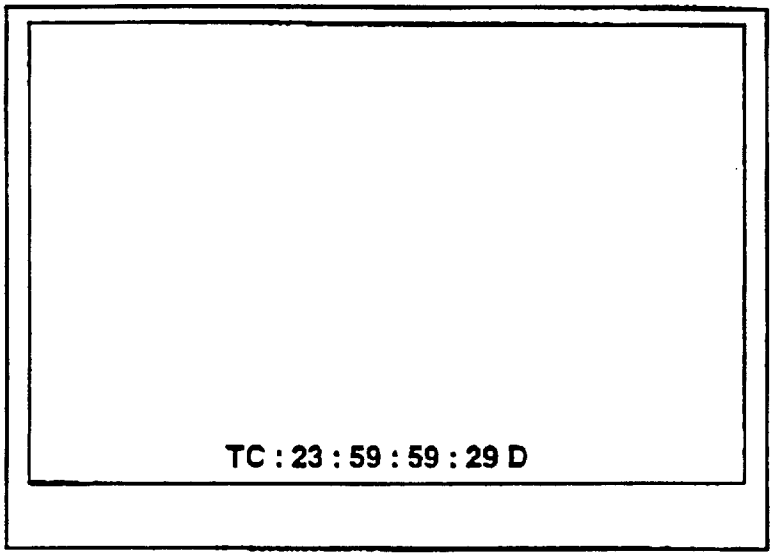

FIG.23

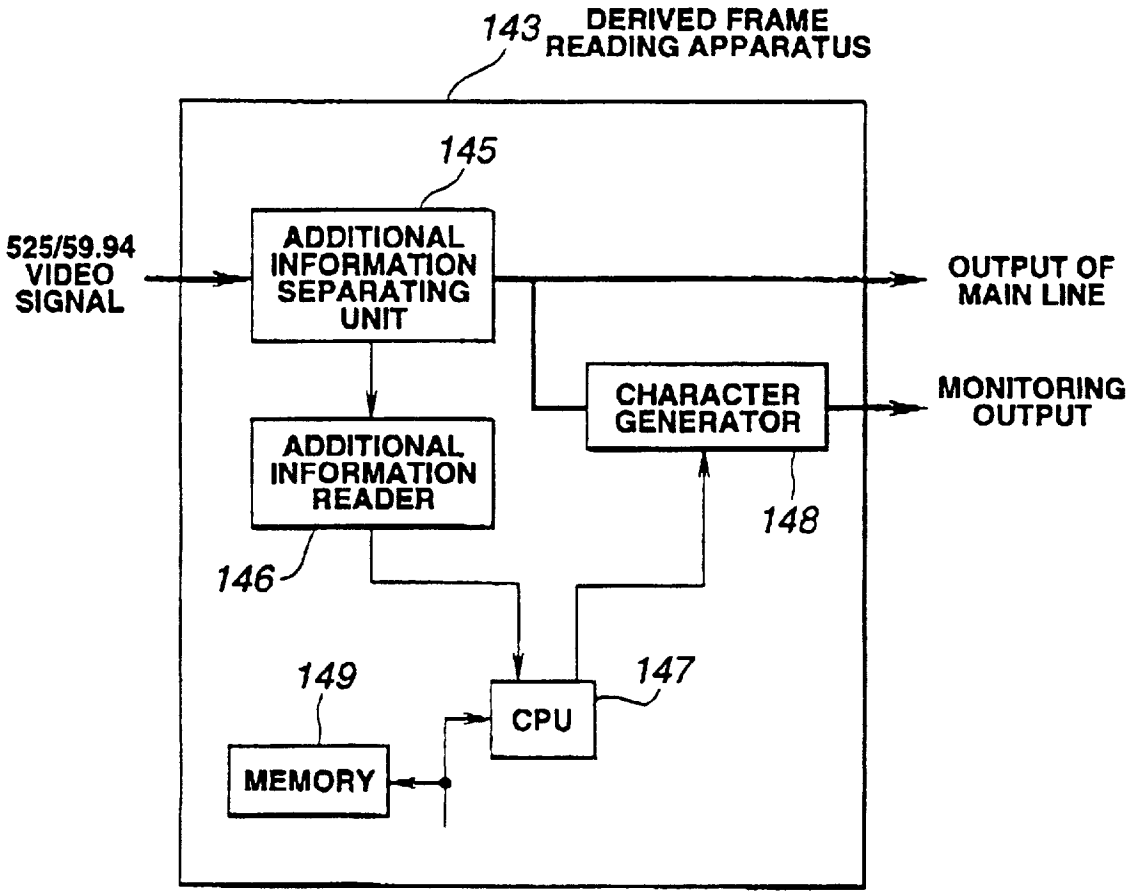
143
DERIVED FRAME READING APPARATUS
145
525/59.94 VIDEO SIGNAL
ADDITIONAL INFORMATION SEPARATING UNIT
OUTPUT OF MAIN LINE
CHARACTER GENERATOR
MONITORING OUTPUT
ADDITIONAL INFORMATION READER
148
146
149
147
CPU
MEMORY

FIG.24

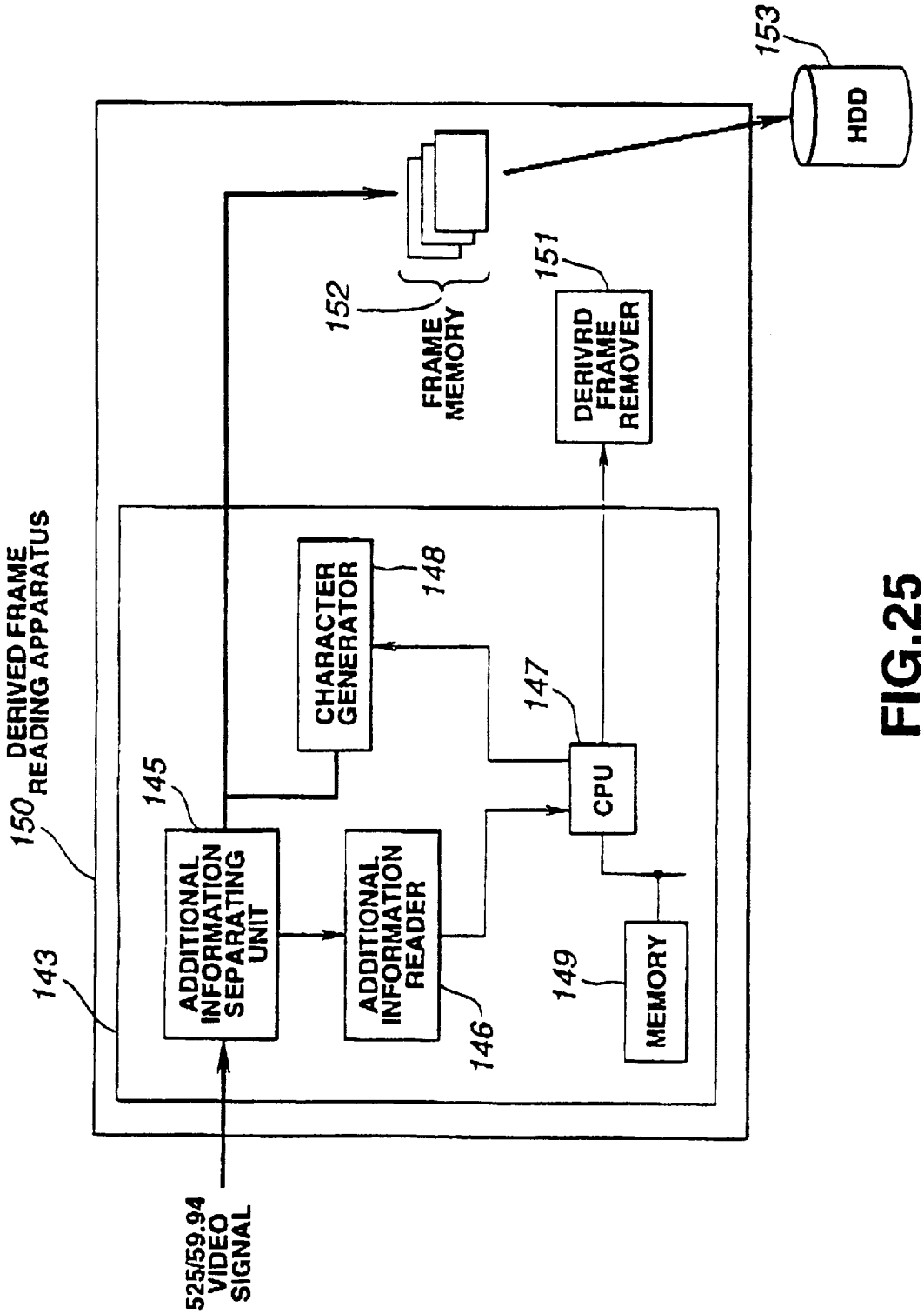
525/59.94 VIDEO SIGNAL
143
150 DERIVED FRAME READING APPARATUS
145
ADDITIONAL INFORMATION SEPARATING UNIT
ADDITIONAL INFORMATION READER
146
CHARACTER GENERATOR
148
147
CPU
149
MEMORY
152
FRAME MEMORY
151
DERIVRD FRAME REMOVER
153
HDD

FIG.25

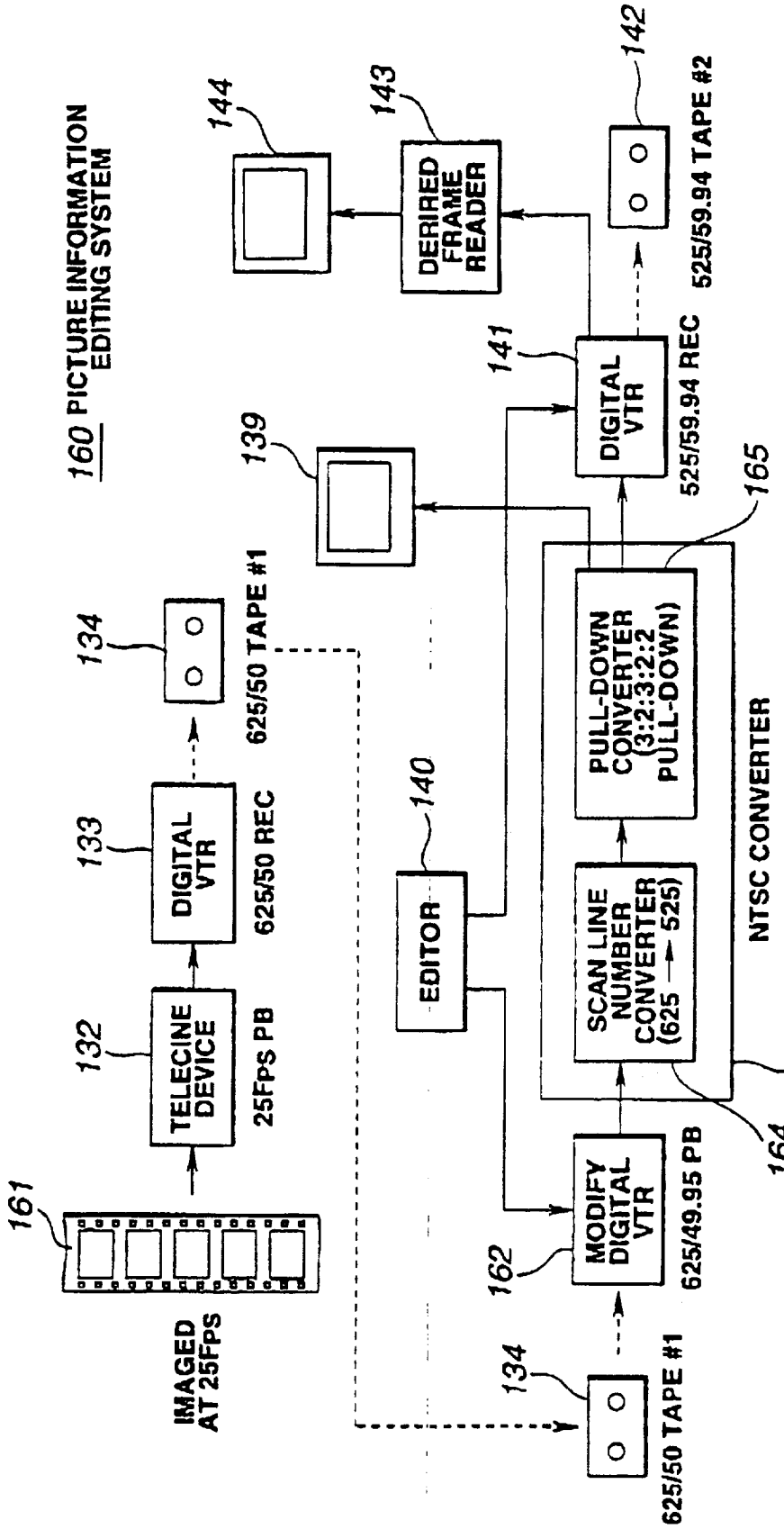
160 PICTURE INFORMATION EDITING SYSTEM
161
IMAGED AT 25FPS
132
TELECINE DEVICE
25FPS PB
133
DIGITAL VTR
625/50 REC
134
625/50 TAPE #1
139
140
EDITOR
141
DIGITAL VTR
525/59.94 REC
142
525/59.94 TAPE #2
143
DERIRED FRAME READER
144
162
MODIFY DIGITAL VTR
625/49.95 PB
134
625/50 TAPE #1
163
NTSC CONVERTER
164
SCAN LINE NUMBER CONVERTER (625 → 525)
165
PULL-DOWN CONVERTER (3:2:3:2:2 PULL-DOWN)

FIG.26

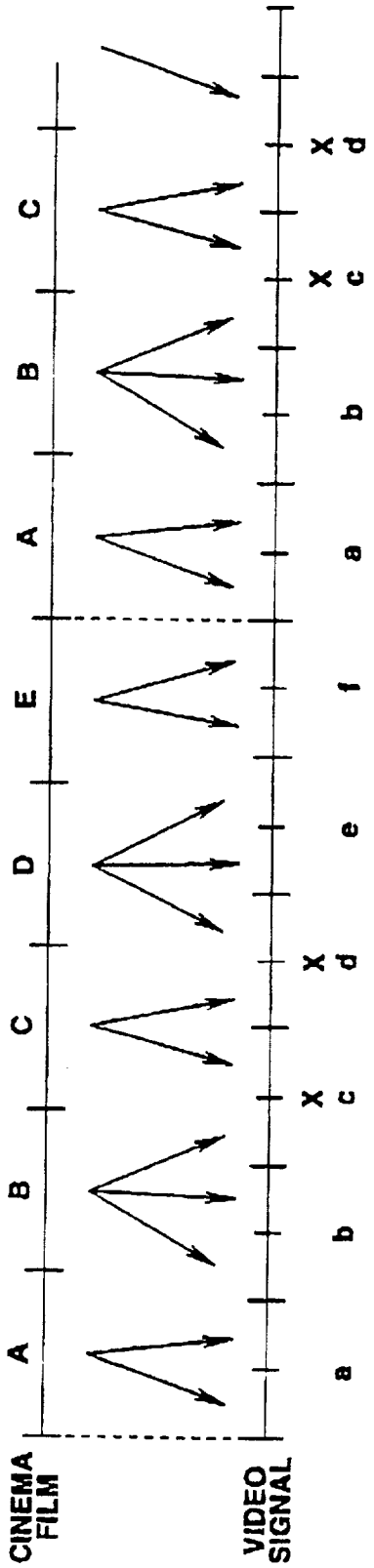

FIG.27

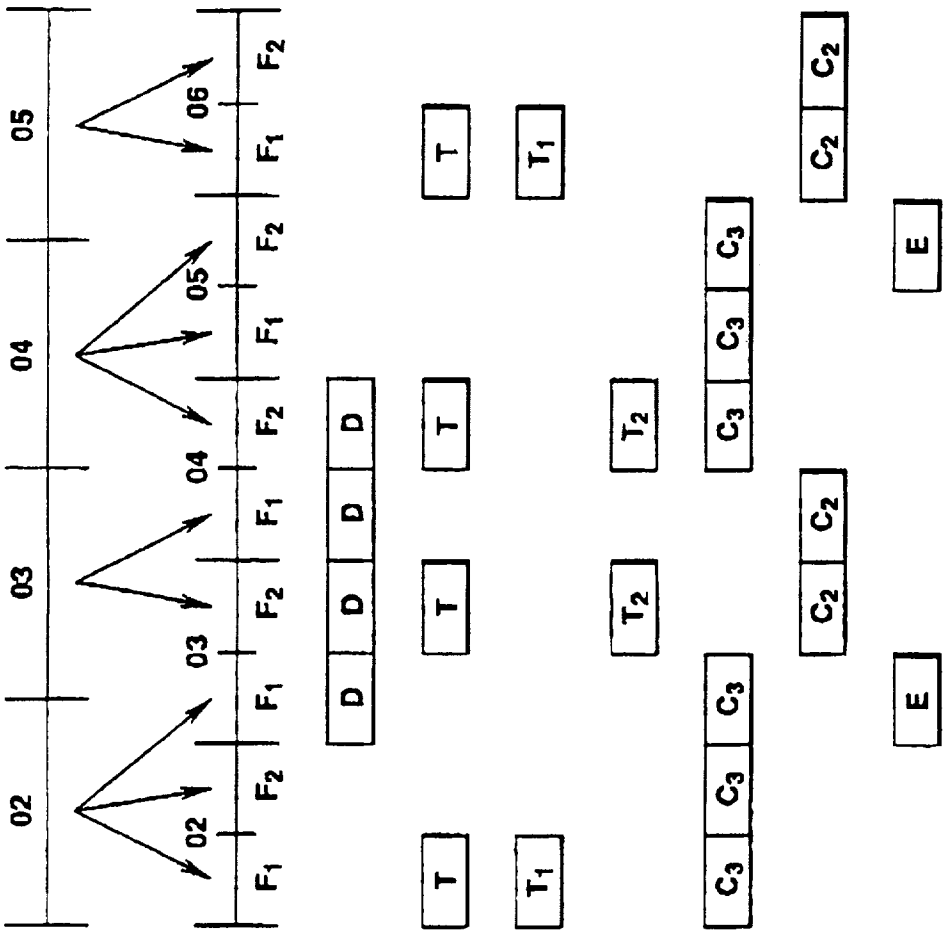

FIG.28A

FIG.28B

FIG.28C

FIG.28D

FIG.28E

FIG.28F

FIG.28G

FIG.28H

FIG.28I