

JP2000152180A OPTICAL DISK, VIDEO DATA EDITOR, RECORDING MEDIUM RECORDING EDIT PROGRAM AND READ BY COMPUTER, REPRODUCING DEVICE FOR OPTICAL DISK, RECODING MEDIUM RECORDING REPRODUCTION PROGRAM AND READ BY COMPUTER

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[0001] BACKGROUND OF THE INVENTION 1. Field of the Invention The present invention relates to an optical disc, a video data editing device, a recording medium recording a computer-readable editing program, an optical disc reproducing device, and a recording medium recording a computer-readable reproducing program.

[0002] 2. Description of the Related Art Video editing technicians who are active in the movie industry, broadcasting industry, etc. make full use of their skilled skills to produce various elaborate video works and send them to the world. Movie enthusiasts and camcorder enthusiasts who were fascinated by these things and had a strong admiration were keenly interested in the challenge of video editing, even if their skills were not reached. We hope that the consumer equipment of the video data editing device which can be easily performed will be developed at an early stage.

[0003] There are various kinds of work generally called video editing, but in the consumer equipment of video data editing equipment that will be developed in the future, the function of connecting many scenes together into one video, so-called scene It is considered that the enhancement of the connecting function is especially required. Conventionally, scene connection work using consumer devices has been performed using a dubbing system in which two VCRs are connected. Hereinafter, how the work of connecting arbitrary scenes in the video has been performed in the dubbing system will be described. FIG. 96(a) is a diagram showing a work environment for video editing using a video deck capable of reproducing/recording existing video signals. As shown in FIG. 96(a), the working environment is such that a magnetic tape cassette 301 on which an image serving as a material is recorded, an empty magnetic tape cassette 302 for recording an edited product, and reproduction/playback of these magnetic tape cassettes. It is composed of video decks 303 and 304 for recording. In such a work environment, the operator is going to perform the scene connection shown in FIG. 96(b). FIG. 96(b) is a diagram showing the relationship between the editing material and the edited product. As shown in the figure, the operator occupies the scene 505 occupying the time t5 to the time t10, the scene 506 occupying the time t13 to the time t21, and the scene 506 and the time t23 to the time t25 in the editing material. The scene 507 is partially reproduced to obtain an edited product consisting of only these.

[0004] In such a working environment, the operator sets the magnetic tape cassette 301 on which the editing material is recorded on the video deck 303, and sets the magnetic tape cassette 302 on which the edited product is to be recorded on the deck 304. After setting, press the fast-forward key on the operation panel of the deck 303 as shown in the figure to cause the deck 303 to start to the beginning of the video scene 505, and then press the play key as shown below. The deck 303 is made to reproduce from the video scene 505. At the same time, the recording key is pressed to cause the deck 304 to start recording the reproduced video, as shown at the same time. When the video is reproduced to the end of the scene 505, the operation of the two decks is stopped. Subsequently, the deck 304 is cued up to the beginning of the video scene 506, and the reproduction of the deck 303 and the recording of the deck 304 are simultaneously started again. After performing the same work on scenes 506 and 507, the tapes on the decks 303 and 304 are rewound and the editing work is completed.

[0005] If the scene connection work described above can be easily performed at home, the images recorded on a large number of magnetic tape cassettes can be easily organized.

[0006] The first problem of the above-mentioned prior art is that since it is necessary to record the editing material and the edited product on different recording media, two magnetic tape cassettes are reproduced/recorded. It is pointed out that it is necessary to provide a video deck to do so, and the facilities for editing will be large-scale. As described above, the video editing cannot be performed unless the two video decks are connected in advance, so that the place where the video editing can be performed is limited.

[0007] A second problem of the above-mentioned conventional technique is that when scene connection is about to be started, the start position of the scene to be connected is cued and a video serving as an editing material is reproduced from the scene start position to the end position. Since it is necessary to repeat the work for the

number of scenes to be connected, the more the number of scenes to be connected, the more the cue and the time required to reproduce from the start position to the end position become enormous. It is pointed out that a lot of work time is spent.

[0008] When professional video editing technicians perform scene concatenation, instead of suddenly creating the final edited product, the sophisticated video work is produced by re-editing the scene concatenation order many times. However, in a work environment in which a great deal of work is required for cueing and reproducing, it is not possible to reconsider the order in which scenes are connected.

[0009] However, these problems can occur in a video editing environment using a magnetic tape as a recording medium, and are naturally improved in a video editing environment using a randomly accessible recording medium such as a hard disk or a phase change optical disc. It seems like For example, if the editing material is recorded on the optical disc and the edited product is recorded on the same optical disc, the video editing can be performed with only one video data editing device using the optical disc as a recording medium. It is expected to be small. However, if the recording of the editing material and the recording of the edited product are performed on the same recording medium, the edited product to be recorded on the recording medium may overwrite the edited material. In this case, even if the operator later notices that the editing has failed, the editing material is overwritten as described above, so that it is virtually impossible to redo the editing again.

[0010] If the edited material is a valuable video recording a commemorative event such as a child's entrance ceremony, athletic meet, family trip, graduation ceremony, etc., such overwriting will erase the valuable video. It would be impossible to edit the video again, let alone edit it. If the capacity of the recording medium is more than twice the length of the video to be edited, it seems that the editing material will not be overwritten. However, even the latest phase change type optical disc, which has a phase-change type, has a capacity of 2.6 GByte on each side, and it cannot be said that videos with a time length of 2 hours or more can be recorded separately as editing materials and editing products. .. Moreover, not only the final product but also the intermediate product of the video editing is individually recorded in a recording medium, and when the optimum one is selected from these at a later date, the audiovisual data (video It is obvious that the recording medium needs to have a capacity three times, four times or more that of data obtained by multiplexing data and acoustic data), and the capacity is insufficient in a single recording medium.

[0011] A third problem of the above-mentioned conventional technique is that subsections to be connected cannot be specified with high accuracy. That is, when performing linked editing as shown in FIG. 96(a), since it is necessary to simultaneously press the play button and the record button of two video decks, one of the play button and the record button may be delayed. Or, if you press one of them too quickly, the part different from the section you want to connect and use may be recorded as an edited product, or the part you want to record as a partial section may be partly missing. is there.

[0012] A first object of the present invention is an optical disc capable of realizing video editing on a single recording medium without overwriting existing video recorded on the recording medium, and video data editing using the same as a recording medium. It is to provide a device. The second purpose is to record not only the final product of the video editing but also the intermediate product of the video editing individually, and the optimum one can be selected at a later date from the optical disc and the recording. An object is to provide a video data editing device used as a medium.

[0013] A third object of the present invention is to provide an optical disc and a reproducing apparatus therefor capable of specifying a partial section to be edited with high time accuracy while viewing a video display.

[0014] The first and second objects are to provide a data area in which a file containing one or more video objects is recorded, original type chain information, and one or more user-defined type chains. And an index area in which information is recorded, the original type chain information manages the file as an array of a plurality of partial sections, and each user-defined type chain information stores a plurality of partial sections in the file. , Partial sections that are specified by a playback order that is not restricted by the arrangement order of each partial section in the file and that are managed by the original type chain information are the start position, the end position of the video object, and the predetermined position inside the video object. Each sub-section is a section obtained by dividing the file into a plurality of parts, with the combination of the two as the boundary, and the playback order is specified by the user-defined type chain information, with the combination of the internal positions of the video objects as the boundary. It is a specified section, and the combination of internal positions includes a combination of a predetermined position inside the video object and another position inside the video object, a combination of different positions inside the object, and a combination of the predetermined

positions. In any of the above, the reproduction order is achieved by the optical disc, which is not restricted by the arrangement order of the partial sections in the file.

[0015] A third purpose is to read a set of reproduction start time information and reproduction end time information and mapping information from the index area when receiving a reproduction instruction of cell information, and use the reproduction start time information and the reproduction end time information. By searching the mapping information with the recording position of the leading video object unit including the picture data indicated by the reproduction start time information and the recording position of the ending video object unit including the picture data indicated by the reproduction end time information. And a reading means for reading out the video object unit sequence recorded between the specified recording positions. The read video object unit sequence is decoded and corresponds to the cell information. If the boundary of the sub-section does not match the start position-end position of the video object unit, the decoding result from the first video field to the last field indicated by the cell information is output, and other This is achieved by a video data editing device including a decoding unit that prohibits output of a decoding result.

[0016] BEST MODE FOR CARRYING OUT THE INVENTION Embodiments of a video data editing apparatus and an optical disk used as a recording medium by the video data editing apparatus will be described below. It should be noted that if the physical structure and logical structure of the optical disk, the hardware configuration and the functional configuration of the video data editing device are described in one embodiment, the description will be extremely complicated. Therefore, the above contents will be individually described in the four embodiments. I shall explain.

[0017] In the first embodiment, a physical structure of an optical disc and a hardware structure of a video data editing apparatus will be described, and seamless connection between video objects will be described as a first basic example of video editing. The second embodiment will describe seamless connection between partial sections of video objects as a second basic example. In the third embodiment, the functional configuration of the video data editing apparatus will be described, and the procedure of video editing realized on the file system will be described.

[0018] In the fourth embodiment, regarding the data structure and the processing procedure of the video data editing device in the case of realizing hierarchical video editing including temporary editing and main editing using two types of program chains of user-defined PGC-original PGC I will explain. (1-1) Physical Structure of Recordable Optical Disk FIG. 1 is a diagram showing the appearance of a DVD-RAM disk which is a recordable optical disk. As shown in the figure, the DVD-RAM is loaded into the video data editing device while being housed in the cartridge 75. The main cartridge 75 is intended to protect the recording surface of the DVD-RAM, and the DVD-RAM is accessed by opening and closing the shutter 76 when the main cartridge 75 is stored.

[0019] FIG. 2A is a diagram showing a recording area of a DVD-RAM disc which is a recordable optical disc. As shown in the figure, the DVD-RAM disc has a lead-in area at the innermost circumference, a lead-out area at the outermost circumference, and a data area therebetween. In the lead-in area, a reference signal necessary for stabilizing the servo when the optical pickup is accessed, an identification signal with other media, etc. are recorded. In the lead-out area, the same reference signal as in the lead-in area is recorded. The data area is divided into sectors (2 kbytes) that are the smallest access unit. FIG. 2B is a diagram showing a cross section and a front surface of the DVD-RAM with sectors as headers. As shown in the figure, one sector is composed of a pit row portion formed on the surface of a reflective film such as a metal thin film and an uneven portion.

[0020] The pit row portion is composed of pits of 0.4 μm to 1.87 μm engraved to represent the sector address. The concavo-convex shape portion includes a concave portion (called a groove) and a convex portion (called a land). Recording marks, which are metal thin films capable of phase change, are attached to the surfaces of the lands and the grooves. The phase change means that the state of the attached metal thin film changes to a crystalline state and an amorphous state by irradiation with a light beam. Data can be written in the uneven portion by utilizing the phase change. In the MO disc, only the land portion is used for recording, whereas in the DVD-RAM, data can be recorded also in the land portion and the groove portion. The achievement of data recording in the groove portion increases the recording density compared to MO. Error correction information for a sector is provided for every 16 sectors. In this embodiment, a sector group (16 sectors) to which an ECC (Error Correcting Code) is added is called an ECC block.

[0021] Further, in the DVD-RAM, a data area is divided into a plurality of zone areas in order to realize rotation control called Z-CLV (Zone-Constant Linear Velocity) at the time of recording/reproducing. FIG. 3A is a

diagram showing a plurality of zone areas provided concentrically on the DVD-RAM. As shown in the figure, the DVD-RAM is divided into 24 zone areas from zone 0 to zone 23. Here, the zone area refers to a group of tracks that are accessed at the same angular velocity. In this embodiment, one zone area includes 1888 tracks. The rotational angular velocity of the DVD-RAM is set for each zone area so that it becomes faster toward the inner circumferential side zone, and is kept constant while the optical pickup accesses within one zone. This increases the recording density of the DVD-RAM and facilitates rotation control during recording/playback.

[0022] FIG. 3B is an explanatory diagram in which the lead-in area, the lead-out area, and the zone areas 0 to 23, which are shown concentrically in FIG. 3A, are arranged in the horizontal direction. The lead-in area and the lead-out area each have a defect management area (DMA). The defect management area is an area in which position information indicating the position of a sector in which a defect has occurred and alternative position information indicating in which of the alternative areas the sector that replaces the defective sector exists are recorded. ..

[0023] Each zone area has a user area inside, and an alternative area and an unused area at the boundary. The user area is an area that the file system can use as a recording area. The replacement area is an area used as an alternative when a defective sector exists. The unused area is an area that is not used for data recording. The unused area is provided for about two tracks. The unused area is provided because the sector address is recorded at the same position on the adjacent tracks in the zone, but the recorded position of the sector address is different on the tracks adjacent to the zone boundary in Z-CLV. This is to prevent misjudgment of the sector address caused by the error.

[0024] Thus, there are sectors that are not used for data recording at the zone boundaries. Therefore, the DVD-RAM assigns logical sector numbers (LSN: Logical Sector Numbers) to the physical sectors of the user area in order from the inner circumference so that only the sectors used for data recording are continuously shown. As shown in FIG. 3C, an area for recording user data, which is composed of sectors to which LSN is added, is called a volume space.

[0025] In the volume area, an AV file containing a plurality of VOBs and an RTRW (Real Time ReWritable) management file that is management information thereof are recorded. Actually, the AV file and the RTRW management file are recorded on the file system conforming to the ISO/IEC13346 standard, but the description thereof will be omitted in the present embodiment, and the detailed description will be repeated in the third embodiment. To do.

[0026] (1-2) Data Recorded on Volume Area FIG. 4A is a diagram showing what kind of content data is recorded on the volume area in the DVD-RAM. The video stream and audio stream shown in the fifth row of FIG. 4A are divided into small parts of about 2 Kbytes as shown in the fourth row. The small portion obtained by the division is interleaved and multiplexed with VOB#1 and VOB#2 in the AV file shown in the third row while being stored in the video pack-audio pack defined in the MPEG standard. The AV file is divided into a plurality of extent data as shown in the second row based on ISO/IEC13346 and is recorded in an empty area in one zone area on the volume area shown in the first row.

[0027] On the other hand, information about VOB#1 to VOB#3 is recorded in the RTRW management file as VOB#1 information, VOB#2 information, and VOB#3 information shown in the fifth row. Similar to the AV file, the RTRW management file containing these is also recorded in a free area in the volume area in a state of being divided into a plurality of extents. Hereinafter, the video stream, the audio stream, and the VOB will be described individually, but before that, the hierarchical structure of the MPEG standard and the DVD-RAM standard that defines these data structures will be described.

[0028] FIG. 4B is a diagram showing a hierarchical structure of data definitions defined by the MPEG standard. The data structure of the MPEG standard is composed of an elementary stream layer and a system layer. The elementary stream layer in FIG. 4B defines a video layer that defines the data structure of the video stream, an MPEG-Audio layer that defines the data structure of the MPEG-audio stream, and a data structure of the audio stream of the Dolby-AC3 method. It has an AC-3 layer and a Linear-PCM layer that defines the data structure of a Linear-PCM audio stream. A playback start time (Presentation_Start_Time) and a playback end time (Presentation_End_Time), which will be described later, are also defined in this elementary stream layer, but in a frame independent in FIG. -As shown in the 3rd layer and the Linear-PCM layer, the data structures of the video stream and the audio stream are independent of each other, and the playback start time and playback end time of the video frame and the playback start time of the audio frame are Similarly, the relationship with the playback end time is also asynchronous.

[0029] The system layer in FIG. 4B defines a pack, a packet, a DTS, and a PTS, which will be described later. In FIG. 4B, the system layer is shown in a frame independent of the video layer and the audio layer. As described above, the pack, packet, DTS, and PTS described above have a non-dependent relationship with the data structure of the video stream and the audio stream. In contrast to such a layer structure of the MPEG standard, the DVD-RAM standard includes a system layer of the MPEG standard and an elementary stream layer shown in FIG. 4B, and includes the pack, packet, DTS, In addition to PTS, the VOB data structure shown in FIG. 4A is defined.

[0030] (1-2-1) Video Stream The data structure of the video stream shown in FIG. 5(a) is defined in the video layer shown in FIG. 4(b), and a plurality of picture data corresponding to one frame of image data are provided. It will be arranged. The picture data is obtained by compressing a video signal of NTSC system or PAL system according to the MPEG standard. A plurality of picture data obtained by compressing an NTSC video signal is displayed in a video frame having a frame period of about 33 msec (1/29.97 sec to be exact), and a plurality of picture data obtained by compressing a PAL video signal is displayed. , A video frame having a frame period of 40 msec. The top row of FIG. 5A shows an example of a video frame. In the figure, a section specified by a pair of "{" symbol and "}" symbol indicates a video frame. In the video frame, the "{" symbol indicates the playback start time (Presentation_Start_Time) of the video frame, and the "}" symbol indicates the video frame playback end time (Presentation_End_Time) (hereinafter, the video frame has such a notation. Also, a plurality of video fields are included in the closed section specified by these symbols.

[0031] Picture data to be displayed in such a video frame is input to the decoder by the reproduction start time of the video frame and is taken out of the buffer by the decoder at the reproduction start time, as shown in FIG. I have to. The compression according to the MPEG standard is a compression that uses the spatial frequency characteristic in the image for one frame and the temporal correlation characteristic with the image to be reproduced in the past and the future, , Bidirectionally predictive Predictive (B) pictures, which are compressed by using the temporal correlation characteristics with the images to be reproduced in the past and future directions, and the temporal correlation characteristics with the images to be reproduced in the past direction. Predictive (P) picture that is compressed by using, the temporal correlation characteristics are not used, and the Intra (I picture is converted to any of the I pictures that are compressed by using the spatial frequency characteristics in the image for one frame. In this figure, B, P, and I pictures are shown with equal sizes, but it should be noted that these data sizes are different. P pictures and B pictures compressed using time correlation characteristics In order to decode a picture, it is necessary to refer to an image to be reproduced in the past direction and the future direction, for example, in decoding a B picture, it is necessary to wait until the decoding of a future image that is a reference destination is completed.

[0032] Therefore, in the MPEG video stream, the display order (display order) of each picture is specified and the coding order (coding order) of each picture is specified. The second and third rows in FIG. 5A show picture data arranged in the display order and picture data arranged in the coding order. In FIG. 5A, it is understood that the reference destination of the B picture is the I picture to be reproduced in the future. In the display order, this I-picture exists after the B-picture, but since the B-picture is compressed by utilizing the correlation characteristic with this I-picture, this I-picture is decoded when the B-picture is decoded. I have to wait for. Therefore, in the encoding order, the decoding of this I picture is specified before the B picture. Swapping the order from the coding order to the display order is called reordering.

[0033] As shown in the third row of FIG. 5A, each picture data is divided into about 2 KByte units in the state of being arranged in the encoding order, and is stored in the video pack string as shown in the bottom row. In addition, if only P pictures and B pictures are continuously used, a problem occurs when decoding is performed from the middle of the stream in special reproduction or the like, so I pictures are inserted into the picture data approximately every 0.5 seconds. A picture data string from this I picture to the head of the next I picture is called GOP (Group of Pictures), and is defined in the system layer of the MPEG standard as one compression unit in MPEG. The "|" symbol in the third row of FIG. 5A indicates the boundary of GOP. In GOP, the picture type of the picture data located at the end in the display order must be P picture, and the picture type of the picture data located at the top in the coding order must be I picture.

[0034] (1-2-2) Audio stream The audio stream is one of the data compressed by the Dolby-AC3 method, the MPEG method, and the LPCM method. Like the video stream, the audio stream is reproduced with audio frames having a unique frame period. FIG. 5B is a diagram showing the correspondence between audio frames and audio data. Specifically, the playback cycle (audio frame) of an audio stream is 32 msec for one frame of Dolby AC3, 24 msec for one frame of MPEG, and about 1.67 msec for one frame of LPCM (correctly 1/600 sec).

[0035] The top row of FIG. 5B shows an example of the audio frame. In the figure, the "<" symbol indicates the reproduction start time of the video frame, and the ">" symbol indicates the reproduction end time of the audio frame (hereinafter, the audio frame is illustrated with such notation). .. Audio data to be displayed in such an audio frame is input to the decoder before the reproduction start time of the audio frame and is taken out of the buffer by the decoder at the reproduction start time, as shown in FIG. 5B. I have to do it.

[0036] The lower part of FIG. 5B is a diagram showing an example of how audio data to be reproduced in each audio frame is stored in an audio pack. In this figure, audio data to be played in audio frames f81 and f82 is stored in audio pack A71, and audio data to be played in audio frame f84 is stored in the next audio pack A72 and audio frame f86. The audio data to be reproduced at f87 is stored in the next audio pack A73. Here, the audio data to be reproduced in the audio frame f83 is stored in a state of being divided into an audio pack A71 to be preceded and an audio pack A72 to be followed. Similarly, the audio data to be reproduced in the audio frame f85 is also stored in a divided state in the audio pack A72 to be preceded and the audio pack A73 to be succeeded. In this way, the audio data that should be played in one audio frame is stored in two audio packs in a divided state because it means that the boundaries of the audio frames and video frames do not match the boundaries of the pack. I mean. Such a boundary mismatch appears because the data structure of the pack is independent of the data structure of the video stream and the audio stream in the MPEG standard.

[0037] (1-2-3) Data structure of VOB VOB (Video Object) #1, #2, #3... Shown in Fig. 4(a) are ISOs obtained by multiplexing video streams and audio streams. / A program stream that complies with the IEC13818-1 standard and has no program_end_code added to its end.

[0038] FIG. 6A is a diagram in which the logical format of the VOB is detailed step by step. That is, in the figure, the upper logical format is a detailed version of the lower logical format. In the figure, the video stream located in the first row is divided into a plurality of GOPs shown in FIG. 5A as shown in the second row. As shown in FIG. 5A, the picture data in GOP units is divided into a plurality of 2 KByte units. On the other hand, the audio stream located on the right side of the first row is divided into a plurality of units of about 2 KByte as shown in the third row, as in FIG. 5B. The GOP-unit picture data divided into 2 KBytes is interleaved-multiplexed with the audio stream divided into about 2 KByte units to form a pack sequence shown in the fourth row. It can be seen that such a pack row forms a plurality of VOBUs (Video Object Units) shown in the fifth row, and the VOB shown in the sixth row has a configuration in which a plurality of VOBUs are arranged in time series. The lead lines shown by the broken lines in this figure clarify which part of the upper logical format is detailed by the lower logical format. Referring to the broken line in the figure based on this notation, the VOB in the fifth row corresponds to the pack row shown in the fourth row, and further corresponds to the picture data in GOP units shown in the second row. ..

[0039] As is clear from the correspondence shown by the broken line, a VOB is multiplexed with at least one GOP consisting of picture data whose reproduction time is approximately 0.4 seconds to 1.0 seconds, and this picture data. It is a unit including audio data, and it can be seen that it is configured by arranging a video pack and an audio pack in the MPEG standard. In the MPEG standard, a unit called GOP is defined in the system layer, but GOP indicates only video data as shown in the second row of FIG. 6A, and is multiplexed with this. Audio data and other data (such as sub-picture data and control data) that are present are not specified by the GOP. In order to interpolate this, in the DVD-RAM standard, a VOB is provided as a unit equivalent to GOP, and at least one GOP consisting of picture data whose playback time is approximately 0.4 seconds to 1.0 seconds and this picture data With this, the audio data multiplexed together can be collectively called.

[0040] VOB is partially deleted with VOB as the minimum unit. For example, it is assumed that a video stream recorded on a DVD-RAM as a VOB contains an image having no recording value such as a commercial. The VOB in the VOB includes one or more GOPs forming the commercial and audio data multiplexed with the picture data, and thus corresponds to the commercial among the plurality of VOBUs forming the VOB. If you delete only the part, you will not have to watch the video without recording value as above when playing the VOB. Further, even if one VOB is deleted, the VOBs before and after the VOB have a video stream for each GOP and an I picture is inserted at the beginning of the VOB, so that normal decoding and reproduction are possible. FIG. 6B is a diagram showing an example of how the VOB is partially deleted. In the figure, the VOB is composed of VOB#1, VOB#2, VOB#3, VOB#4... VOB#7. If partial deletion of VOB#2, VOB#4, and VOB#6 is ordered, the area occupied by these VOBs in the DVD-RAM is released to a free area as shown in the second row, and the second row is displayed. As shown, VOB#1, VOB#3, VOB#5, and VOB#7 are reproduced in this order.

[0041] The video pack and audio pack included in VOBUs each have a data length of 2 Kbytes. This size of 2 KByte matches the sector size of DVD-RAM. Therefore, the video pack-audio pack is recorded at a ratio of 1:1 in each sector. The arrangement of the video pack-audio pack is equivalent to the arrangement of logical sector columns, and the data stored in these packs is read from the DVD-RAM. That is, the arrangement of video pack-audio pack means the order of reading from DVD-RAM. Each video pack has a storage capacity of about 2 KBytes. For example, the data size of a video stream per VOB is several 100 KBytes, so the above video stream should be divided and stored in several hundred video packs. become.

[0042] (1-2-3-1) Data Structure of Video Pack and Audio Pack FIGS. 6C to 6E are diagrams showing logical formats of the video pack and the audio pack to be stored in the VOB. Generally, multiple packets are inserted in one pack in the MPEG system stream, but the DVD-RAM standard basically limits the number of packets to be inserted in one pack to one. FIG. 6C is a diagram showing a logical format of a video pack arranged at the head of the VOB. In this figure, the head video pack in the VOB is a pack header, a system header, a packet header, and a video stream. It can be seen that it is composed of a part of video data.

[0043] FIG. 6(d) is a diagram showing a logical format of video packs arranged other than at the beginning of the VOB. In this figure, the video packs arranged at other than the beginning of the VOB have a configuration without the system header. It can be seen that it is composed of a pack header, a packet header, and video data. FIG. 6(e) is a diagram showing a logical format of an audio pack. In this figure, the audio pack is a pack header, a packet header, and a compression method of an audio stream included in this pack is a Linear-PCM method. It can be seen that it is composed of sub_stream_id indicating whether there is a Dolby-AC3 system and a part of the audio stream compressed by the compression system.

[0044] (1-2-3-2-1) Buffer control in VOB Video stream and audio stream are stored in video pack and audio pack as described above. However, in order to play the VOB without interruption, it is not enough to simply store the video data and audio data in the video pack and audio pack, and the arrangement of the video pack and audio pack is considered so that the continuity of buffer control is guaranteed. I have to do it. The buffer mentioned here is an input buffer (hereinafter referred to as a video buffer and an audio buffer, which temporarily stores a video stream and an audio stream in the preceding stage of the decoder. Refer to the video buffer 4b and the audio buffer 4d in FIG. 19). Is the control of input/output to/from each buffer so that each input buffer does not overflow or underflow. Although a detailed description will be given later, the encoder shows the time stamps (indicating data input, output, and display time) specified in the MPEG stream as shown in FIG. 6D and FIG. 6E. Buffer control is realized by adding the packet header. If an underflow or overflow occurs in the video buffer or audio buffer, the reproduction of the video stream or audio stream will be inevitably interrupted. To prevent these, guaranteeing the continuity of buffer control has important implications.

[0045] Each audio data has a time limit that it must be transferred to the audio buffer and decoded by the playback start time of the audio frame to be played, but the audio stream has a fixed code length and the amount of data. Therefore, by storing the data necessary for reproduction in each audio frame in the audio pack and transferring it to the audio buffer, it is possible to sufficiently meet the above time limit.

[0046] FIG. 7A is a diagram showing an ideal buffer state of the audio buffer, showing an audio frame and a buffer occupation amount in the audio buffer. In this figure, the vertical axis represents the buffer occupation amount and the horizontal axis represents the time axis. This time axis is separated by 32 msec, which matches the time length of a Dolby-AC3 audio frame. Referring to this graph, it can be seen that the buffer occupancy changes in a "sawtooth wave".

[0047] The height of the triangle forming the sawtooth means the amount of data of the audio stream reproduced in each audio frame. The inclination of each triangle means the transfer rate of the audio stream. This transfer rate is the same in all audio frames. The triangles in this figure indicate that each audio data is accumulated in the audio buffer at a constant transfer rate during the display period (32 msec) of the audio frame immediately before the audio frame in which it is to be played back. It means that the audio frame is instantly taken out from the audio buffer at the reproduction end time (which means the decoding time for this audio data). The above-mentioned "sawtooth wavy" change means that the processes from the accumulation to the extraction are repeated endlessly.

[0048] For example, assume that the transfer of the audio stream to the audio buffer starts at time T1. This audio data is to be reproduced at time T2, and by the transfer of this audio data, the amount of accumulation in the audio buffer gradually increases from time T1 to time T2. Since the transferred audio data is output at the

reproduction end time of the audio frame, the audio data in the audio buffer is exhausted, and the buffer occupancy of the audio buffer returns to 0. In FIG. 7A, the same repetition is performed at time T2-time T3 and time T3-time T4.

[0049] As previously noted, the buffer state of FIG. 7A is an ideal buffer state described on the assumption that audio data to be played in each audio frame is stored in one audio pack, and In general, as shown in FIG. 5B, a plurality of audio data to be reproduced in a plurality of audio frames are stored in one audio pack. FIG. 7B is a diagram showing a more realistic buffer state. The audio pack A31 in this figure stores therein audio data A21, A22, A23 to be decoded at the reproduction end time of the audio frames f21, f22, f23. It can be seen that, of these audio data, the audio data A21 is decoded at the reproduction end time of the audio frame f21, and then the audio data A22, A23 is decoded at the reproduction end time of the audio frames f22, f23. Of the audio frames stored in the audio pack, the earliest one that should be decoded is the audio data A21, and this audio data should be decoded at the playback end time of the audio frame f21. It should be read from the DVD-RAM during the display period of the audio frame f21.

[0050] Video streams are coded with a variable code length because there is a large difference in the code amount required for each picture type (I picture, P picture, B picture) due to the adoption of the compression method using the time correlation characteristic. In addition, since the amount of data is large, transfer of each picture data, especially the data necessary for playing I-pictures, must be completed by the playback end time of the video frame immediately before the video frame in which it should be played. It is difficult.

[0051] FIG. 7C is a diagram showing a video frame and a buffer occupation amount in the video buffer. In this figure, the vertical axis represents the buffer occupation amount and the horizontal axis represents the time axis. One division of this time axis is every 33 msec, which matches the time length of the NTSC video frame. Referring to this graph, it can be seen that the buffer occupancy changes in a "sawtooth wave".

[0052] The height of the triangles forming the sawtooth means the amount of data of the video stream reproduced in each video frame, and this amount of data varies among the video frames. The data amount is thus different because the code amount is dynamically assigned according to the complexity of the image. The inclination of each triangle means the transfer rate of the video stream. The rough value of the transfer rate of the video stream is calculated by subtracting the output rate of the audio stream from the output rate of the track buffer. This transfer rate is the same in all frame periods.

[0053] The triangles in this figure indicate that each picture data is accumulated in the video buffer at a constant transfer rate (33 msec) during the display period of the video frame immediately before the video frame in which it is to be played back. It means that the video frame is instantly taken out from the video buffer at the reproduction end time (which means the decoding time for this picture data). The above-mentioned "sawtooth wavy" change means that the processes from the accumulation to the extraction are repeated endlessly.

[0054] When the image to be displayed in a certain video frame is complicated, it is necessary to allocate more code amount to this image. When a large amount of code is allocated in this way, the amount of data also becomes enormous, so it is necessary to store data in the video buffer fairly early. Generally, the time length from the transfer start time of each picture data to the video buffer to the decoding time of the picture data is called "V BV (Video Buffer Verify) delay". This "V BV delay" tends to increase as the image has a more complicated pattern and is assigned a larger code amount.

[0055] With reference to FIG. 7C, it can be seen that the transfer of the picture data decoded at the reproduction end time T16 of the video frame starts from time T11. On the other hand, at time T12, it can be seen that transfer of the picture data decoded at time T18 has started. Similarly, it can be seen that at time T14, time T15, and time T17, transfer of the picture data decoded at time T19, time T20, and time T21 has started.

[0056] FIG. 7D is an explanatory diagram for explaining the transfer time of each picture data in more detail. Considering FIG. 7C, the transfer of the picture data to be decoded at time T24 in FIG. 7D should be reproduced in the next video frame from the start time T23 of "V BV delay". It can be said that it has been completed within the time "Tf_Period" until the image transfer starts. The increase in the buffer occupancy after this time is caused by the transfer of the image to be reproduced in the next video frame.

[0057] The picture data accumulated in the video buffer waits for a time T24 at which the picture data should be decoded. When the image A is decoded at the decoding time T24, the picture data in the video buffer is exhausted, and the buffer occupancy decreases. Considering the above, it is sufficient for the transfer of audio

data to be played in a certain audio frame to start about one frame before the audio frame to be played, but the transfer in a certain video frame is It must start well before the time it should be decoded. In other words, the audio data to be played in a certain audio frame must be input to the audio buffer at approximately the same time as the picture data to be played in a video frame that is considerably future in time from the audio frame. is there. This means that in an MPEG stream in which a video stream and an audio stream are multiplexed, multiplexing is performed with the picture data preceding the audio data, and the video data and audio data in the VOB have audio data The fact is that the video data to be reproduced in the future is multiplexed.

[0058] It has already been explained that the arrangement of a plurality of video packs and audio packs in the VOB means the transfer order of the data stored in these packs. Therefore, in order to read out the audio data to be reproduced in a certain audio frame and the picture data to be reproduced in a video frame that is considerably future in time from the audio frame at approximately the same time, the audio data and the picture The audio pack and the video pack storing the data may be arranged in the vicinity of the VOB.

[0059] FIG. 8A shows how to store an audio pack storing audio data to be reproduced in each audio frame and a video pack storing picture data to be reproduced in each video frame. FIG. In this figure, the vertically long and horizontally long rectangles with "V" and "A" arranged in the center indicate video packs and audio packs, respectively. FIG. 8B is a diagram showing what the vertical width and the horizontal width of this rectangle mean. The vertical width of the rectangle indicates the bit rate of the pack, and the horizontal width indicates the transfer time of the pack. Packs indicated by vertical rectangles indicate packs that enter the buffer at a high bit rate in a relatively short period of time, and packs indicated by horizontal rectangles indicate a pack that is input at a low bit rate and take a relatively long period of time. Indicates the pack to be input to.

[0060] In the figure, the picture data V11 decoded at time T11 is transferred within the period k11. Since the audio data A11 is transferred and decoded in this period k11, as shown in the lower part of FIG. 8A, the video pack storing the picture data V11 and the audio pack storing the audio data A11 are close to each other. Is located in.

[0061] In the figure, the picture data V12 decoded at time T12 is transferred within the period k12. Since the audio data A12 is transferred and decoded in this period k12, the video pack storing the picture data V12 and the audio pack storing the audio data A12 are close to each other as shown in the lowermost part of FIG. Placed in position.

[0062] Similarly, the audio data A13, A14, A15 are also arranged in the vicinity of the picture data V13, V14 whose transfer is started at these output times. When picture data with a large code amount, such as the picture data V16, is to be stored in the video buffer, a plurality of audio data A15, A16, A17 are multiplexed during k16 which is the transfer period.

[0063] FIG. 9 shows how to store an audio pack storing a plurality of audio data to be reproduced in a plurality of audio frames and a video pack storing picture data to be reproduced in each video frame. FIG. In the figure, an audio pack A31 is an audio pack in which audio data A21, A22, A23 to be reproduced in audio frames f21, f22, f23 are stored. Of the audio data stored in this audio pack, the earliest to be decoded is the audio data A21. Since this audio data should be decoded at the reproduction end time of the audio frame f20, it should be read from the DVD-RAM together with the picture data V11 transferred at the same time as this audio frame f20 (period k11). Therefore, as shown at the bottom of FIG. 9, it is arranged in the vicinity of the video pack storing the picture data V11.

[0064] The audio pack A32 that internally stores the audio data A24, A25, A26 to be played at the playback end time of the audio frames f24, f25, f26 is a picture that is transferred at the same time (the period k15) as the audio frame f23. It should be read from DVD-RAM with data V15. Therefore, as shown at the bottom of FIG. 9, it is arranged in the vicinity of the video pack storing the picture data V15.

[0065] The audio pack can store audio data to be decoded in multiple audio frames, and the fact that the audio pack is arranged in the vicinity of the video pack that constitutes the picture data to be decoded in the future in time is taken into consideration. Considering that, it seems that the audio data-picture data to be decoded at the same time are stored in the audio pack-the video pack which are considerably separated on the VOB. However, this is not the case, and audio data that should be decoded at the same time cannot be placed near a video pack that stores picture data that will be decoded in the future for 1 second or longer. This is because the MPEG standard defines an upper limit for the time that data can be stored in the buffer, and there is a restriction that all data must be retrieved from the buffer within 1 second after being input to the buffer. is there. This constraint is

called the "1 second rule" in the MPEG standard. Since this "1 second rule" exists, even if audio data and picture data that should be decoded at the same time are separated, a maximum of 3 VOBUs from the VOB that stores picture data that should be decoded at a certain time. Audio packs to be decoded at the same time should be stored within the range.

[0066] (1-2-3-2-2) Buffer control between VOBs Next, the buffer control in the case where two or more VOBs are continuously reproduced will be described. FIG. 10A is a diagram showing a buffer state at the leading end of the video stream. Input of a pack including picture data is started at FIRST_SCR located in the middle of the video frame f71 in the figure, and only BT2 is stored in the video buffer at the reproduction end time of the video frame f72. At the playback end time of the video frame f73, only BT3 of picture data is stored in the video buffer. After that, at the reproduction end time of the video frame f74 (hereinafter referred to as FIRST_DTS), it is taken out by the video decoder. As described above, since there is no preceding video stream at the leading end of the VOB, only the triangle is drawn as the buffer state as shown in FIG. Note that this figure is drawn on the assumption that a video pack is input with FIRST_SCR, but if the pack located at the beginning of the VOB is another pack, FIRST_SCR and the start of buffer state increase. It does not match. Also, LAST_SCR is located in the middle of the video frame because the data structure of the pack and the data structure of the video data are independent.

[0067] FIG. 10B is a diagram showing a buffer state at the end of the video stream. In this figure, the data input to the video buffer is completed at LAST_SCR located in the middle of the video frame f61. After that, the accumulated video data is taken out from the video buffer by the data amount $\Delta 3$ at the reproduction end time of the video frame f61. After that, it is understood that only the data amount $\Delta 4$ is extracted at the reproduction end time of the video frame f62, and the data amount $\Delta 5$ is extracted from the video buffer at the reproduction end time of the video frame f63 (hereinafter referred to as LAST_DTS). At the end of VOB, the input of video pack-audio pack is completed by the time indicated by LAST_SCR in the figure, and the accumulated amount of video buffer gradually decreases at video frames f61, f62, f63, f64 after LAST_SCR. It will continue. Therefore, the buffer state at the end of the video stream has a step difference as shown in FIG.

[0068] FIG. 10C is a diagram showing a buffer state between VOBs. A video stream having the buffer state shown in FIG. 10B at its end and a buffer state shown in FIG. 10A at its tip. 7 shows a buffer state in the case of seamless connection with a video stream having a. When seamlessly connecting two video streams, there must be a FIRST_DTS at the end of the video stream to be played back after one video frame of LAST_DTS at the end of the video stream to be played first. That is, the first decoding of the subsequent video stream must be performed after one video frame of the last decoding time of the preceding video stream. When the interval between the LAST_DTS at the end and the FIRST_DTS at the end is one video frame, the picture data at the end of the preceding video stream and the picture at the end of the subsequent video stream are stored in the video buffer as shown in FIG. A state where data and data are mixed appears.

[0069] In FIG. 10C, it is assumed that the video frames f71, f72, f73 shown in FIG. 10A and the video frames f61, f62, f63 shown in FIG. .. In this state, at the reproduction end time of the video frame f71, the picture data BE1 at the end portion and the data BT1 forming the picture data at the end portion exist in the video buffer, and at the reproduction end time of the video frame f72, the end portion Part picture data BE2 and data BT2 forming the picture data of the tip part exist in the video buffer. At the reproduction end time of the video frame f73, the picture data BE3 at the end portion and the data BT3 forming the picture data at the tip portion exist in the video buffer. As the video frame progresses, the picture data at the end of the VOB gradually decreases, whereas the picture data at the end of the VOB gradually increases. Since such an increase/decrease appeared at the same time, the buffer state in FIG. 10(c) is sawtooth, and is similar to the buffer state in the VOB shown in FIG. 7(c). I understand.

[0070] It should be noted that the sum $BT1+BE1$ of the data amount BT1 and the data amount BE1, the sum $BT2+BE2$ of the data amount BT2 and the data amount BE2, and the sum $BT3+BE3$ of the data amount BT3 and the data amount BE3 are both Is also below the capacity of the video buffer. That is, when the sum $BT1+BE1$, the sum $BT2+BE2$, and the sum $BT3+BE3$ described above exceed the upper limit value of the video buffer, the video buffer overflows. If the maximum value of the total sum is $Bv1+Bv2$, the $Bv1+Bv2$ needs to be lower than the upper limit value of the video buffer.

[0071] (1-2-3-3) Pack header, system header, and packet header The information for buffer control described above is stored in the pack header, system header, and packet header shown in FIGS. 6(f) to 6(h). It is described as a time stamp. 6F to 6H are diagrams showing the logical formats of the pack header, the system header, and the packet header. As shown in FIG. 6(f), the pack header includes Pack_Start_Code, SCR (System Clock

Reference) indicating when the data stored in the pack should be input to the video buffer and the audio buffer, and Program_max_rate. The first SCR in the VOB is set to STC as an initial value of a system time clock (hereinafter referred to as "STC") that is standardly equipped with an MPEG standard decoder.

[0072] The system header shown in FIG. 6(g) is added only to the video pack located at the beginning of the VOBU, and the maximum rate information (in the figure) indicating the transfer rate required for the playback device when inputting data is input. Rate.bound.info) and buffer size information (Buffer.bound.info in the figure) indicating the maximum buffer size required for the playback device when inputting data in VOBU.

[0073] The packet header includes a DTS (Decoding Time Stamp) indicating the decoding time and, in the case of a video stream, a PTS (Presentation Time Stamp) that indicates when to reorder the decoded video stream and output it. PTS and DTS are set based on the playback start time of video frames and audio frames. Although PTS and DTS can be set for all packs in terms of the data structure, they are rarely added to the picture data to be displayed in all video frames. It is often applied once per GOP, that is, about once every 0.5 seconds. On the other hand, SCR is added to all video packs and audio packs.

[0074] In the video stream, one PTS is often added to each GOP video frame, but in the audio stream, one PTS is often added to every 1 to 2 audio frames. In the audio stream, the coding order and the display order cannot be interchanged, so that DTS is not added. When audio data to be reproduced in two or more audio frames is completely stored in one audio pack, the PTS of the first audio frame is described.

[0075] For example, for the audio pack A71 of FIG. 5B, the playback start time of the audio frame f81 may be described as PTS. On the other hand, for the audio pack A72 that stores the divided audio frame f83, the playback start time of the audio frame f83 must be described in the PTS, not the playback start time of the audio frame f83. The same applies to the audio pack A73, and the playback start time of the audio frame f85 must be described in the PTS, not the playback start time of the audio frame f85.

[0076] (1-2-3-4) Continuity of time stamps Next, what values are set for PTS, DTS, and SCR shown in FIGS. 6(f) to 6(h) in each video pack and audio pack. I will explain. FIG. 11A is a graph in which the SCR values of the packs included in the VOB are plotted and drawn in the pack arrangement order. The horizontal axis represents the rank of each video pack, and the vertical axis represents the SCR value given to each video pack.

[0077] It can be seen that the initial value of SCR in FIG. 11A is not "0" but a predetermined value of Init1. In this way, the initial value of SCR is not "0" because the VOB targeted by the video data editing device is often subjected to video editing several times so far, and the tip part is partially deleted. This is because there are often cases where Of course, the VOB just encoded is considered to have the initial value of SCR set to 0. However, in the present embodiment, as shown in FIG. 11A, the SCR initial value of VOB is anything other than 0. Suppose that it is set to the value of.

[0078] Referring to this graph, it can be seen that the video pack located earlier in the VOB has a smaller SCR value, and the video pack located later in the VOB has a larger SCR value. This means that video packs located later in the VOB will have a higher SCR. As described above, a pack that is located earlier in the VOB has a smaller time stamp value, and a pack that is located later in the VOB has a larger time stamp value, which is called "time stamp continuity". This continuity exists in DTS as well. The PTS assigned to each video pack causes the video pack encoded later in the encoding order to be displayed first, so the PTS value may be reversed in the preceding and following video packs, but in general, Similar to SCR and DTS, it does not change to have continuity.

[0079] On the other hand, the SCR of the audio pack has continuity like the video pack. However, the continuity in SCR, DTS, and PTS is an essential requirement for normal decoding of VOB, but what value of SCR can maintain the continuity will be explained. In FIG. 11B, a straight line showing the SCR of the section B exists on an extension of the straight line showing the SCR of the section A. In such a case, it can be said that the time stamps are continuous between section A and section B.

[0080] It can be seen from FIG. 11C that the initial value of the SCR in the section D is higher than the final value of the straight line showing the SCR in the section C. However, even in this case, since the value of the time stamp is smaller in the pack located earlier and the value of the pack is larger in the pack located later, it can be said that the time stamps are continuous between section C and section D. .. Of course, when the difference between other stamps is large, the stamps are discontinuous. In the MPEG standard, the difference

between each time stamp, for example, the difference between SCRs must not exceed 0.7 seconds. Therefore, if it exceeds this range, it is treated as discontinuous.

[0081] In FIG. 11D, it can be seen that the end value of the SCR in the section E is higher than the initial value of the straight line showing the SCR in the section F. In this case, the continuity is broken that the earlier the pack is, the smaller the value of the time stamp is, and the VOB is the later pack is, the larger the value of the time stamp is. It is discontinuous. Before and after the discontinuity boundary of the time stamps, as in section E-section F in FIG. 11D, two VOBs are managed.

[0082] The details of buffer control between VOBs and the multiplexing method are described in detail in the patents "International Publication No. WO97/13367" and "International Publication No. WO97/13363". For more detailed technical contents, refer to these publications. (1-2-4) AV file An AV file is a file that contains one or more VOBs that should be played continuously. If multiple VOBs are stored in this file, these VOBs will be played in the order in which they are recorded in the file. In the example of FIG. 4, it can be seen that the AV file stores three VOBs VOB#1, VOB#2, VOB#3, but these VOBs are called VOB#1, VOB#2, VOB#3. It will be played in order. Of the VOBs stored in this way, the buffer status between the video stream located at the end of the VOB to be played first and the video stream located at the end of the VOB to be played subsequently. Is shown in FIG. 10(c), and when the maximum value $Bv1+Bv2$ of the buffer storage amount exceeds the capacity of the video buffer, or the last time stamp in the VOB to be played first and the subsequent time stamp If there is a discontinuity between the first time stamp in the VOB to be played back and the VOB to be played back earlier, the VOB to be played back earlier and the subsequent VOB will be played back along with a break in playback. (1-3) Logical structure of RTRW management file Next, the structure of the RTRW management file will be described. The RTRW management file is information indicating the attributes of each VOB recorded in the AV file for each VOB.

[0083] FIG. 12A is a diagram in which the recorded contents of the RTRW management file are detailed step by step. That is, in the figure, the logical format located on the right side is a detailed version of the logical format located on the left side, and the leader line shown by the broken line indicates that the logical format on the right side is within the logical format on the left side. It clarifies which part of the is detailed.

[0084] Referring to the logical format of VOB in this figure according to such notation, the RTRW management file contains VOB information about VOB#1, VOB#2, VOB#3...VOB#6, It can be seen that the VOB information is composed of VOB general information, stream attribute information, a time map table, and seamless connection information. (1-3-1) VOB General Information "VOB general information" includes a VOB-ID uniquely assigned to each VOB recorded in the AV file and VOB reproduction time information.

[0085] (1-3-2) Stream attribute information "Stream attribute information" consists of "video attribute information" and "audio attribute information". The "video attribute information" includes video format information in which either MPEG2 or MPEG1 is described, and a display system in which NTSC or PAL/SECAM is described. When the video attribute information is described in the NTSC system, it is possible to describe 720 x 480, 352 x 240, etc. as the resolution. Also, 4:3 or 16:9 can be described as the aspect ratio. It is possible to describe the presence/absence of copy protection control for analog video signals, and the presence/absence of copy guard to the VTR by changing the signal amplitude of the blank section of the video signal and impeding the AGC circuit of the VTR.

[0086] "Audio attribute information" indicates the encoding format that indicates MPEG2, Dolby Digital, linear PCM, etc., the sampling frequency at which 48KHz, etc. are set, and the bit rate for a fixed bit rate, and for a variable bit rate " And the audio bit rate where the mark "VBR" is described. The "time map table" describes the size of each VOB that makes up the VOB and the playback time of those VOBs. To further improve access performance, a representative VOB is selected at regular intervals, for example, in units of several tens of seconds. The address and elapsed time from the beginning of the VOB are recorded.

[0087] (1-3-3) Seamless connection information "Seamless connection information" is information that seamlessly performs continuous playback of multiple VOBs recorded in the AV file, and includes "seamless flag", "video playback start time VOB_V_S_PTM", and Video playback end time VOB_V_E_PTM", "FIRST_SCR", "LAST_SCR", "audio gap start time A_STP_PTM", "audio gap length A_GAP_LEN", and "audio gap position information A_GAP_LOC".

[0088] (1-3-3-1) Seamless flag "Seamless flag" means that the VOB corresponding to this seamless connection information will be seamless after the VOB (front VOB) placed before this VOB in the AV file has finished

playing. It is a flag indicating whether or not to be performed. When this flag is set to 01, it indicates that the reproduction of the main VOB (rear VOB) is performed seamlessly, and when it is set to 00, it indicates that the rear VOB is reproduced non-seamlessly.

[0089] In order to realize seamless playback of multiple VOBs, the following relationships (1) and (2) must be satisfied between the rear VOB and the front VOB. (1) The video stream display methods (NTSC, PAL, etc.) indicated in the video attribute information are the same. (2) The encoding methods (AC-3, MPEG, LPCM, etc.) of the audio streams indicated in the audio attribute information are the same.

[0090] In the above (1) and (2), seamless playback is not possible because the display method, encoding method and bit rate of the video decoder and audio decoder are different when the display method and encoding method of the video stream and audio stream are different. This is because the operation is stopped due to the switching. For example, in two audio streams to be played continuously, when one encoding method is AC3 method and the other is MPEG standard, when the stream changes from AC3 to MPEG, the audio decoder is Since the stream attribute is switched with, decoding stops during this period. The same applies when the attributes of the video stream change.

[0091] The seamless flag is set to 01 only when all of the relationships (1) and (2) are satisfied, and the seamless flag is set to 00 when even one of the relationships (1) and (2) is not satisfied. It (1-3-3-2) Video playback start time VOB_V_S_PTM "Video playback start time VOB_V_S_PTM" describes the time when the playback of the first video field of the video stream forming the VOB starts in PTM description format. is there.

[0092] The PTM description format is a format defined to express a time to be described with a time accuracy of $1/27,000,000$ seconds and a time accuracy of $1/90,000 (=300/27,000,000)$ seconds. Here, the time accuracy of $1/90,000$ seconds considers the common multiple of the frame frequency of NTSC signal, PAL signal, Dolby AC-3, and MPEG audio, and the time accuracy of $1/27,000,000$ second is 27 MHz which is the frequency of STC. Is taken into consideration.

[0093] FIG. 12B is a diagram showing a PTM description format. In this figure, the PTM description format has a base part (PTM_base) that represents the quotient when the playback start time is divided by $1/90,000$ seconds, and the remainder when the playback start time is divided by the base part is $1/27,000,000$ seconds. It consists of an extension part (PTM_extension) that is expressed in time accuracy. (1-3-3-3) Video playback end time VOB_V_E_PTM "Video playback end time VOB_V_E_PTM" describes the time when the playback of the final video field of the video stream forming the VOB ends in PTM description format. is there.

[0094] (1-3-3-4) Relationship between video playback start time VOB_V_S_PTM and video playback end time VOB_V_E_PTM What should be the relationship between VOB_V_S_PTM of the rear VOB and VOB_V_E_PTM of the front VOB when seamlessly playing back two VOBs? Will be described. Originally, the rear VOB is played after all the video packs contained in the front VOB have been played, so the VOB_V_S_PTM of the rear VOB must be the same as the VOB_V_E_PTM of the front VOB, and the time stamp will not be incorrect. Continuity occurs and it is not possible to continuously regenerate the front VOB-rear VOB. However, for two VOBs encoded completely separately, the encoder uniquely gives a time stamp to each video pack and audio pack when encoding, and the video playback end time VOB_V_E_PTM of the front VOB and the rear VOB It is difficult to request the relationship that the video playback start times VOB_V_S_PTM are equal.

[0095] FIG. 13 is a graph showing the buffer occupation amount for each of the front VOB and the rear VOB. In these graphs, the vertical axis represents the buffer occupancy of the buffer, and the horizontal axis is the time axis. On this time axis, the times indicated in SCR, PTS, video reproduction end time VOB_V_E_PTM, and video reproduction start time VOB_V_S_PTM are plotted. In FIG. 11B, the picture data to be displayed last in the front VOB waits for the PTS which is the reproduction start time when the input of the video data forming the picture data into the video buffer is completed by LAST_SCR. The display process is started (this is not the case when the pack finally input to the MPEG decoder is another pack such as an audio pack). The time when the display period h1 has elapsed from this PTS is the video reproduction end time VOB_V_E_PTM. The display period h1 is a period in which drawing from the first field to the last field forming an image for one screen is completed.

[0096] In the lower part of FIG. 13, the picture data to be displayed first in the rear VOB is input to the video buffer by FIRST_SCR and displayed after waiting for the PTS which is the reproduction start time. This display time is the video reproduction start time VOB_V_S_PTM. In this figure, SCR, video playback end time

VOB_V_E_PTM, and video playback start time VOB_V_S_PTM are given to the video packs of the front VOB and rear VOB. You can see that

[0097] Then, the reason why seamless reproduction is possible even in the relationship of VOB_V_S_PTM of the rear VOB (VOB_V_E_PTM of the front VOB will be described. In the DVD-RAM standard, an extended STD model (hereinafter referred to as "E-STD") is defined as a standard model of the playback device (see FIG. 19). Generally, an MPEG standard decoder has a system time clock STC that measures a reference time, and a video decoder and an audio decoder perform a decoding process and a display process with reference to the reference time measured by this STC. E-STD has an adder that adds an offset to the reference time output by the STC, in addition to the STC, and selects either the reference time output by the STC or the output value of the adder. Then, it can be given to a video decoder and an audio decoder. With this configuration, even if the time stamps are discontinuous between VOBs, by giving the output value of the adder to the decoding, it is possible to behave as if the time stamps between VOBs are continuous. Even if the VOB_V_E_PTM of the front VOB and the VOB_V_S_PTM of the rear VOB have the above discontinuous relationship, seamless reproduction is performed.

[0098] Not only that, the difference between the video playback end time VOB_V_E_PTM of the rear VOB and the video playback start time VOB_V_S_PTM of the front VOB can be used as an offset (generally called "STC offset") to be added by the adder. ... Therefore, the playback device of the E-STD model uses the video playback end time VOB_V_E_PTM and the video playback start time VOB_V_S_PTM to perform the following calculation, obtain STC_offset, and set it in the adder. $STC_offset = VOB_V_E_PTM \text{ of front VOB} - VOB_V_S_PTM \text{ of rear VOB}$ Actually, video playback start time VOB_V_S_PTM and end time VOB_V_E_PTM in seamless connection information are described. It also has the purpose of making the adder set.

[0099] FIG. 11E is a diagram in which the graph showing the continuity of the time stamps shown in FIG. 11A is described for two VOBs. The time stamp of the first pack in VOB#1 has an initial value Init1, and the time stamp of a later pack has a larger value. The time stamp of the first pack in VOB#2 also has an initial value Init2, and the time stamp of a later pack has a larger value. In this figure, since the end value of the time stamp in VOB#1 exceeds the initial value of the time stamp in VOB#2, it can be seen that the time stamps of the two VOBs are discontinuous. Nevertheless, if you want to decode the first pack of VOB#2 after the last pack of VOB#1, you can add STC_offset to the time stamp of VOB#2, and the continuity of the time stamp of VOB#2 will be Move from what is shown by the solid line to what is shown by the broken line. When the VOB#2 time stamp moves to that shown by the broken line, the straight line showing the increasing property of the VOB#2 time stamp value is located on the extension of the increasing line of the VOB#1 time stamp value. It can be seen that

[0100] (1-3-3-5) FIRST_SCR In "FIRST_SCR", the SCR attached to the first pack of the VOB is entered in the PTM description format. (1-3-3-6) LAST_SCR In "LAST_SCR", the SCR attached to the last packed pack in the VOB is entered in the PTM description format.

[0101] (1-3-3-7) Relationship between FIRST_SCR and LAST_SCR As described above, since the VOB is reproduced by the E-STD type decoder, the LAST_SCR of the front VOB and the FIRST_SCR of the rear VOB are the front VOB. It can be seen that LAST_SCR of = does not have to be FIRST_SCR of the rear VOB. However, considering STC_offset, the relation of the following formula must be satisfied. $LAST_SCR \text{ of front VOB} + 1 \text{ time required for pack transfer} \leq STC_offset + FIRST_SCR \text{ of rear VOB}$ where LAST_SCR of front VOB and FIRST_SCR of rear VOB do not satisfy the above relationship means packs forming front VOB And the packs forming the rear VOB are transferred to the video buffer and the audio buffer at the same time, and the MPEG standard and E-STD decoders that transfer in pack units according to the order of pack sequences. It goes against the model. Here, referring to FIG. 10C, it can be seen that the LAST_SCR of the front VOB matches the $STC_offset + FIRST_SCR$ of the rear VOB, and the above relationship is satisfied.

[0102] When reproducing a VOB using an E-STD type decoder, it is important to note the timing of switching between the reference time output by the STC and the reference time with an offset output by the adder. Since the VOB time stamp does not contain any information about such a switching time, there is a possibility that the timing of switching to the output value of the adder may be missed even if the E-STD is a corner.

[0103] FIRST_SCR, LAST_SCR is effective to inform the decoder of the output value switching timing of the adder, and the decoder compares the reference time output by the STC with the FIRST_SCR, LAST_SCR while

the STC is being counted. I do. If the reference time output by the STC and the FIRST_SCR, LAST_SCR match, the reference time output by the STC is switched to the output value of the adder.

[0104] Here, there are two types of VOB playback: normal playback in which playback is performed from the front VOB to the rear VOB, and rewind playback in which playback is performed from the rear VOB to the front VOB, but LAST_SCR is used during normal playback. FIRST_SCR is used to switch the reference time, and FIRST_SCR is used to switch the reference time during rewinding reproduction. During rewind playback, the last VOB of the rear VOB is decoded to the first VOB, and after the first video pack of the rear VOB is decoded, it is decoded from the last VOB of the front VOB to the first VOB. .. In other words, during rewind playback, it is necessary to switch the reference time at the time when the decoding of the first video pack of the rear VOB has been completed, and in order to notify this time to the E-STD video data editing device, the RTRW management file must be written. FIRST_SCR of each VOB is entered.

[0105] For more detailed technical contents regarding the above E-STD and STC_offset, refer to International Publication "International Publication No. WO97/13364". (1-3-3-8) Audio gap start time A_STP_PTM "Audio gap start time A_STP_PTM" is the PTM description format for the stop start time at which the audio decoder operation should stop when there is an audio playback gap in the VOB. Can be described in. The time designated by the audio gap start time A_STP_PTM is one for each VOB.

[0106] (1-3-3-9) Audio gap length A_GAP_LEN "Audio gap length A_GAP_LEN" indicates how many hours the audio decoder should be stopped from the stop start time indicated by the audio gap start time A_STP_PTM. The time length of the audio gap length A_GAP_LEN is limited to less than 1 audio frame.

[0107] (1-3-3-10) Necessity of Audio Gap The reason why the audio gap start time A_STP_PTM and the audio gap length A_GAP_LEN are used to identify the period when the audio gap occurs will be described. Since the video stream and the audio stream are reproduced in different cycles, the total reproduction time of the video stream and the audio stream included in the VOB are different from each other. For example, when the video stream is the NTSC system and the audio stream is the Dolby-AC3 system, the total playback time of the video stream is an integral multiple of 33 msec as shown in FIG. 14A, and the total playback time of the audio stream is It is an integer multiple of 32 msec.

[0108] When two VOBs are continuously played regardless of the total playback time, the playback time of any picture data and the playback time of audio data are aligned in order to synchronize the playback of picture data and the playback of audio data. There is a need. When trying to align in this way, a time difference of the total reproduction time appears at the beginning or end of the picture data and audio data.

[0109] FIG. 14B is a diagram showing a state in which a time difference g1 appears at the end of picture data and audio data because the reproduction time of picture data and the reproduction time of audio data are attempted to be aligned at the end of VOB. .. It can be seen that VOB#1 has a time difference g1 at its terminal end. If you try to connect VOB#2 to VOB#1 here, the audio stream of VOB#2 is played so as to close the time difference g1, so the playback of the audio stream in VOB#2 is performed at time g0. I will be destroyed. This is because the audio decoder uses the fact that the audio stream is played back at a constant frame rate to continuously decode the audio stream at a fixed cycle. This is because if VOB#2 to be played has already been read from the DVD-RAM, VOB#2 decoding will be started as soon as all the audio streams of VOB#1 have been decoded.

[0110] To prevent the playback of the VOB audio stream that is played subsequently during seamless playback from preceding, manage the audio gap information in the stream on the host side in the playback device, and during the audio gap period, the host side plays the audio gap information. Decoding must be stopped for the decoder. This reproduction stop period is an audio gap, and the audio gap start time A_STP_PTM and the audio gap length A_GAP_LEN specify the time zone in which this audio gap appears.

[0111] Also, in the stream, processing for specifying the audio gap is performed. Specifically, the PTS of the audio frame immediately after the audio gap is described in the packet header of the audio packet to specify when the audio gap ends. However, this specifying method has a problem when a plurality of audio data to be reproduced in a plurality of audio frames are stored in the audio packet. This is because, when a plurality of audio data to be reproduced in a plurality of audio frames is stored, the PTS can be described in the packet only in the first audio frame among the plurality of audio frames. In other words, PTS cannot be described for the remaining audio frames. If audio data to be played in audio frames located before and after the audio gap is placed in the same packet, the PTS of the audio frame immediately after the audio gap cannot be described, so

the audio gap cannot be specified and the audio gap is It will disappear. Therefore, the audio frame immediately after the audio gap is processed so as to be arranged at the beginning of the next audio pack, and the PTS (audio gap start time $A_STP_PTM + \text{audio gap length } A_GAP_LEN$) of the audio frame immediately after the audio gap is explicitly shown in the stream.

[0112] Furthermore, if necessary, in an audio packet storing audio data to be reproduced immediately before the audio gap, a padding-packet defined by the MPEG standard is inserted immediately after the audio data. FIG. 14C shows audio data y-2, y-1 to be reproduced in a plurality of audio frames y-2, y-1, y located at the end of VOB#1 shown in FIG. 14B. , y and a padding-packet are included in the audio pack G3, and an audio pack G4 including a plurality of audio frames u, u+1, u+2 located at the end of VOB#2 is shown. Is.

[0113] The audio pack G4 described above is a pack including audio data to be reproduced in an audio frame located immediately after the audio gap, and the audio pack G3 is a pack located immediately before the pack. When the audio data to be played in the audio frame located immediately after the audio gap is included in the pack, the pack located immediately before the pack is referred to as an "audio pack including an audio gap".

[0114] Since the audio pack G3 is located behind the video pack row in the VOB, there is no picture data to be displayed in the future from VOB#1. However, since the reproduction of VOB#1 is premised on that VOB#2 follows, the picture data contained in VOB#2 is read in audio frames y-2, y-1, y. It becomes the correct picture data. If so, the audio pack G3 including the audio gap may be placed in any one of the three VOBs located at the tip of VOB#2 within a range that does not violate the "1 second rule". FIG. 14D is an explanatory diagram showing that the audio pack G3 including the audio gap is arranged in any one of VOB#1, VOB#2, and VOB#3 located at the tip of VOB#2. is there.

[0115] During the audio gap, the operation of the audio decoder must be temporarily stopped. This is because the audio decoder tries to perform the decoding process even during the audio gap period, and the host-side control unit that performs the central control in the playback device is the decoder after the playback of the picture data-audio data is completed. To the audio pause and temporarily stop the audio decoder (this instruction information is ADPI (Audio Decoder Pause Information) in FIG. 19). Thus, during the audio gap, the audio decoder It is possible to stop the operation of. However, no matter how the audio gap appears, it does not mean that audio output can be stopped.

[0116] Because the control unit is often composed of a general-purpose microcomputer and software, it is possible that the stop instruction from the control unit will not be in time if the audio gap is continuous for a short time due to the reason of stopping audio decoding. Because there is. For example, when playing a VOB continuously for about 1 second, it is necessary to instruct to stop the audio decoder at an interval of about 1 second. It may not be possible to stop the audio decoder while continuing. Also, in VOB playback, if you try to align the playback time of picture data and the playback time of audio data many times, it is necessary to instruct the audio decoder to stop each time, so it is composed of a general-purpose microcomputer and software. The control unit may not be able to stop the audio decoder while the audio gap continues.

[0117] Therefore, the following restrictions are set so that the audio gap occurs after a certain period. First of all, the time length of VOB is set to 1.5 seconds or more so that the stop control by the control unit can be performed with a margin to prevent the audio gap from being shortened. Secondly, the reproduction time of picture data and the reproduction time of audio data are aligned only once for each VOB. By doing this, there will be one audio gap per VOB.

[0118] Thirdly, the time length of the audio gap is limited to less than 1 audio frame. Finally, with the audio gap start time $VOB_A_STP_PTM$ as the reference for the rear video playback start time $VOB_V_S_PTM$, the audio gap start time ($VOB_A_STP_PTM$) should be placed within one audio frame before the rear video playback start time ($VOB_V_S_PTM$). Restricted to. That is, it is limited so as to satisfy the relationship of the following equation. $VOB_V_S_PTM - 1 \text{ Audio frame playback time} \leq A_STP_PTM \leq VOB_V_S_PTM$ Because even if an audio gap occurs at such time, the first video is just displayed in the rear VOB, and the audio output is silent, the operator This is because it is considered unlikely to give a feeling of strangeness to.

[0119] By setting the above restrictions, the audio gap occurrence interval during seamless playback is at least "1.5 seconds-1 audio frame playback time x 2". If you apply the numerical value concretely, if the audio is Dolby AC3, one audio frame playback time is 32 msec, so the audio gap occurrence interval is 1436 msec at the minimum, and the stop control by the control unit is performed with a margin. Probability is high.

[0120] (1-3-3-11) Audio gap position information "Audio gap position information A_GAP_LOC" indicates in which VOB of the three VOBs located at the front end of the rear VOB the audio pack including the audio gap is inserted. It is a 3-bit value. When this information is 1, it indicates that VOB#1 has an audio gap, and when this information is 2, it indicates that VOB#2 has an audio gap. A value of 3 indicates that there is an audio gap in VOB#3.

[0121] The need for such a flag is to recreate the audio gap when the rear VOB of the two VOBs to be seamlessly reproduced needs to be partially deleted. Partial deletion of a VOB refers to deleting a plurality of VOBUs located at the front end or end of the VOB. For example, when editing a video, it is often desirable to cut only the opening scene. In this case, the "VOB partial deletion" is to delete the VOBU including the opening scene.

[0122] When performing such partial deletion, it should be noted that the audio pack includes the audio gap moved to the rear VOB. As described above, since the audio gap is determined based on the video reproduction start time VOB_V_S_PTM of the rear VOB, the audio gap is multiplexed in any of the three VOBs at the head of the VOB. Therefore, when a part of VOBUs, for example, the first VOBU is deleted, it is not known whether the audio gap is deleted or disappeared.

[0123] Also, the number of audio gaps that can be provided in a VOB is only one audio gap per VOB, and when a new audio gap is generated, the past audio gap becomes unnecessary and must be deleted. What is troublesome here is that the audio pack G3 including an audio gap as shown in FIG. Since it is inserted, the audio pack G3 including the above audio gap must be taken out from the packs included in these VOB#1 to VOB#3. Even with at most three VOBs, stream analysis is required to immediately extract only the audio pack G3 containing the audio gap from these. This is because each VOBU contains several hundreds of packs, and the inside of each VOBU requires a considerable amount of processing.

[0124] The audio gap position information A_GAP_LOC indicates the position of the VOBU among the three VOBs located at the front end of the rear VOB with a 3-bit flag that indicates the audio gap search. The target VOBU can be specified as any one, and the audio pack G3 including the audio gap can be easily taken out.

[0125] FIGS. 15A to 15D show a video data editing device when a VOBU located at the tip of VOB#2 among VOB#1-VOB#2 that should be played back seamlessly is deleted. FIG. 9 is an explanatory diagram showing a procedure for recreating an audio gap. In FIG. 15A, it can be seen that VOB#1 has "VOBU#98", "VOBU#99", and "VOBU#100" arranged at its end. Also, it can be seen that VOB#2 has "VOBU#1", "VOBU#2", and "VOBU#3" arranged at the tip thereof. It is assumed that the video data editing apparatus is instructed to partially delete VOBU#1 to VOBU#2 in VOB#2.

[0126] The audio gap position information A_GAP_LOC is referred to in order to specify the VOBU in which the audio pack G3 including the audio gap is arranged. If the audio gap position information A_GAP_LOC is set as shown in FIG. 15B, it can be seen that the audio pack G3 including the audio gap is arranged in VOBU#3 of VOB#2.

[0127] When it is found that the audio pack G3 including the audio gap is arranged in VOBU#3 in this way, it is known whether or not the audio gap is multiplexed within the partial deletion range. Since no gap is included, A_GAP_LOC is modified by the number of deleted VOBUs as shown in FIG. (1-4) System Configuration of Video Data Editing Device The video data editing device according to the present embodiment also has a function as a DVD-RAM reproducing device-recording device. FIG. 16 shows a configuration example of a system using the video data editing device according to this embodiment. The video data editing apparatus (hereinafter referred to as the DVD recorder 70) in this system includes a remote controller 71, a television receiver 72 connected to the DVD recorder 70, and an antenna 73. The present DVD recorder 70 is assumed to be used as an alternative machine with an editing function of a video tape recorder which is widely used as a recorder for television broadcasting, and the present system is a video data editing apparatus for such an application. Shows the case where is used at home. The DVD-RAM is used as a recording medium for the DVD recorder 70 to record a television broadcast.

[0128] When the DVD recorder 70 is loaded with the DVD-RAM, the DVD recorder 70 compresses the video signal or the NTSC signal received through the antenna 73 and records it on the DVD-RAM as a VOB, and also includes it in the VOB recorded on the DVD-RAM. The video stream and the audio stream are expanded and the video signal or the NTSC signal and the audio signal are output to the television receiver 72.

[0129] (1-4-1) Hardware Configuration of DVD Recorder 70 FIG. 17 is a block diagram showing the hardware configuration of the DVD recorder 70. The DVD recorder 70 has a control unit 1, an MPEG encoder 2, a disc access unit 3, a decoder 4, a video signal processing unit 5, a remote controller 71, a bus 7, a remote controller signal receiving unit 8 and a receiver 9.

[0130] The solid line arrows in the figure are physical connection lines mounted as board wiring in the video data editing device, and the broken lines in the figure are on the connection lines indicated by the solid line arrows during video editing, where various data It is a logical connection line that shows how the data is input and output. The numbers (1), (2), (3), (4), and (5) attached to the broken lines indicate which VOB, the picture data that composes it, and the audio data on the physical connection line when re-encoding the VOB. It shows how to transmit.

[0131] The control unit 1 is a host-side control unit having a CPU 1a, a processor bus 1b, a bus interface 1c, a main memory 1d, and a ROM 1e. By executing a program stored in the ROM 1e, VOB recording, reproduction, editing, etc. I do. In the MPEG encoder 2, when the receiver 9 receives the NTSC signal through the antenna 73, or when the video signal output from the home video camera is input from the video input terminal provided on the back surface of the DVD recorder 70. A VOB is obtained by encoding the NTSC signal and the video signal, and the VOB as the encoding result is output to the disk access unit 3 through the bus 7. In particular, as a process related to video editing, the MPEG encoder 2 inputs the decoding result by the decoder 4 output from the connection line c1 via the bus 7 as shown by a broken line (4), and encodes this decoding result to obtain VOB. Then, the encoded VOB is output to the disk access unit 3 through the bus 7 as indicated by a broken line (5).

[0132] The disk access unit 3 has a track buffer 3a, an ECC processing unit 3b, and a drive mechanism 3c for the DVD-RAM, and accesses the DVD-RAM under the control of the control unit 1. More specifically, when the control unit 1 instructs recording on the DVD-RAM and the encoded VOBs are sequentially output from the MPEG encoder 2 as shown by the broken line (5), the disk access unit 3 outputs those output signals. The VOB is stored in the track buffer 3a, is subjected to the ECC processing by the ECC processing section 3b once, and then the drive mechanism 3c is controlled so as to be sequentially recorded in the DVD-RAM. On the other hand, when the control unit 1 instructs reading from the DVD-RAM, the drive mechanism 3c is controlled to sequentially read the VOBs from the DVD-RAM, and the read VOBs are subjected to the ECC processing by the ECC processing unit 3b. After that, it is stored in the track buffer 3a.

[0133] Here, the drive mechanism 3c is a base for setting a DVD-RAM, a spindle motor for clamping and driving the set DVD-RAM to rotate, an optical pickup for reading a signal recorded in the DVD-RAM, and an optical pickup. The read/write of the DVD-RAM is realized by these controls, but the details of the control are not the main object of the present invention and can be realized by a known technique. The description is omitted.

[0134] When the VOB read from the DVD-RAM by the disc access unit 3 is output as indicated by the broken arrow (1), the decoder 4 decodes the output VOB to generate digital uncompressed video data. , The audio signal is obtained, and the digital uncompressed video data is output to the video signal processing unit 5 and the audio signal is output to the television receiver 72. Further, at the time of video editing, the decoder 4 outputs the decoding results of the video stream and the audio stream to the bus 7 via the connection lines c2 and c3 in FIG. 17 as indicated by broken line arrows (2) and (3). The decoding result output to the bus 7 is output to the MPEG encoder 2 via the connection line c1 as indicated by a dashed arrow (4).

[0135] The video signal processing unit 5 converts the video data from the decoder 4 into a video signal for the television receiver 72, and if graphics data is output from the outside, combines the graphics data with the converted video signal. Signal processing as follows. The remote control signal receiving unit 8 receives the remote control signal, notifies the control unit 1 of the key code included in the signal, and causes the control unit 1 to perform control according to the operation of the remote control 71.

[0136] (1-4-1-1) Internal Configuration of MPEG Encoder 2 FIG. 18 is a block diagram showing the configuration of the MPEG encoder 2. As shown in the figure, the MPEG encoder 2 includes a video encoder 2a, a video buffer 2b for storing the output of the video encoder, an audio encoder 2c, an audio buffer 2d for storing the output of the audio encoder, and an encoding in the video buffer 2b. A system encoder 2e that multiplexes the encoded video stream and the encoded audio stream in the audio buffer 2d, an STC (system time clock) unit 2f that generates a synchronization clock for the encoder 2, and an encoder that controls and manages these. It is composed of a control unit 2g.

[0137] (1-4-1-2) Internal Configuration of Decoder 4 FIG. 19 is a block diagram showing the configuration of the decoder 4. As shown in the figure, the decoder 4 includes a demultiplexer 4a, a video buffer 4b, a video decoder 4c, an audio buffer 4d, an audio decoder 4e, a reorder buffer 4f, an STC 4g, an adder 4h, a switch SW1, a switch SW2, and a switch SW3. , Switch SW4, and decoder control unit 4k.

[0138] The demultiplexer 4a refers to the header of the packet read from the VOB and determines whether each pack is a video pack or an audio pack. If the determination result is a video pack, the video data in the pack is output to the video buffer 4b, and if it is an audio pack, the audio data in the pack is output to the audio buffer 4d.

[0139] The video buffer 4b is a buffer for accumulating the video data output by the demultiplexer 4a. Each picture data is stored in the video buffer 4b at the decoding time until it is taken out from the buffer. The video decoder 4c takes out the picture data stored in the video buffer 4b from the video buffer 4b at each decoding time and instantly decodes it.

[0140] The audio buffer 4d is a buffer for accumulating the audio data output by the demultiplexer 4a. The audio decoder 4e sequentially decodes audio data in audio frame units stored in the audio decoder 4e. When the output of ADPI (Audio Decoder Pause Information) issued by the control unit 1 is accepted, the audio decoder 4e stops the decoding process of the audio frame data. ADPI is issued from the control unit 1 when the current time reaches the audio gap start time A_STP_PTM indicated in the seamless connection information.

[0141] When the picture data decoded by the video decoder 4c is an I picture or a P picture, the re-order buffer 4f is a buffer for storing the decoding result of those pictures. The reason why the decoding results of the I picture and the P picture are stored in this way is to change the encoding order and the display order, and all the decoding results stored in the re-order buffer 4f should be displayed. After the B picture is decoded by the video decoder 4c, the re-order buffer 4f outputs the decoding result of the I picture and P picture stored until then as a video signal or an NTSC signal.

[0142] The STC (system time clock) unit 4g generates a synchronous clock indicating the reference time in the decoder 4. The adder 4h outputs a value obtained by adding STC_Offset to the reference time indicated by the synchronous clock as the reference time with offset. This STC_offset is calculated and set by the control unit 1 taking the difference between the video reproduction start time VOB_V_S_PTM and the video reproduction end time VOB_V_E_PTM indicated in the seamless connection information.

[0143] The switch SW1 supplies the reference time measured by the STC 4g or the reference time with offset output from the adder 4h to the demultiplexer 4a. The switch SW2 supplies the reference time counted by the STC 4g or the reference time with offset output by the adder 4h to the audio decoder 4e. The supplied reference time or reference time with offset is used for comparison with the decoding time and reproduction start time of each audio frame.

[0144] The switch SW3 supplies the reference time counted by the STC 4g or the reference time with offset output by the adder 4h to the video decoder 4c. The supplied reference time or reference time with offset is used for collation with the decoding time of each picture data. The switch SW4 supplies the reference time measured by the STC 4g or the reference time with offset output from the adder 4h to the re-order buffer 4f. The supplied reference time or reference time with offset is used for collation with the reproduction start time of each picture data.

[0145] The decoder control unit 4k receives from the control unit 1 a decoding process request in an integer multiple unit of VOB, that is, in an integer multiple unit of GOP, and causes the demultiplexer 4a to the re-order buffer 4f to perform the decoding process. When the reproduction output is valid, the decoding result of the video decoder 4c and the audio decoder 4e is output to the outside, and when the reproduction output is invalid, the video decoder 4c and the audio decoder are received. The output of the 4e decoding result to the outside is prohibited. The valid/invalid instruction can be made in a unit smaller than the video frame, that is, in the video field. The information that specifies the effective section of the reproduction output in units of this video field is called effective reproduction section information.

[0146] (1-4-1-2-1) Switching Timing of Switches SW1 to SW4 FIG. 20 is a timing chart showing switching timing of the switches SW1 to SW4. This timing chart shows at what timing the switches SW1 to SW4 are switched when VOB#1 and VOB#2 are continuously reproduced. The upper part of the figure shows the pack

sequence forming VOB#1-VOB#2, and the middle part shows the video frame. The lower row shows audio frames.

[0147] The switching timing of the switch SW1 is the time when the pack sequence transferred to the decoder 4 is changed from VOB#1 to VOB#2. This time is indicated in LAST_SCR of seamless connection information about VOB#1. The switching timing of the switch SW2 is the time when all the VOB stored in the audio buffer 4d before the switching of the switch SW1, that is, all the audio data of VOB#1 are decoded.

[0148] The switching timing of the switch SW3 is a time point when all the VOB accumulated in the video buffer 4b before the switching time (T1) of the switch SW1, that is, all the video data of VOB#1 are decoded. The switching timing of the switch SW4 is the time when the display of the last video frame is completed in the display order of VOB#1.

[0149] The program stored in the ROM 1e includes a module that processes so that the two VOBs recorded in the DVD-RAM are seamlessly reproduced. (1-4-1-2-2) Processing procedure for seamless processing on VOB FIGS. 21 and 22 show the processing procedure of the processing module for processing so that two VOBs in an AV file are seamlessly connected. It is a flowchart shown. FIG. 23A and FIG. 23B are explanatory diagrams showing how the buffer state is analyzed based on each video pack. In FIGS. 24A and 25, the audio frame x , $x+1$, $y-1$, y , u , $u+1$, $u+2$ used in FIG. 22 corresponds to which audio frame of the audio stream. FIG.

[0150] Next, VOB re-encoding will be described. In step S102 of FIG. 21, the control unit 1 obtains STC_OFFSET by calculating $VOB_V_E_PTM$ of the front VOB- $VOB_V_S_PTM$ of the rear VOB. In step S103, the control unit 1 analyzes the change in the buffer occupancy amount from FIRST_SCR of the front VOB to the decoding end time of all data. 23A and 23B are explanatory diagrams showing the process of analyzing the buffer occupancy in step S103. As shown in FIG. 23A, when the front VOB includes video pack #1 and video pack #2, SCR#1 and #2 and DTS#1 included in these video packs are included. Is plotted on the time axis. Then, the data size of the data contained in the video pack #1 and the video pack #2 is detected. The slope of the bit rate information in the pack header from SCR#1 is plotted for the data size of video pack #1. Next, similarly plot only the data size of Video Pack #2 from SCR #2. Next, plotting is performed so that the size is reduced by the data size of the picture data P1 decoded by DTS#1. At this time, the size of the picture data P1 is obtained by analyzing the video stream.

[0151] When the data sizes of the video pack and the picture data are plotted in this way, the buffer state of the video buffer 4b from the beginning SCR to DTS can be graphed. By repeating the same procedure for all the video data and audio data included in the VOB, a graph showing the buffer state as shown in FIG. 23B can be obtained.

[0152] In step S104, the control unit 1 analyzes the change in the video buffer occupation amount from FIRST_SCR of the rear VOB to the decoding end time LAST_DTS of all data by performing the same analysis as in step S103 on the rear VOB. In step S105, the control unit 1 analyzes the change in the video buffer occupancy from FIRST_SCR+STC_offset of the rear VOB to LAST_DTS of the front VOB. In the time zone from FIRST_SCR+STC_offset of the rear VOB to LAST_DTS of the front VOB, the first picture data of the rear VOB is transferred to the video buffer 4b even though the last picture data of the front VOB is accumulated in the video buffer 4b. It is a time zone that

[0153] When the video data of the front VOB and the rear VOB are mixed in the buffer, the buffer state becomes as shown in FIG. 10(c). In FIG. 10C, in the period from FIRST_SCR+STC_offset to LAST_DTS, both video data of the front VOB and the rear VOB are accumulated in the video buffer 4b, and thus the maximum video buffer among them. The accumulated amount $Bv1+Bv2$ of 4b is calculated.

[0154] In step S106, the control unit 1 controls the disk access unit 3 to read the three VOBUs located at the end of the front VOB. Subsequently, in step S107, the control unit 1 controls the disk access unit 3 to read out the three VOBUs located at the front end of the rear VOB. FIG. 23C is a diagram showing a read range to be read from the front VOB in step S106. In FIG. 23C, when the front VOB includes VOBUs #98 to #105 and the last VOB is #105, VOBUs #103 to # are the VOBUs including the picture data V_END to be decoded last. 105 will be read. FIG. 23D is a diagram showing a read range to be read from the rear VOB in step S107. In FIG. 23D, when the rear VOB includes VOB#1 to #8 and the first VOB is #1, VOB#1 to #3 are the VOB including the picture data V_TOP to be decoded first. Will be read.

[0155] Here, according to the 1-second rule, audio data and picture data that should be played back within 1 second may be stored up to three VOBUs separated from each other. By reading out three VOBUs including the end point, in step S106, all pictures to be reproduced from one second before the reproduction end time of the picture data V_end located at the end of the front VOB to the reproduction end time. The data and audio data were read together. Further, in step S107, all the picture data and audio data to be reproduced from the reproduction start time of the picture data V_top located at the front end of the rear VOB to 1 second after the reproduction start time are collectively read. It was. In this flow chart, reading was performed in units of 3 VOBUs, but the number of VOBUs may be any number. Further, instead of reading in units of VOBUs, only all of the picture data and audio data included in the VOB that should be reproduced in one second may be read. Furthermore, the video data and audio data to be reproduced in a period longer than 1 second may be read.

[0156] After reading, in step S108, the control unit 1 controls the demultiplexer 4a so as to separate the VOBUs at the leading end and the trailing end into a video stream and an audio stream, and decodes these streams by the video decoder 4c and the audio decoder 4e. Let it be done. During normal reproduction, the decoding results of the video decoder 4c and the audio decoder 4e are output as video and audio, but during re-encoding, the control unit 1 inputs the decoding results to the MPEG encoder 2. The decoding result of the audio stream is output to the bus 7 as indicated by broken line arrows (2) and (3) in FIG. The decoding result of the video stream and the decoding result of the audio stream transferred to the bus 7 are taken in by the sequential MPEG encoder 2 as indicated by a dashed arrow (4).

[0157] After that, the control unit 1 calculates the code amount for causing the MPEG encoder 2 which has taken in the decoding result of the video stream and the decoding result of the audio stream to re-encode. First, in step S109, the control unit 1 determines whether or not the buffer storage amount at each decoding timing exceeds the upper limit value of the buffer in the period in which the front VOB and the rear VOB are mixed in the buffer. In the present embodiment, it is determined whether $Bv1+Bv2$ calculated in step S105 exceeds the upper limit value of the buffer. If the upper limit value is not exceeded, the process proceeds to step S112. If the upper limit value is exceeded, in step S110, the control unit 1 decodes the code amount based on the over amount A, that is, the code amount with the over amount A subtracted. Assign to VOBUs column. The reduction of the code amount lowers the image quality of the video stream in the read VOBUs sequence, but overflow of the video buffer 4b must be avoided in order to seamlessly connect the two VOBs. The method of lowering is selected. In step S111, the video decoder 4c is controlled so that the decoding results of the video decoder 4c and the audio decoder 4e are re-encoded based on the code amount assigned in step S110.

[0158] Here, the pixel value of the video data is once converted into the digital data of the YUV coordinate system by the decoding by the MPEG encoder 2. The digital data of the YUV coordinate system is digital data having signals (luminance signal (Y), color difference signals (U, V)) that specify a color in a color TV, and the video decoder 4c reproduces such digital data again. Encode into multiple picture data. As the code amount allocation technique, the technique described in MPEG2 DIS (Draft International Standard) Test Model 3 is used. Re-encoding with the code amount constrained is realized by processing such as replacing the quantization coefficient. The code amount with the excess amount A reduced may be assigned only to the rear VOB or may be assigned only to the front VOB.

[0159] In step S112, the control unit 1 calculates, from the decoding results of the audio data obtained by separating the front VOB, the one corresponding to the audio frame x including $FIRST_SCR+STC_offset$ of the rear VOB. In the upper graph of FIG. 24A, the buffer state by the video data of the front VOB and the rear VOB is shown. In the lower graph of FIG. 24A, the audio obtained by separating the front VOB is shown. An audio frame of data and an audio frame of audio data obtained by separating the rear VOB are arranged above and below, respectively. The audio frame sequence in the lower row clarifies the correspondence between the time axis of the upper graph and each audio frame. Here, if a perpendicular is drawn from $FIRST_SCR+STC_offset$ in the upper graph, this perpendicular intersects with one audio frame in the audio frame sequence of the front VOB. This intersected audio frame is the audio frame x, and the immediately following audio frame x+1 is the last audio data included in the front VOB. The data of the audio frames x and x+1 is included in a plurality of audio data to be reproduced in a time period in which 1.0 second before and after the display period of the final picture data V_END at the end of the front VOB is added. It is included in the three VOBUs read in step S105.

[0160] FIG. 24B shows the case where $FIRST_SCR+STC_offset$ matches the audio frame boundary of the front VOB. In the case of such a match, the audio frame immediately before that is defined as audio frame x. In step S113, the control unit 1 calculates the audio frame y+1 including $VOB_V_S_PTM+STC_Offset$ of the rear VOB. When a perpendicular line is drawn from the video reproduction start time $VOB_V_S_PTM$ in the upper graph in FIG. 24A, this perpendicular line intersects with one audio frame in the audio frame sequence of the

rear VOB. This intersected audio frame is the audio frame y+1, and the audio frames up to the preceding audio frame y are the valid audio frames that are used even after the editing among the original audio data included in the front VOB.

[0161] FIG. 24C is a diagram showing a case where the video reproduction start time $VOB_V_S_PTM+STC_offset$ matches the audio frame boundary of the front VOB. In the case of such a match, the audio frame immediately before the time video playback start time $VOB_V_S_PTM+STC_offset$ is set as the audio frame y. In step S114, audio data from audio frame x+2 to audio frame y is cut out from the front audio data. In FIG. 24A, the audio frames after the audio frame y+1 are shown by broken lines, which means that the parts shown by these broken lines are not multiplexed in the VOB. Since the time stamp in the front VOB is added to the audio frame moved to the rear VOB, the time stamp is re-added to the rear VOB.

[0162] In step S115, the audio frame u which is the next audio frame of the audio frame including the audio frame y and the boundary of the audio frame y+1 is detected from the audio frame sequence of the rear VOB. If a perpendicular is drawn from the boundary line between the audio frame y and the audio frame y+1, it intersects with any one audio frame in the audio frame sequence of the rear audio data. The audio frame next to this intersected audio frame is the audio frame u.

[0163] FIG. 24D shows the case where the reproduction end time of the audio frame y and the audio frame boundary of the rear VOB coincide. In the case of such a match, the audio frame immediately before this time is set as the audio frame u. In step S116, an audio pack G4 including an audio data string in which the audio data reproduced in the audio frame u is arranged at the head is generated from the audio stream of the rear VOB. In FIG. 24A, the audio frames before the audio frame u are shown by broken lines, which means that the part shown by the broken lines in the rear audio data is not multiplexed with VOB.

[0164] It is understood from the above steps S114 to S116 that the first audio frame to the audio frame x+1 of the front audio data are multiplexed in the front VOB. It can be seen that the audio frame x+2 to the audio frame y of the front audio data and the audio frame u to the last audio frame of the rear audio data are multiplexed in the rear VOB. With such multiplexing, the audio frame at the end of the rear audio data is read from the DVD-RAM at the same time as the picture data to be reproduced in the future in time.

[0165] At this time, if the audio data of the front VOB does not exist up to the audio frame y, that is, if it is short, silent audio frame data is interpolated only for the missing audio frames. Similarly, if the audio data of the rear VOB does not exist from the audio frame u, that is, if the audio data is short, the audio frame data with no sound is interpolated only for the missing audio frames.

[0166] Here, when trying to multiplex the audio frame x+2 of the front audio data to the audio frame y and the audio frame u of the rear audio data to the last audio frame in the rear VOB, the problem arises. , AV synchronization. As shown in FIGS. 24A to 24D, there is a reproduction gap between the audio frame y and the audio frame u. When the reproduction gap is ignored and multiplexing is performed, the audio frame u There will be a synchronization shift such that it will be earlier than the video display.

[0167] To prevent such an increase in deviation, a time stamp indicating the audio frame u may be added to the audio packet. Therefore, in step S117, the padding-packet or the stuffing byte is inserted after the data of the audio frame y in the pack so that the audio frame u is not stored in the pack storing the audio frame y, and the audio frame u becomes the next pack. Start from the beginning of.

[0168] In step S118, of the audio data extracted from the VOB located at the end of the front VOB, the audio data up to audio frame x+1 and the re-encoded video data are multiplexed and the front VOB of the front VOB is multiplexed. Create a VOB string located at the end. In step S119, the data after the audio frame x+2 and the video data extracted from the VOB located at the front end of the rear VOB are multiplexed to create a VOB to be arranged at the front end of the rear VOB.

[0169] Specifically, an audio pack G3 including an audio data string from the first audio frame x+2 to the audio frame y and a Padding-Packet, and an audio pack including an audio data string after the audio frame u of the rear audio data. G4 and G4 are multiplexed with the re-encoded video data, and the system encoder 2e is controlled so as to create a VOB to be arranged at the front end of the rear VOB. With such multiplexing, the audio frame at the end of the front audio data is read from the DVD-RAM at the same time as the picture data to be reproduced in the future in time.

[0170] FIG. 25 shows how an audio pack storing a plurality of audio data to be reproduced in a plurality of audio frames and a video pack storing picture data to be reproduced in each video frame are multiplexed. FIG. In FIG. 25, it can be said that the transfer of the picture data V_TOP to be decoded at the beginning of the rear VOB is completed within the time "Tf_Period". The pack string located immediately below the time "Tf_Period" constitutes the picture data V_TOP.

[0171] In this figure, an audio pack G3 including an audio gap is an audio pack in which audio data $x+2, y-1, y$ to be reproduced in audio frames $x+2, y-1, y$ are stored. .. Of the audio data stored in this audio pack, the earliest to be decoded is the audio data $x+2$. Since this audio data should be decoded at the playback end time of audio frame $x+1$, the pack sequence is transferred from the DVD-RAM together with the picture data V_TOP that is transferred at the same time (Tf_period) as this audio frame $x+1$. Should be read. Therefore, as shown in the bottom row of FIG. 9, it is inserted between the video pack sequence P51 storing the picture data V_TOP and the video pack sequence P52.

[0172] The audio pack G4 having the audio data $u, u+1, u+2$ to be reproduced in the audio frames $u, u+1, u+2$ stored therein is the audio data u as the audio data to be decoded earliest. Since this audio data should be decoded at the playback start time of the audio frame u , it is read from the DVD-RAM together with the picture data V_NXT in which the pack sequence is transferred at the same time as this audio frame u . Should be. Therefore, as shown at the bottom of FIG. 25, it is inserted between the video pack P52 storing the picture data V_TOP and the video pack P53 storing the picture data V_NXT.

[0173] As described above, the audio pack G3 including the audio gap is inserted between the video pack row P51 and the video pack row P52, and the audio pack G4 is inserted between the video pack row P53 and the pack P54. By doing so, multiplexing is completed. Then, in step S120, the control unit 1 writes FIRST_SCR, LAST_SCR, seamless flag, VOB_V_E_PTM, VOB_V_S_PTM of the front VOB and the rear VOB in the seamless connection information of the front VOB. In subsequent steps S121 and S122, the audio gap start time A_STP_PTM, the audio gap length A_GAP_LEN, and the audio gap position information A_GAP_LOC are described in the seamless connection information in order to describe all the information regarding the audio gap in the seamless connection information.

[0174] After the above processing, the end portion of the front VOB, the tip portion of the rear VOB, and seamless connection information are written in the DVD-RAM. Here, SCRs are given to the video data and the audio pack in which the video data and the audio data obtained by the re-encoding are stored in ascending order. The SCR value before re-encoding given to the pack located at the beginning in the re-encoding range is used as the initial value of SCR in the ascending order.

[0175] Since the SCR indicates the time at which each video pack and audio pack should be input to the video buffer 4b-audio buffer 4c, the SCR must be updated if the number of data changes before and after re-encoding. Even so, for example, normal decoding is possible as long as the SCR of the front end portion re-encoded in the rear VOB is lower than the SCR of the video pack of the remaining portion outside the re-encoding range.

[0176] PTS and DTS are given based on video frames and audio frames and do not change significantly after re-encoding. Therefore, the continuity between the DTS-PTS outside the re-encoding range and the DTS-PTS within the re-encoding range is maintained. Next, a case where discontinuity of the time stamp occurs will be described. In order to play two VOBs seamlessly, it is necessary to avoid the occurrence of time stamp discontinuity. Therefore, it is determined in step S123 whether SCR duplication has occurred. If there is no overlap, the processing of this flowchart is ended, but if there is overlap, the over amount A is calculated based on the number of packs to which the overlapping SCRs are added in step S124, The process proceeds to step S110 to determine the code amount based on the over amount A and perform re-encoding again.

[0177] The six VOBUs newly multiplexed by this flow are output to the disk access unit 3 as shown by the broken arrow (5), and the disk access unit 3 transfers these VOBU strings to the DVD-RAM. Write. In the flowcharts of FIGS. 21 to 22, the seamless connection between the two VOBs has been described, but the seamless connection may be performed to the partial section included in one VOB. For example, when some VOBUs #2, #4, #6, #8 are partially deleted as shown in FIG. 6B, the VOBU row located in the front of the deletion range and the rear of the deletion range The seamless connection shown in FIGS. 21 and 22 may be performed with the VOBU row located.

[0178] A reproduction procedure for continuously reproducing two VOBs processed for seamless connection by the above procedure will be described. When the operator instructs to continuously play two or more VOBs

recorded in the AV file, the control unit 1 indicates the seamless connection information about the rear VOB among the two VOBs. Refer to the seamless flag. If the seamless flag is set to ON, the time obtained by subtracting the video playback start time VOB_V_S_PTM of the succeeding VOB from the video playback end time VOB_V_E_PTM of the preceding VOB is set as STC_offset, and is added to the reference time measured by STC4g. Control 4h. After that, the buffer input time FIRST_SCR of the preceding VOB indicated in the seamless connection information is compared with the reference time counted by the STC 4g. When this reference time reaches this FIRST_SCR, the switch SW1 is controlled so as to switch the output from the reference time measured by the STC 4g to the reference time with offset to which the offset is added by the adder 4h. After that, SW2 to SW4 are switched as shown in the timing chart of FIG.

[0179] As described above, according to the present embodiment, it is possible to perform processing such that the reproduction of a plurality of VOBs can be performed seamlessly by reading out only the end-tip end of the VOB and performing the re-encoding. Since the target of re-encoding is only the VOB located at the end-tip of the VOB, re-encoding of VOB can be completed in an extremely short period of time. In the present embodiment, seamless connection information is managed for each VOB, but information required for seamless VOBs may be collected in one place. For example, although the video reproduction end time VOB_V_E_PTM and the video reproduction start time VOB_V_S_PTM required to obtain STC_offset are described separately in two VOB information, they may be described as seamless connection information of subsequent VOBs. In this case, it is desirable to provide the VOB information with an information element of the reproduction end time (PREV_VOB_V_E_PTM) of the previous VOB.

[0180] Similarly, in LAST_SCR, it is desirable to provide an information element called a previous VOB end SCR (PREV_VOB_LAST_SCR) as seamless connection information of the following VOB. Further, in the present embodiment, the DVD recorder 70 is shown as a configuration on the assumption that it is used as a substitute for the conventional stationary VCR for home use. The configuration may be as follows. That is, the disk access unit 3 is connected to a computer bus as a DVD-RAM drive device via a SCSI, IDE, IEEE 1394 compliant interface. Further, the components other than the disk access unit 3 in the figure are realized by executing the OS and application programs on the hardware of the computer.

[0181] The DVD recorder 70 has a control unit 1, an MPEG encoder 2, a disc access unit 3, a decoder 4, a video signal processing unit 5, a remote controller 71, a bus 7, a remote controller signal receiving unit 8 and a receiver 9. Further, in the present embodiment, the video stream and the audio stream are multiplexed in the VOB. However, sub-picture data obtained by run-length compressing subtitle characters may be multiplexed. Further, the video streams forming the still image data may be multiplexed.

[0182] In addition, in the present embodiment, the VOB is once decoded by the decoder 4 and then the MPEG encoder 2 performs the re-encoding, but the direct disk access unit 3 outputs the VOB to the MPEG encoder 2 without decoding. May be re-encoded. In addition, although all units are described by video frames and audio frames in the present embodiment, a video stream using 3:2 pulldown used when compressing a video of 24 frames/second like a film material is used. In this case, there are cases where 1.5 frames=1 picture instead of 1 frame=1 picture. The present invention is not substantially dependent on 3:2 pulldown and is not limited to the frames described above.

[0183] Finally, the processing module software procedure (FIGS. 21 to 22) described with reference to the flow chart in the first embodiment is realized by a machine language program, and recorded in a recording medium to be distributed or sold. May be. Such recording media include IC cards, optical disks, floppy disks, etc., but the machine language programs recorded on these are used by being installed in a general-purpose computer. This general-purpose computer sequentially executes the installed machine language program to realize the function of the video data editing apparatus shown in this embodiment.

[0184] (Second Embodiment) In the first embodiment, seamless connection processing between VOBs was premised, whereas the second embodiment is an embodiment related to seamless connection of a plurality of partial sections included in a VOB. Depending on how to specify this partial section, in the second embodiment, it is assumed that the partial section is specified using the time information representing the video field. The video field mentioned here is a unit smaller than a video frame, and the time information can be expressed using the PTS of the video pack.

[0185] A partial section specified using time information about a video field is called a cell, and information for designating a partial section is called cell information. The cell information is recorded in the RTRW management file as one information element of PGC information. The data structures of the cell information and

PGC information and the procedure for creating them will be described in detail in the fourth embodiment. FIG. 26 is a diagram showing an example of a partial section specified by a video field serving as a start point and an end point. The set of time information C_V_S_PTM and C_V_E_PTM in FIG. 26 specifies the video fields that are the start point and the end point.

[0186] C_V_S_PTM in FIG. 26 is the playback start time of the video field in which the P picture in VOB#100 forming the VOB should be played, and C_V_E_PTM is the B picture 1 in VOB#105 forming the same VOB. It specifies the playback end time of the video field to be played. C_V_S_PTM and C_V_E_PTM specify the partial section from P picture to B picture 1 in FIG. 26 as a cell.

[0187] (2-1) When seamlessly connecting the VOB subsections designated by the reconstruction time information of the GOP structure, two processes that are not necessary in the first embodiment are required. The first of these is the process of reconstructing the GOP structure in order to convert the partial section specified by the time information into an independent VOB. The second process is a process of predicting an increase in the buffer occupancy due to the reconstruction of the GOP structure.

[0188] Here, the rebuilding of the GOP structure refers to a process of rebuilding the GOP structure so that the subsections designated by the cells have a proper display order and coding order. To be more specific, when a partial section to be connected is specified by the cell information, an edit boundary may be set in the middle of the VOB as shown in FIG. 28(a). If the editing boundary is set at such a position, the two cells to be connected cannot have the proper display order and coding order.

[0189] In order to justify the display order and the encoding order, processing is performed according to the following three rules shown in FIG. 28B when the GOP structure is reconstructed. The process according to the first rule is a process of re-encoding this picture data into a P picture (or I picture) when the last picture data is a B picture in the display order of the front cell. Further, the future P picture referred to by the B picture exists in front of the B picture in the encoding order, but is not displayed and is deleted from the VOB.

[0190] 2The process according to the second rule is a process of re-encoding this picture data into an I picture when the leading picture data is a P picture in the coding order of the front cell. In the display order of the front cell, when the plurality of picture data located at the beginning is the B picture group, the processing according to the third rule is the picture data to be reproduced in the past direction. It is encoded into picture data that does not depend on the correlation characteristics of (which means picture data that depends on the correlation characteristics with the image to be reproduced in the future direction. Hereinafter, picture data of this picture type is referred to as Forward-B picture). It is a process of fixing.

[0191] (2-2) Prediction process of increase in buffer occupancy The prediction process of increase in buffer occupancy is based on the above three rules, and when the picture type is changed, the size of the changed picture data is calculated. Is a process of predicting whether or not to have. When the above reconstruction process is performed on the front cell, the picture data located at the end in the display order of the front cell is changed from the B picture to the P picture or the I picture, so that the size becomes larger. ..

[0192] When the above reconstruction process is performed on the rear cells, the picture type of the picture data located first in the coding order of the rear cells is changed from P picture to I picture, and the video data located first in the display order is changed. Since the picture type changes to Forward-B picture, its size becomes larger. Then, how to predict the increase in size due to the change of the picture type will be described. 29A and 29B are explanatory diagrams for explaining how to predict the increase in the buffer occupancy amount due to the change of the picture type in the front cell.

[0193] In FIG. 29A, up to B picture B3 of VOB belongs to the front cell. According to the above rule, this B picture B3 must be changed to the P picture P1. Here, if the B picture B3 has an information component dependent on the P picture P2 to be reproduced in the future, the information component of this P picture P2 is changed to the P picture after the change when the picture type is changed. It should be captured in picture P2.

[0194] Considering this, it is possible to predict the size of the P picture P1 to be obtained by changing the picture type based on the value obtained by adding the size of the B picture B3 and the size of the P picture P2. However, it is needless to say that other prediction methods may be used). By determining the code amount at the time of re-encoding based on the buffer occupancy predicted in this way, the optimum code amount can be assigned to the front cell and the rear cell.

[0195] FIGS. 30(a) and 30(b) are explanatory diagrams for explaining how to predict an increase in buffer occupancy due to a change in picture type in a rear cell. 30(a) and 30(b), it is assumed that the V picture B3 to B3 belong to the rear cell. Since the head of the cell is determined based on the display time, the B picture B3 is the picture data located at the head of the display order of the rear cells. Therefore, the B picture B3 must be changed to the Forward-B picture B1 according to the above rule. If the B picture B3 has an information component dependent on the P picture P2 to be reproduced in the past, the information component of this P picture P2 is taken into the Forward-B picture B1 when the picture type is changed. It should be.

[0196] Considering this, the size of the Forward-B picture B1 to be obtained by changing the picture type can be predicted based on the value obtained by adding the size of the B picture B3 and the size of the P picture P2. For the rear VOB, the picture type of the picture data located at the beginning in the coding order must be changed. Referring to the display order of the rear VOB, it can be seen that the P picture P3 exists as the picture data to be displayed immediately after the B picture B3. The P picture P3 is accumulated in the re-order buffer 4f until the B picture B3 is decoded, and is displayed after the B picture B3 is decoded. Although the P picture P3 is displayed after the B picture B3 by the reordering via the reorder buffer 4f as described above, the P picture P3 should precede the P picture P3. According to the above rule, the P picture P3 detected as the leading picture data in the coding order in this way must be changed to the I picture. If the P picture P3 has an information component that depends on an I picture to be reproduced in the past, the information component of this I picture is taken into the P picture P3 when the picture type is changed. It should be.

[0197] Considering this, the size of the I picture I to be obtained by changing the picture type can be predicted based on the value obtained by adding the size of the P picture P3 and the size of the I picture located immediately before. By determining the code amount at the time of re-encoding based on the buffer occupancy predicted in this way, the optimum code amount can be assigned to the front cell and the rear cell.

[0198] (2-3) Processing Procedure for Seamlessly Connecting Partial Sections FIG. 31, FIG. 32, and FIG. 33 are flowcharts showing a processing procedure for performing processing so that two cells are reproduced seamlessly. Note that this flowchart has many steps described by replacing the term "VOB" with "cell" in the procedure shown in FIGS. The same reference numerals as those in the first embodiment are attached to these steps to simplify the description.

[0199] FIG. 34 is a diagram showing which audio frame of the audio stream the audio frame x, the audio frame x+1, and the audio frame y used in FIG. 31 correspond to. In step S102, the control unit 1 determines the time information for identifying the end of the preceding partial section (hereinafter referred to as the front section) and the subsequent partial section (hereinafter referred to as the rear section). STC_offset is obtained by subtracting C_V_S_PTM of the rear cell from C_V_E_PTM of the front cell based on the time information specifying the front end.

[0200] In step S103, the control unit 1 analyzes the change in the buffer occupation amount from FIRST_SCR of the front cell to the decoding end time LAST_DTS of all data of the front cell. In step S104, the control unit 1 analyzes the change in the buffer occupancy amount from FIRST_SCR of the rear cell to the decoding end time LAST_DTS of all the data of the rear cell by performing the same analysis of step S103 on the rear cell.

[0201] In step S130, the control unit 1 predicts the increase amount α of the buffer occupation amount due to the change of the picture type of the rear cell according to the procedure shown in FIG. In step S131, the increase amount β of the buffer occupancy amount due to the picture type change of the front cell is predicted according to the procedure shown in FIG. In step S132, the increments α and β are added to the buffer occupancy of the front cell and the rear cell.

[0202] In step S105, the control unit 1 analyzes the change in the video buffer occupancy from FIRST_SCR+STC_offset of the rear cell to LAST_DTS of the front cell. As shown in FIG. 10C of the first embodiment, the maximum storage amount Bv1+Bv2 of the video buffer 4b in the state where the video data of both the front cell and the rear cell is stored in the video buffer 4b is obtained.

[0203] In step S106, the control unit 1 controls the disk access unit 3 to read three VOBUs that are considered to include picture data located at the end of the front cell. Subsequently, in step S107, the disk access unit 3 is controlled to read out three VOBUs that are considered to include picture data located at the leading end of the rear cell.

[0204] FIG. 27A is a diagram showing a read range to be read from the front cell in step S106. In FIG. 27A, it is assumed that the VOB includes VOBUs #98 to #107, of which VOBUs #99 to #105 are designated as the front cells. If the picture data to be displayed last in the front cell is the picture data Bend, this picture data Bend is included in VOBUs #103 to #105 according to the 1-second rule, so the picture to be displayed last is VOBUs #103 to #105 are read out as a VOB string including data.

[0205] In FIG. 27B, the VOB includes VOBUs #498 to #507, of which VOBUs #500 to #506 are designated as the rear cells. When the picture data to be displayed first in the subsequent cell is the picture data Ptop, this picture data Ptop is included in VOBUs #500 to #502, so the VOB string containing the picture data to be displayed first. As a result, VOBUs #500 to #502 will be read. These VOBUs include all the picture data that has a dependency relationship with the picture data Ptop and the picture data Bend, in addition to the audio data that should be reproduced at the same time as the picture data Ptop and the picture data Bend. This means that all the picture data necessary for the above has been read out.

[0206] In this flow chart, reading was performed in units of 3 VOBUs, but the number of VOBUs may be any number. Instead of reading in units of VOBUs, only all of the picture data and audio data included in the VOB that should be reproduced in one second may be read out. Furthermore, the video data and audio data to be reproduced in a period longer than 1 second may be read.

[0207] After reading, in step S108, the control unit 1 controls the demultiplexer 4a so as to separate the VOBs located at the leading end and the trailing end into video data and audio data. In step S109, it is determined whether the buffer accumulation amount at each decoding timing exceeds the upper limit value of the buffer during the period when the front cell and the rear cell are mixed in the buffer. Specifically, it is determined whether the value of $Bv1+Bv2$ calculated in step S105 exceeds the upper limit value of the buffer. If it does not exceed, the process proceeds to step S133, but if it exceeds, the code amount based on the over amount A is assigned to the front cell and the back cell in step S110. Note that only one of the front cells and the rear cells may be re-encoded instead of both. In step S111, the video data obtained from the two cells is re-encoded with the front video data based on the code amount assigned in step S110.

[0208] In step S133, FIRST_SCR newly assigned to the rear video data re-encoded is acquired. Since the picture type of the leading picture data in the display order of the rear VOB and the leading picture data in the coding order has been changed to larger picture data, it goes without saying that $STC_offset+FIRST_SCR$ is located in the past direction in FIG. ..

[0209] In step S112, out of the audio data obtained by separating the front cell, the one corresponding to the audio frame x including $FIRST_SCR+STC_offset$ newly assigned to the rear video data is calculated. 34, the upper graph shows the buffer state of the front cell and the rear cell with the video data, and the lower graph of FIG. 34 shows the audio frame of the audio data obtained by separating the front cell. Has been done. The audio frame sequence in the lower row clarifies the correspondence between the time axis of the upper graph and each audio frame. Here, the buffer occupancy of the rear cell newly obtained by the re-encoding is increased by $\alpha 1$ ($\alpha 1$ means that it is different from the increased amount α predicted in step S132), and is increased. By the amount $\alpha 1$, the FIRST_SCR newly added to the rear video data indicates the past.

[0210] It can be seen from the upper graph that the new $FIRST_SCR+STC_offset$ is located in the past by the time $T\alpha 1$. When a perpendicular is drawn from this new $FIRST_SCR+STC_offset$, this perpendicular intersects one audio frame in the audio frame sequence of the front cell. This intersected audio frame is the audio frame x, and the immediately following audio frame x+1 is the last audio data included in the front cell.

[0211] Since $STC_offset+new\ FIRST_SCR$ of the rear video data is located in the more past direction, the audio frame in the more past direction corresponds to the audio frame x. Since the audio frame in the past direction corresponds to the audio frame x, the front audio data to be read together with the video data at the start of reading the video data of the rear cell becomes larger than that of the first embodiment.

[0212] After that, the system encoder 2e is caused to perform the multiplexing as shown in FIG. 25 by performing the processing of steps S113 to S119. Subsequently, in step S120, FIRST_SCR, LAST_SCR, seamless flag, VOB_V_E_PTM, VOB_V_S_PTM of the front cell and the rear cell are written in the seamless connection information of the front cell, and then the processes of steps S121 to S122 are performed. Of the 6 VOBUs' worth of data obtained by re-encoding, the 3 VOBUs (preceding VOBUs) placed ahead are originally from the front section, so they are added to the rear section of the front section. The 3 VOBUs (subsequent VOBUs) that are arranged subsequent to the re-encoded data originally belong to the rear section, so they are

added before the rear section. One of the front section and the rear section to which the re-encoded data is added in this way is assigned and managed with the same identifier as the division-source VOB, but the other is assigned an identifier different from that of the division-source VOB. Be managed and managed. That is, after division, the front section and the rear section are managed as separate VOBs. This is because the boundary between the front section and the rear section is likely to be a discontinuous boundary of time stamps.

[0213] Then, as in the first embodiment, the SCR continuity is determined in step S123. If there is continuity, the processing of this flow chart is ended, but if there is no continuity, the over amount A is calculated based on the number of packs to which duplicate SCRs have been added in step S124. , And proceeds to step S109 so as to determine the code amount based on the over amount A and perform re-encoding again.

[0214] When the cell is re-encoded through the above procedure, these partial sections designated by the cell information become independent VOBs. Then, in the RTRW management file, VOB information about the newly created VOB is needed. The following describes how to define VOB information for subsections.

[0215] The "video stream attribute information" includes compression mode information, TV system information, aspect ratio information, and resolution information, but these may use the information set for the VOB that is the cutout source of the partial section as it is. The "audio stream attribute information" includes the encoding mode, the presence/absence of dynamic range control, the sampling frequency, the number of channels, etc., but these can be used as they are for the information set for the VOB from which the partial section is cut out. ..

[0216] The "time map table" consists of the size of each VOB that makes up a VOB and the display time of those VOBs. Then, the size and display time of only the re-encoded VOB are corrected. Next, the "seamless connection information" generated in step S133 will be described. Seamless connection information consists of "seamless flag", "video playback start time VOB_V_S_PTM", "video playback end time VOB_V_E_PTM", "FIRST_SCR", "LAST_SCR", "audio gap start time A_STP_PTM", and "audio gap length A_GAP_LEN". , I will describe these information individually.

[0217] The "seamless flag" has the same video stream display system (NTSC, PAL, etc.) indicated in (1) video attribute information between the front section and the rear section. (2) The encoding methods (AC-3, MPEG, LPCM, etc.) of the audio streams indicated in the audio attribute information are the same.

[0218] Set to 01 only when all of the relationships (1) and (2) are satisfied, and set to 00 when even one of the relationships (1) and (2) is not satisfied. The "video playback start time VOB_V_S_PTM" is updated to the playback start time after re-encoding. The "video playback end time VOB_V_E_PTM" is updated to the playback end time after re-encoding.

[0219] "FIRST_SCR" is updated to the SCR of the first pack after being re-encoded. "LAST_SCR" is updated to the SCR of the final pack after being re-encoded. "Audio gap start time A_STP_PTM" sets the reproduction end time of the last audio frame y reproduced by the plurality of audio data transferred to the rear cell in FIG.

[0220] The "audio gap length A_GAP_LEN" sets the time length from the reproduction end time of the last audio frame y reproduced by the plurality of audio data transferred to the rear cell in FIG. 34 to the reproduction start time of the audio frame u. The VOB information is generated as described above, and the RTRW management file including this is recorded on the DVD-RAM. As a result, the two partial sections designated by the cell information are recorded in the DVD-RAM as two VOBs that are seamlessly reproduced.

[0221] As described above, according to the present embodiment, it is possible to perform processing such that the reproduction of the partial sections in the VOB is performed seamlessly by reading out only the terminal end-tip end of the cell and performing the re-encoding. Since the target of re-encoding is only the VOBs located at the end-tip of the cell, re-encoding of the cell can be completed in an extremely short time.

[0222] In the present embodiment, the partial section is designated by the time precision of the video field, but it may be designated by the time precision of the video frame. In addition, the procedure (FIGS. 31 to 33) of the processing module software described with reference to the flowchart in the second embodiment is realized by a machine language program and is recorded in a recording medium to be a target of distribution/sales. May be. Such recording media include IC cards, optical disks, floppy disks, etc., but the machine language programs recorded on these are used by being installed in a general-purpose computer. This general-purpose computer

sequentially executes the installed machine language program to realize the function of the video data editing apparatus shown in this embodiment.

[0223] (Third Embodiment) A third embodiment is an embodiment for managing an AV file on a file system and realizing video editing with a higher degree of freedom. (3-1) Directory structure on DVD-RAM The RTRW management file and AV file shown in the first embodiment are arranged on the directory shown in FIG. 35 in the file system defined by ISO/IEC13346. .. FIG. 35 is a diagram showing a directory structure in which the RTRW management file and the AV file shown in the first embodiment are arranged. In FIG. 35, an elliptical figure represents a directory and a rectangle represents a file. The root directory has one directory called RTRW and two files File1.DAT and File2.DAT, and the RTRW directory has three files Movie1.VOB, Movie2.VOB and RTRWM.IFO. ..

[0224] (3-1-1) Management Information for File System in Directory The management information for the RTRW management file and the AV file in the directory structure shown in FIG. 35 will be described. FIG. 36 is a diagram showing the file system management information in the directory shown in FIG. In the figure, the volume space shown in FIG. 3D, the sectors, and the recorded contents of the sectors are hierarchically illustrated. Arrows in the figure indicate the order in which the recording position of the file "Movie1.VOB" is specified according to the management information in the figure.

[0225] The first layer in the figure shows the volume space shown in FIG. The second layer shows a file set descriptor, a terminal descriptor, a file entry, a directory, etc. in the management information. This information complies with the file system defined in ISO/IEC13346. The file system defined in ISO/IEC13346 realizes hierarchical directory management.

[0226] The management information of FIG. 36 is illustrated along this directory structure. However, the recording area of each file shows only Movie1.VOB which is an AV file. The file set descriptor (LBN80) in the second layer indicates the LBN of the sector in which the file entry of the root directory is recorded. The end descriptor (LBN81) indicates the end of the file set descriptor.

[0227] The file entry (LBN 82, 584, 3585, etc.) is recorded for each file (including directory) and indicates the recording position of the file or directory. The file entry for a file and the file entry for a directory are defined in the same format so that a hierarchical directory structure can be freely constructed.

[0228] The directory (LBN83, 584, 3585, etc.) indicates the recording position of the file entry for each file and each directory included in the directory. The third hierarchy illustrates three file entries and two directories. The file entry and the directory are tracked by the file system, and have a data structure capable of specifying the recording position of a specific file regardless of how the directory structure is hierarchical.

[0229] Each file entry includes an allocation descriptor indicating the recording position of the file or directory. When the data recorded in the file is divided into a plurality of extents, the file entry will have a plurality of allocation descriptors for each extent data. Here, the extent is a partial section of data recorded in a file and should be stored in a continuous area. For example, when the size of the VOB to be recorded in the AV file is large and there is no continuous area for storing this, the AV file cannot be recorded in the DVD-RAM. However, if multiple small continuous areas are scattered in the partition space, if the VOB that should be recorded in the AV file is divided into multiple parts, each partial section obtained by the division is divided into these continuous areas. Can be recorded. This division increases the probability that the VOB can be recorded as an AV file even when the number and length of continuous areas in the partition space are limited. In order to improve the recording rate in DVD-RAM, VOBs to be recorded in an AV file are divided into a plurality, and the respective extents obtained by the division are recorded in scattered continuous areas.

[0230] In addition, it is clarified so that there is no doubt in interpretation, but the continuous area means an area composed of ECC blocks which are logically or physically continuous. For example, each file entry of the LBNs 82 and 584 in FIG. 36 includes one allocation descriptor, which means that the file is not divided into a plurality of extents (consisting of one extent). On the other hand, the file entry of LBN3585 includes two allocation descriptors, which means that the data to be stored in the file consists of two extents.

[0231] Each directory includes, for each file and directory included in the directory, a file identification descriptor indicating the recording position of the file entry. According to such file entries and directories, for example, as shown by the arrow in the figure, the recording position of the "root/video/Movie1.VOB" file is the

file set descriptor → → file entry (root) → → directory (root) → → file entry (RTRW) → → directory (RTRW) → → file entry (Movie1.VOB) → → file (Movie1.VOB extents #1, #2).

[0232] FIG. 37 is a diagram in which the link relationship between the file entry and the directory on this path is rewritten according to the directory structure. In the figure, the root directory includes file identification descriptors for the parent directory (the root parent is the root itself), the RTRW directory, the File1.DAT file, and the File2.DAT file. The RTRW directory also includes file identification descriptors for the parent directory (root) directory, Movie1.VOB file, Movie2.VOB file, and RTRWM.IFO file. Also in the figure, the recording position of the Movie1.VOB file is specified by following the above steps 1 to 3. (3-1-2) Data Structure of File Entry FIG. 38(a) is a diagram showing a more detailed data structure of the file entry. As shown in the figure, the file entry has a descriptor tag, an ICB tag, an allocation descriptor length, an extended attribute, and an allocation descriptor. In the figure, BP represents a bit position and RBP represents a relative bit position.

[0233] The descriptor tag is a tag indicating that it is a file entry. There are types such as a file entry descriptor and a space bitmap descriptor in the tag in DVD-DAM. In the case of a file entry, 261 indicating the file entry is described as the descriptor tag. The ICB tag indicates attribute information about the file entry itself.

[0234] The extended attribute is information for indicating an attribute higher than the content defined by the attribute information field in the file entry. In the allocation descriptor field, the same number of allocation descriptors as the extents forming the file are recorded. The allocation descriptor indicates a logical block number (LBN) indicating the recording position of the extent of the file or directory. The data structure of the allocation descriptor is shown in FIG. In FIG. 38(b), the allocation descriptor includes data indicating the extent length and a logical block number indicating the recording position of the extent. However, the upper 2 bits of the data indicating the extent length indicate the recording status of the extent recording area as shown in FIG. 38(c). (3-1-3) Data structure of file identification descriptor for directory and file FIGS. 39(a) and 39(b) show detailed data of file identification descriptor for directory and file included in the directory, respectively. The configuration is shown. The two types of file identification descriptors have the same format, and include management information, identification information, the length of the directory name, and an address indicating in which logical block number the file entry of the directory or file is recorded. , Extension information, and a directory name. As a result, the address of the file entry corresponding to the directory name or file name is specified.

[0235] (3-1-4) Minimum size of AV block When a VOB to be recorded in an AV file is divided into multiple extents, its data length must exceed the AV block. Here, the AV block is the minimum length that guarantees that the track buffer 3a does not underflow when reading a VOB from a DVD-RAM.

[0236] In order to guarantee continuous playback, the minimum size of the AV block is determined in relation to the track buffer in the playback device. Here, the theory with which the lower limit value of the AV block is determined will be described. (3-1-5) Minimum Size of AV Block Area First, the theoretical basis for determining the minimum size for guaranteeing continuous playback in (1) above will be described.

[0237] FIG. 40 is a model diagram of how AV data read from a DVD-RAM is buffered in a track buffer in a playback device that plays back a video object. This model is a model that defines the minimum specifications to be provided as a playback device, and continuous playback can be guaranteed as long as this specification is satisfied. In the upper part of FIG. 40, the AV data read from the DVD-RAM is subjected to ECC processing, temporarily stored in the track buffer (FIFO memory), and further output from the track buffer to the decoder. Let V_r be the transfer rate of the track buffer input (readout rate from the optical disk), and V_o be the transfer rate of the track buffer output (decoder input rate) (provided that $V_r > V_o$). In this model, $V_r = 11\text{Mbps}$.

[0238] The lower part of FIG. 40 is a graph showing changes in the data amount of the track buffer in this model. The vertical axis represents the amount of data in the track buffer, and the horizontal axis represents time. In the figure, it is assumed that the AV block #j having no defective sector and the AV block #k having a defective sector are sequentially read. The period T_1 on the time axis is the time required to read all AV data from the beginning to the end of the AV block #j that does not include a defective sector. During this period, the amount of data in the buffer increases at the rate of $(V_r - V_o)$.

[0239] A period T_2 (hereinafter referred to as a jump period) is a time required for the light pickup from the AV block #j to the AV block #k to jump. The jump time includes the seek time of the optical pickup and the time required for the rotation of the optical disc to stabilize. This time is the maximum jump time from the innermost

circumference to the outermost circumference, and is about 1500 mS in this model. During this period, the amount of data in the buffer decreases at the V_o rate.

[0240] Periods T3 to T5 are times required to read all AV data from the beginning to the end of the AV block #k including the defective sector. Of these, the period T4 is a time for skipping the Ecc block in which the defective sector exists and skipping to the next Ecc block. This skip refers to skipping the Ecc block (16 sectors) and jumping to the next consecutive Ecc block if any defective sector exists in the Ecc block. In other words, in the Ecc block in which the defective sector exists in the AV block, only the defective sector cannot be logically replaced by the replacement sector (alternative Ecc block), and the Ecc block (all 16 sectors) is simply not used. (ECC block skip method above). This time T4 is a rotation waiting time when the disk makes one rotation at maximum, and is about 105 mS in this model. In the periods T3 and T5, the data amount in the buffer increases at the rate of $(V_r - V_o)$, but in the period T4, it decreases at the rate of V_o .

[0241] The size of the AV block is expressed as $N_{ecc} * 16 * 8 * 2048$ bits, where N_{ecc} is the number of all Ecc blocks included in the AV block. The lower limit value of N_{ecc} for guaranteeing continuous reproduction can be derived as follows. In the period T2, only AV data is read from the track buffer. If the buffer capacity becomes 0 within this period, an underflow occurs in the decoder. In this case, continuous reproduction of AV data cannot be guaranteed. Therefore, in order to guarantee continuous reproduction (to prevent underflow), the following formula must be satisfied. (Stored amount B) $\geq$ (Consumed amount R) The buffer stored amount B is the amount of data stored in the buffer at the end of the period T1. The consumption amount R is the total amount of data read within the period T2. $\geq$ means greater than or equal to.

[0242] The accumulated amount B can be expressed by the following equation. (Amount B) = (Period T1) * $(V_r - V_o)$ = (Read time for one AV block) * $(V_r - V_o)$ = (AV block size L/V_r) * $(V_r - V_o)$ = $(N_{ecc} * 16 * 8 * 2048 / V_r) * (V_r - V_o) = (N_{ecc} * 16 * 8 * 2048) * (1 - V_o / V_r)$ The consumption amount R can be expressed by the following formula. (Consumption amount R) = $T2 * V_o$ When both sides of the above (Formula 1) are replaced by (Formula 2) and (Formula 3), the following formula is obtained. $(N_{ecc} * 16 * 8 * 2048) * (1 - V_o / V_r) = T2 * V_o$ From this equation, the number of Ecc blocks N_{ecc} for guaranteeing continuous playback must satisfy the following equation. $N_{ecc} \geq V_o * T_j / ((16 * 8 * 2048) * (1 - V_o / V_r))$ In this expression, T_j is the above jump time, which is 1.5 seconds at the maximum. V_r is a fixed value (about 11 Mbps in the reproducing device model in the upper part of FIG. 40). Further, V_o is represented by Expression 6 in consideration of the fact that the video object has a variable bit rate. That is, V_o is obtained not by the maximum physical transfer rate of the output of the track buffer, but by the equation 6 as the substantial input rate of the variable bit rate AV data decoder. However, regarding the AV block length, the number of packs in an AV block consisting of N_{ecc} Ecc blocks is N_{pack} . $V_o = \text{AV block length (bit)} * (1 / \text{AV block playback time (sec)}) = (N_{pack} * 2048 * 8) * (27M / (SCR_{first_next} - SCR_{first_current}))$ where SCR_{first_next} is the beginning of the next AV block The SCR of the pack, and $SCR_{first_current}$ is the SCR of the first pack of the AV block. SCR indicates the time when the pack should be output from the track buffer to the decoder, and has a unit of $(1/27M)\text{sec}$.

[0243] As shown in (Equation 5) and (Equation 6), the minimum size of the AV block can be theoretically calculated according to the bit rate of the actually recorded AV data. Further, in the above expression 5, the number of Ecc blocks N_{ecc} for ensuring continuous reproduction when the defective sector exists, which is valid when the optical disk does not have the defective sector, will be described.

[0244] It is assumed that there are dN_{ecc} ECC blocks having defective sectors in the AV block area. AV data is not recorded in the dN_{ecc} ECC blocks due to the above ECC block skip. The loss time T_s due to skipping dN_{ecc} ECC blocks is expressed as $T4 * dN_{ecc}$ ($T4$ is the ECC block skip time in the model of FIG. 40).

[0245] Taking these into consideration in Equation 5, in order to guarantee continuous reproduction even if there is a defective sector, a continuous area with the number of ECC blocks N_{ecc} that satisfies the following expression may be used as an AV block area. $N_{ecc} \geq dN_{ecc} + V_o * (T_j + T_s) / ((16 * 8 * 2048) * (1 - V_o / V_r))$ As described above, in the AV block area, when there is no defective sector, Equation 5 is used. If the defective sector exists, the size may be set to satisfy the formula 7.

[0246] However, when one continuous AV data is composed of a plurality of AV blocks, not all the AV blocks need to satisfy the equation 5 or the equation 7, and the AV blocks at the beginning and the end are represented by the equation 5 or the equation 7. Does not have to be satisfied. This is because the trailing AV block has no subsequent AV data, and the leading AV block delays the decoding start timing, that is, starts supplying data to the decoder when the data is accumulated in the track buffer. By doing so, it is possible to guarantee continuous

reproduction between the beginning and the next AV block. (3-2) Functional Block of DVD Recorder 70 FIG. 41 is a functional block diagram showing the configuration of the DVD recorder 70 by function. Each function in the figure is realized by the CPU 1a in the control unit 1 executing the program of the ROM 1e to control the hardware shown in FIG.

[0247] 41, the DVD player includes a disc recording unit 100, a disc reading unit 101, a common file system unit 10, an AV file system unit 11, a recording/editing/playback control unit 12, an AV data recording unit 13, an AV data reproducing unit 14, It is composed of the AV data editing unit 15. (3-2-1) Disc recording unit 100-Disc reading unit 101 The disc recording unit 100 receives the logical sector number to start recording and the data to be recorded from the common file system unit 10 and the AV file system unit 11. Then, the optical pickup is moved to the logical sector number, and the logical data is recorded in the logical sector designated by the optical pickup on the disk in ECC block (16 sector) units. When the data to be recorded in the logical data is less than 16 sectors, the size of the ECC block is once changed, the ECC process is performed, and then the ECC block is recorded.

[0248] When the logical sector number and the number of sectors from which data is to be read are input from the common file system unit 10 and the AV file system unit 11, the disk reading unit 101 moves the optical pickup to the logical sector number and the optical pickup. Data is read in units of ECC blocks from the logical sector designated by. The read data is subjected to ECC processing, and only necessary sector data is transferred to the common file system unit 10. The overhead is reduced by reading in units of 16 sectors for each ECC block when reading the VOB as in the disk recording unit. (3-2-2) Common File System Unit 10 The common file system unit 10 has a standard function for accessing a data format conforming to ISO/IEC13346, which is a recording/editing/playback control unit 12, a recording/editing/playback control unit. 12, the AV data recording unit 13, the AV data reproducing unit 14, and the AV data editing unit 15. The standard function provided by the common file system unit 10 means controlling the disc recording unit 100 and the disc reading unit 101 to read/write the DVD-RAM in directory units and file units. A typical function provided by the common file system unit 10 is a function of recording a file entry in the disc recording unit 100 and outputting a file identification descriptor to the recording/editing/playback control unit 12 (1), a function of releasing the recording area occupied by one file on the disc to a free area (2), controlling the disc reading unit 101 to read the file identification descriptor of the specified file from the DVD-RAM Function (3), function of controlling the disc recording unit 100 to record the data existing on the memory as a non-AV file on the disk (4), read extents constituting the file recorded on the disk There are types such as a function (5) for controlling the disc reading unit 101 and a function (6) for controlling the disc reading unit 101 so as to move the optical pickup to a desired position on an extent forming a file.

[0249] In order to receive the functions (1) to (6), the recording/editing/playback control unit 12 to the AV data editing unit 15 designates a file to record data or a file to read out data as a parameter. The command (hereinafter, common file system command) may be issued to the common file system unit 10. Common file system commands include types such as "(1) CREATE", "(2) DELETE", "(3) OPEN/CLOSE", "(4) WRITE", "READ" and "SEEK". It is assigned to each of the above functions (1) to (6). The assignment of the standard functions and commands in this embodiment is set as follows. That is, in order to receive the provision of the function (1), the recording/editing/playback control unit 12 to the AV data editing unit 15 may issue a CREATE command to the common file system unit 10. To receive the provision of the function (2), the recording/editing/playback control unit 12 to the AV data editing unit 15 may issue a DELETE command to the common file system unit 10, and similarly the functions (3)(4)(5) To receive (6), issue OPEN/CLOSE command, WRITE command, READ command, and SEEK command.

[0250] (3-2-3) AV File System Unit 11 The AV file system unit 11 is a function that cannot be provided by the common file system unit 10, and records/edits extended functions required only for recording AV files and editing AV files. Provided to the reproduction control unit 12 to the AV data editing unit 15. Typical of these extended functions are a function (7) of writing a VOB encoded by the MPEG encoder 2 to a DVD-RAM as an AV file, and a preset AV data included in the AV file. A function to cut out the range to another file (8), a function to release a pre-specified range in the AV data recorded in the AV file to a free area (9), two already managed on the DVD-RAM There is a function (10) for connecting the AV file of and the AV data arranged in the memory.

[0251] In order to receive the provision of these functions (7) to (10), the recording/editing/playback control unit 12 to the AV data editing unit 15 selects a file to record data or a file to connect or cut out data. A command specified as a parameter (hereinafter, command for AV file system) may be issued to the AV file system unit 11. There are three types of commands for AV file systems: "(7)AV-WRITE", "(8)SPLIT", "(9)SHORTEN", and

"(10)MERGE". It is assigned to each of 7) to 10). The assignment of the extended function and the command in the present embodiment is set as follows. That is, in order to receive the function (7), the recording/editing/playback control unit 12 to the AV data editing unit 15 may issue an AV-WRITE command, and to receive the function (8), the recording The editing/playback control unit 12 to the AV data editing unit 15 may issue the SPLIT command. To receive the functions (9) and (10), issue the SHORTEN command and MERGE command. In the function (10), the extents of the concatenated files are concatenated so as to be the AV block length or more. (3-2-4) Recording/Editing/Playback Control Unit 12 The recording/editing/playback control unit 12 issues an OPEN command specifying each directory name as a parameter to the common file system unit 10 to write to the DVD-RAM. The common file system unit 10 is made to read a plurality of already recorded file identification descriptors, the directory structure in the DVD-RAM is analyzed from these file identification descriptors, and the directory to be operated in this directory structure is to be operated. And the designation of the file is accepted from the operator. When the designation of the operation target is accepted, the operation content by the operator is specified based on the user operation notified from the remote control signal receiving unit 8, and the operation content processing is performed on the directory and the file specified as the operation target. The data recording unit 13, the AV data reproducing unit 14, and the AV data editing unit 15 are instructed to perform the processing.

[0252] In designating the operation target, the recording/editing/playback control unit 12 outputs graphics data in which the directory structure, the total number of AV files, the data size of the free area on this disk, etc. are drawn to the video signal processing unit 5, and Is converted into a video signal and displayed on the television receiver 72. FIG. 42 is a diagram showing an example of graphics data displayed on the television receiver 72 under the control of the recording/editing/reproduction control unit 12. When drawing this graphics data, any directory or file is displayed as an operation target while changing the drawing color (the state in which the operator's attention is attracted by the change in the drawing color is called the focus state. A state where no such changes have been made). When the mark key of the remote controller 71 is pressed, the files and directories set in the focus state are returned to the normal state, and other files and directories in the normal state are changed to the focus state. When any of the files and directories is set to the focus state, the recording/editing/playback control unit 12 waits for the confirmation key on the remote controller 71 to be pressed. The recording/editing/playback control unit 12 recognizes the file or directory in the focus state as the operation target when the enter key is pressed. In this way, the recording/editing/playback control unit 12 can specify the file and directory to be operated.

[0253] On the other hand, in specifying the operation content, the recording/editing/reproduction control unit 12 determines what operation content is assigned to the key code notified from the remote control signal receiving unit 8. As shown on the left side of FIG. 41, a character string such as "play", "rewind", "stop", "fast forward", "record", "mark", "temporary edit", "main edit" is written on the keys on the remote controller 71. There is. The recording/editing/playback control unit 12 specifies the operation content designated by the operator according to the key code notified from the remote control signal receiving unit 8. (3-2-4-1) Operation contents accepted by the recording/editing/playback control unit 12 The above operation contents are provided for the operation contents provided to the operator by the existing consumer AV device and the video editing. It is classified as a specially provided operation content. Specifically, among the above operation contents, "play", "rewind", "stop", "fast forward", and "record" are classified as the former, and "mark", "temporary edit", and "main edit" are It is classified into the latter.

[0254] "Playback" is an operation that instructs the DVD recorder 70 to play the VOB recorded in the AV file specified as the operation target, and "rewind" is the playback of the VOB currently being played in the past direction. This is an operation for instructing the DVD recorder 70 to proceed with. "Stop" is an operation that instructs the DVD recorder 70 to stop the playback of the VOB that is currently being played, and "fast forward" is to advance the playback of the VOB that is currently being played in the future direction. This is an operation commanding the DVD recorder 70.

[0255] "Recording" is an operation instructing the DVD recorder 70 to create a new AV file in a directory designated as an operation target, write a VOB to be recorded therein, and write it. These operations are familiar to many operators as the functions of existing consumer AV equipment, that is, video tape recorders and CD players. On the other hand, the latter operation content allows the operator to perform a video editing operation of cutting an arbitrary portion of a movie film and joining the cut portions to obtain an arbitrary combination of films. ..

[0256] The "mark" is used by the DVD recorder 70 to play the VOB recorded in the AV file designated as the operation target and mark the time when any image appears in the moving image played by the VOB. It is a

command operation. For example, the act of specifying the cut portion of a movie film corresponds to this "mark" operation, when compared to video editing on a film.

[0257] "Temporary editing" means selecting a plurality of arbitrary two sets from among the time points marked by the mark operation as the reproduction start point and the reproduction end point, and giving the reproduction order to these plural sets. This is an operation for instructing the DVD recorder 70 to define a logical reproduction route. The partial section specified by the set of the reproduction start point and the reproduction end point selected by the operator in the temporary editing operation is a cell, and the reproduction route defined by giving the reproduction order to each cell is defined by the program chain. Say.

[0258] "Main editing" is to cut out the range specified by the cell into another file from the AV files recorded on the DVD-RAM, and connect the cut out files according to the playback order shown in the program chain. Refers to the processing that commands the DVD recorder 70. This operation corresponds to the act of cutting the cut edges determined by the "mark" operation and joining the cut parts together. In this editing, the extents of the concatenated files are concatenated so as to be the AV block length or more.

[0259] The recording/editing/playback control unit 12 manages which of the above-mentioned operation contents each of the AV data recording unit 13 to the AV data editing unit 15 has a processing capacity. At the same time as specifying the content, the constituent elements according to the operation content are selected and an instruction of the operation content is output to the AV data recording unit 13 to the AV data editing unit 15. Hereinafter, an example of what kind of instruction the recording/editing/playback control unit 12 issues to the AV data recording unit 13, the AV data playback unit 14, and the AV data editing unit 15 will be illustrated according to the combination of the operation contents of the operation targets.

[0260] When the directory DVD_Video shown in FIG. 42 is set to the focus state and the recording key is pressed, the recording/editing/playback control unit 12 specifies the directory DVD_Video as the operation target and specifies "recording" as the operation content. The AV data recording unit 13 is selected as a component having a processing capability of the operation content "record", and an instruction is made to create a new AV file in the operation target directory.

[0261] When the file AV_FILE#1 is set to the focus state and the playback key is pressed, the recording/editing/playback control unit 12 identifies the file AV_FILE#1 as the operation target and "playback" as the operation content. The AV data reproducing unit 14 is selected as a component having the processing capability of the operation content to instruct to reproduce the AV file to be operated. When the file AV_FILE#1 is set to the focus state and the mark key is pressed, the recording/editing/playback control unit 12 identifies the file AV_FILE#1 as the operation target and the "mark" as the operation content. The AV data editing unit 15 is selected as a component having the processing capability of the operation content, and the AV data editing unit 15 is instructed to perform the marking process on the AV file to be operated. (3-2-5) AV data recording unit 13 The AV data recording unit 13 controls the MPEG encoder 2 to perform encoding, and combines the common file system command and the AV file system command in a predetermined order to create a common file. The recording operation is realized by issuing the system unit 10 and the AV file system unit 11 to provide the functions (1) to (10). (3-2-6) AV data reproducing unit 14 The AV data reproducing unit 14 controls the decoder 4 to perform decoding, and combines the common file system command and the AV file system command in a predetermined order to form a common file system. Issuing to the section 10 and the AV file system section 11 and making them provide the functions (1) to (10), the operation contents such as "play", "rewind", "fast forward", and "stop" can be realized. Measure (3-2-7) AV data editing unit 15 The AV data editing unit 15 controls the MPEG decoder 4 to perform decoding, and combines the common file system command and the AV file system command in a predetermined order to create a common file. Issuing to the system unit 10 and the AV file system unit 11 to cause them to provide the functions (1) to (10), the operation contents such as "mark", "temporary edit", and "main edit" are realized. ..

[0262] Specifically, when the recording/editing/playback control unit 12 instructs the AV data editing unit 15 to set a mark on the AV file to be operated, the AV data editing unit 15 plays back the AV file to be operated to the AV data playing unit 14. Then, it is monitored that the mark key is pressed again. When the mark key is pressed during the reproduction period, information indicating how many seconds after the start of reproduction of the AV file is pressed is written in the non-AV file as information called a mark point.

[0263] When the recording/editing/playback control unit 12 instructs the content of the temporary editing operation, the AV data editing unit 15 generates information defining a logical playback route in accordance with a key operation on the remote controller 71. Then, the common file system unit 10 is controlled so as to

write this as a non-AV file in the DVD-RAM. When the recording/editing/playback control unit 12 instructs the operation contents of the main editing, the AV data editing unit 15 cuts out the range instructed by the cell from the AV file recorded in the DVD-RAM into another file, Concatenate the cut out files in the order of cells.

[0264] The AV data editing unit 15 performs a concatenation process of a plurality of files in the AV files after the concatenation so that seamless reproduction within the file is realized. Here, "in-file seamless" means that reproduction of an AV file after concatenation is performed without interruption, and the AV data editing unit 15 selects extents other than the extent to be reproduced last among the extents forming the AV file. , The extent concatenation processing is performed from the viewpoint that the length is all equal to or greater than the AV block length. (3-2-7-1) Temporary Editing and Main Editing Process Procedure by AV Data Editing Unit 15 FIG. 43 shows how the temporary editing and main editing processes described above are performed. It is a flow chart. FIG. 44 is an explanatory diagram for supplementarily explaining the processing of the AV data editing unit 15 in the flowchart of FIG. The editing process by the AV data editing unit 15 will be described with reference to this flowchart and the explanatory diagram of FIG.

[0265] It is assumed that the AV file shown in FIG. 44A is already recorded on the DVD-RAM, the AV file is designated as the operation target, and the operator presses the play key on the remote controller 71. When this pressing is detected by the recording/editing/playback control unit 12 and a playback operation is instructed, the AV data editing unit 15 causes the AV data playback unit 14 to start playback of the AV file in step S1. It is assumed that the operator depresses the mark key again after the reproduction is started until the time t1 shown in FIG. Then, the mark point #1 indicating the relative time code of the time t1 is set in the AV file. Similarly, it is assumed that the operator has pressed the mark key seven times in total at the time when the times t2, t3, t4... T8 have passed. Then, as shown in FIG. 44B, the mark points #2, #3, #4, #5,... #8 indicating the relative time codes of the times t2, t3, t4, t5... Is set.

[0266] After execution of step S1, the process proceeds to step S2, and the AV data editing unit 15 causes the operator to designate a set of mark points, and in accordance with the designation of the set, determines a plurality of cells to be reproduced in the AV file. .. In FIG. 44(c), the operator designates a pair (1) of Mark#1 and Mark#2, and similarly, a pair of Mark#3 and Mark#4 (2), Mark#5 and Mark#6. It is assumed that one set (3) and one set (4) of Mark#7 and Mark#8 are designated.

[0267] Then, the AV data editing unit 15 sets one set of these mark points as one cell, and sets four cells Cell#1, Cell#2, Cell#3, Cell#4 (note that Mark is set). It is also possible to specify one set of #2-Mark#3, one set of Mark#4-Mark#5 as a cell, and by specifying in this way, one set of Mark#2-Mark#3, Each set of #4-Mark#5 is set as one cell.)

[0268] Subsequently, in step S3, the AV data editing unit 15 creates a program chain by giving a reproduction order to each cell. Of the four Cell#1, Cell#2, Cell#3, Cell#4 already set in FIG. 44(d), the first playback order is given to Cell#1 (1st in the figure). , Cell#2 is assigned the second playback order (2nd in the figure). Similarly, it is assumed that Cell#3 and Cell#4 are provided with the third and fourth playback orders (3rd and 4th in the figure). Then, the AV data editing unit 15 interprets a plurality of cells as a program chain according to the playback order set in this way (note that FIG. 44 shows the simplest example, cell #3, cell #1). , It is also possible to specify the order of cell #2.).

[0269] In step S6, the AV data editing unit 15 monitors whether the operator has instructed the program chain to perform reproduction, and in step S5 checks whether the operator has instructed the program chain to perform main editing. Monitor. When the reproduction instruction is given, the AV data editing unit 15 instructs the AV data reproducing unit 14 to reproduce the program chain for which the reproduction is instructed.

[0270] The instructed AV data reproducing unit 14 firstly causes the AV data editing unit 15 to issue a SEEK command to seek the optical pickup to Mark#1 which is the reproduction start point of the cell#1 as shown in FIG. Issue. When the optical pickup moves to Mark#1 of the AV file by issuing the SEEK command, a "READ" command is issued to the common file system unit 10 so that the range of Mark#1 to Mark#2 is read. As a result, the VOBUs of cell #1 is read from the DVD-RAM, the read VOBUs are sequentially decoded by the decoder 4, and the video is displayed on the television receiver 72. When the reproduction of VOBUs is performed up to Mark#2, the same processing is performed on the remaining cells. Then, only the range designated as cells #1, #2, #3, and #4 will be played.

[0271] Here, it is assumed that the AV file shown in FIG. 44A is a movie televised. Further, as shown in FIG. 44(f), the video content of each time zone of the AV file is the credit scene V1 displaying the characters and

directors of the movie from the time t1 to the time t1 from the time t1. The period up to time t2 is the first show scene V2 of the main part of the movie, the period from time t2 to time t3 is the commercial scene V3 inserted because it is a TV broadcast, and the period from time t3 to time t4 is It is assumed that the second showcase scene V4 of the movie main part and the period from time t5 to time t6 are the third showcase scene V5 of the movie main part.

[0272] Mark#1, Mark#2, Mark#3, Mark#4, Mark#5, Mark#6 are set at these times t1, t2, t3, t4, t5, t6, and a pair of mark points is set. Is specified as a cell, and the display order as a program chain is set. Therefore, when the reading is performed as shown in FIG. 44(e), the credit scene V1 is not reproduced and skipped, and the show scene V2 is reproduced from time t1 to time t2. Subsequently, the commercial scene V3 is skipped without being reproduced, and the show-scene V4 from time t3 to time t4 is reproduced.

[0273] Next, the process when the operator gives an instruction for main editing will be described with reference to the explanatory diagrams of FIGS. 45 and 46. 45 and 46 are explanatory diagrams for supplementarily explaining the processing of the AV data editing unit 15 in the flowchart of FIG. In this explanatory diagram, each variable mx, Af used in the flow chart of FIG. 43 indicates which part of the AV file is designated. The processing procedure of the main editing will be described with reference to this flow chart.

[0274] First, in step S8, the AV data editing unit 15 determines two or more ranges to be cut out from the AV file according to the program chain defined by the temporary editing. Mark points of Mark#1, #2, #3,..., #8 are added to the "editing source AV file" of FIG. Since the cells set for the AV file are specified by a set of Mark#1, #2, #3,... #8, the AV data editing unit 15 starts editing a set of these mark points. Interpret as a point or an edit end point. That is, one set of Mark#1 and #2 is interpreted as an edit start point In point (1) and an edit end point Out point (1), and one set of Mark#3 and #4 is edited start point In point (2).), the edit end point is interpreted as the Out point (2). Mark#5,#6 pair, Mark#7,#8 pair edit start point In point (3), edit end point Out point (3), edit start point In point (4), edit End point Interpreted as Out point (4).

[0275] Here, the period from Mark#1 to Mark#2 corresponds to the first showcase scene V2 of the main part of the movie from time t1 to time t2 shown in FIG. 44(f). The period from Mark#3 to Mark#4 corresponds to the second showcase scene V4 of the main movie from time t3 to time t4 shown in Fig. 44(f), and from Mark#5 to Mark#6. Since the period corresponds to the third show scene V5 of the main movie from time t5 to time t6 shown in FIG. 44(f), the operator performs the show scenes V2, V4, V5 by the processing of the main editing thereafter. They are trying to get an AV file consisting of only.

[0276] Next, in step S9, the AV data editing unit 15 issues to the AV file system unit 11 a SPLIT command that cuts out the determined cutout range into mx (mx is an integer of 2 or more) AV files. The AV data editing unit 15 interprets the closed section specified by the pair of the edit start point and the edit end point shown in FIG. Cut out the AV file of.

[0277] Hereinafter, each of the extracted mx AV files is called an AV file Af1, Af2, Af3, Af4... Afm, and in this flowchart, these are designated by the variable "Af". .. In step S10, the variable Af is initialized by setting the variable Af to 1, and in step S11, the VOB (hereinafter referred to as the end part) located at the end of the AV file Af in the program chain and the AV file Af+. A READ command is issued to the AV file system unit 11 for the VOB (hereinafter referred to as the front end) located at the front end of 1. After issuance, in step S12, the read end portion and tip portion are re-encoded using the procedure shown in the second embodiment.

[0278] When the re-encoding is performed, the SHORTEN command for the end portion and the tip portion of the AV files Af and Af+1 is issued to the file system. In FIG. 45(c), the end portion of the AV file Af1 and the end portion of the AV file Af2 are read by the "READ" command, and the end portion and the end portion are re-encoded. By this re-encoding, the re-encoded data obtained by re-encoding one set of these is stored in the memory of the DVD recorder 70. By issuing the "SHORTEN" command in step S13, the areas originally occupied by the leading end and the trailing end are deleted.

[0279] When deleting as described above, it should be noted that the following two cases will occur. The first case is that both the extent of the AV file Af from which the portion to be re-encoded is removed and the extent of the AV file Af+1 have a continuous length equal to or longer than the AV block length. This is the case where the continuous length on one side is less than the data size of the AV block. The length of the AV block is set to a length that avoids the occurrence of underflow, so if playback of the AV file Af or AV file Af+1 is instructed while the continuous length is less than the AV block length, the track The buffer underflows.

[0280] The second case is a case where the data size of the data (in-memory data) re-encoded and stored in the memory is less than the data size of the AV block. That is, when the data size of the data in the memory is large and the data in the memory occupies an area of one AV block or more when recorded on the DVD-RAM, it is isolated from the AV file Af and the AV file Af+1. In-memory data may be recorded at the location. However, if the data size of the in-memory data is smaller than the data size of the AV block, the in-memory data cannot be recorded in an isolated position separated from the AV file Af and AV file Af+1.

[0281] The reason is that if the data in the memory is recorded in an isolated position, the data size of the data in the memory is small, and therefore, when the data in the memory is read out to the track buffer and is read out to the track buffer, a sufficient storage amount in the track buffer can be obtained. This is because if it is not possible and it takes a long time to jump from the in-memory data to the AV file Af+1, an underflow of the track buffer occurs during the jump.

[0282] In FIG. 45(d), the AV files Af1 and Af2 have the leading end and the trailing end deleted as represented by the broken lines. At this time, it is found that the continuous length of the AV file Af1 is less than the AV block length. Similarly, it can be seen that the data size of the re-encoded in-memory data is less than the data size of the AV block. If the AV file Af1 is left in a short state, underflow may occur when the AV file Af1 is played back and jumped to the AV file Af2. In order to avoid the occurrence of underflow, a MERGE command for the AV file Af and the AV file Af+1 is issued to the file system in step S14. Then, as shown in FIG. 45(e) and FIG. 46(a), the AV file Af1 and the re-encoded VOBUs are linked, and the continuous length of the recording area of all extents forming the AV file Af is the AV block length. That is all. After issuing the "MERGE" command, it is determined in step S15 whether the variable Af and the number of AV files mx-1 match. If they do not match, the variable Af is incremented in step S16 and the process proceeds to step S11. As a result, the procedure of steps S11 to S14 is repeated.

[0283] When the variable Af is incremented to 2, the end of the concatenated AV file Af2 and the end of the AV file Af3 are read by the "READ" command (see FIG. 46(b)), and the end is When the front end is re-encoded, the re-encoded data obtained by re-encoding one set of these is stored in the memory of the DVD recorder 70. The area originally occupied by the leading end and the trailing end is deleted by issuing the "SHORTEN" command in step S13 (see FIG. 46(c)). At this time, the AV file Af3 has the AV block length. The continuous length is less than. Since the AV file Af3 may also underflow, the AV data editing unit 15 issues the MERGE command for the AV files Af2 and Af3 to the file system again (see FIGS. 46D and 46E).). The above process is repeated until the variable Af becomes mx-1.

[0284] As a result of the above processing, the extents on the recording area are all the show scenes V2, V4, and V5. Further, since all of these extents have a continuous length equal to or longer than the AV block length, it is guaranteed that the video display will not be interrupted during the reproduction. Here, the period from Mark#1 to Mark#2 corresponds to the show scene V2. Also, the period from Mark#3 to Mark#4 corresponds to the second show-scene V4, and the period from Mark#5 to Mark#6 corresponds to the third show-scene V5. By the processing of, the operator has obtained an AV file consisting of only the show scenes V2, V4, and V5.

[0285] (3-2-7-1-2) Processing of the AV file system unit 11 at the time of issuing the SPLIT command The processing of the AV file system unit 11 when providing the extended function by issuing the "SPLIT" will be described in detail. FIG. 48A is a flowchart showing a processing procedure of the AV file system unit 11 when a function is provided by issuing a "SPLIT" command. Hereafter, it is assumed that the mx edit start points (In points) and edit end points (Out points) set in one AV file in this flowchart are designated by the variable h. In step S22, 1 is assigned to the variable h in order to designate the first In point and Out point.

[0286] In step S31, the file entry (h) is generated, and in step S32, the AV file system unit 11 adds the file identification descriptor (h) for the file entry (h) to the directory file in the temporary directory. In step S33, the start address s and the occupied block number r of the u logical block string occupying from the logical block corresponding to the In point (h) to the logical block corresponding to the Out point (h) are calculated ($u \geq 1$). In step S34, u allocation descriptors are generated in the file entry (h). In step S35, the start address s and the occupied block number r of the u logical block string are registered in each of the u allocation descriptors, and in step S35, it is determined whether the variable h has reached mx-1. If not, the variable h is incremented and the process proceeds to step S31. In this way, the procedure of steps S31 to S35 is repeated until the variable h becomes mx-1, and the closed section specified by the set of mx-1 In points and Out points is mx-1 independent. It is cut out as an AV file. (3-2-7-1-3) Processing of AV file system unit 11 when issuing the SHORTEN command Next, the processing of the AV file system unit 11 when providing extended functions by issuing

"SHORTEN" will be described in detail. To do. FIG. 48B is a flowchart showing the processing contents when the SHORTEN command is issued.

[0287] In step S38, the AV file system unit 11 calculates the start address c and the number of occupied blocks d of the logical block sequence occupying from the deletion start address that specifies the deletion range to the deletion end address. In step S45, the allocation descriptor of the AV file whose leading or trailing end should be deleted is accessed. In step S46, it is determined whether the deletion range is the tip of the extent. If it is the leading end, step S46 becomes Yes and the process moves to step S47, and the recording start address p of the extent in the allocation descriptor is updated to the recording start address $p+c \times d$ in step S47. After updating, in step S48, the occupied block number q in the allocation descriptor is updated to the extent data size q to the data size $q-c \times d$. If it is the end portion, the process directly goes to step S48 in step S46, and the occupied block number q in the allocation descriptor is updated to the extent data size q to the data size $q-c \times d$.

[0288] (3-2-7-1-4) Processing of the AV file system unit 11 when issuing the MERGE command Next, the processing contents of the AV file system unit 11 when providing the extended function when issuing the "MERGE" command will be described in detail. .. In the following description, of the processes shown in FIGS. 45 and 46, the procedure for performing the process in the range indicated by the alternate long and short dash lines y3 and y4 will be clarified.

[0289] During execution of the MERGE command, the AV file system unit 11 is re-encoded by the DVD recorder 70 and two AV files A_f and A_{f+1} which are cut out by the "SPLIT" command and whose ends are deleted by the "SHORTEN" command. Therefore, the re-encoded data (in-memory data) arranged on the memory of the DVD recorder 70 and the AV file A_f , the data on the memory, and the AV file A_{f+1} can be seamlessly played in this order on the DVD-RAM. To place.

[0290] FIG. 47A is a diagram showing an example of an object to be processed by the AV file system unit 11 when the extended function is provided by issuing the "MERGE" command. In FIG. 47A, the AV file A_f and the AV file A_{f+1} are AV files cut out by the "SPLIT" command. Here, it is assumed that the reproduction route is defined so that the audiovisual data is reproduced in the order of the AV file A_f , the in-memory data, and the AV file A_{f+1} by the temporary editing. FIG. 47A is a diagram showing an example of a reproduction route set for the audiovisual data recorded in the AV file A_f and the AV file A_{f+1} . In this figure, the horizontal axis means the time axis, and when interpreting the display order along this horizontal axis, the playback route in this figure is determined in the order of AV file A_f , in-memory data, AV file A_{f+1} . I understand.

[0291] In the AV file A_f , the range from the beginning to the data size m is recorded in a continuous area in the DVD-RAM and corresponds to the preceding extent. In the AV block, the range from the end to the data size n is also recorded in a continuous area in the DVD-RAM and corresponds to the subsequent extent. Here, if the AV audio file A_f and AV file A_{f+1} are obtained by cutting out the audiovisual data of an arbitrary section by the "SPLIT" command, the file system manages as an empty area, but the actual logical block The contents of the original AV file should have been left unrecorded. In addition, since the above-mentioned setting of the reproduction route by the operator is based on the premise that it is set without considering "in which AV block on the DVD-RAM the clipped AV file is recorded". The positional relationship between the preceding extent and the following extent in the DVD-RAM cannot be uniquely specified. Even if the playback route is specified in the order of AV file A_f and AV file A_{f+1} , it is possible that audiovisual data completely unrelated to the playback route exists between the preceding extent and the following extent. can not deny.

[0292] Keeping the above in mind, when concatenating AV files cut out by the "SPLIT" command, it is not assumed that the preceding extent and the succeeding extent are recorded at consecutive positions in the DVD-RAM, but rather in advance. It should be assumed that the extent and the subsequent extent are recorded in a completely unrelated position on the DVD-RAM.

[0293] Further, between the recording areas of the preceding extent and the succeeding extent, at least one extent of another file that is completely unrelated to the reproduction route specifying the AV file A_f and AV file A_{f+1} is recorded. (In the present embodiment, the preceding extent and the succeeding extent are assumed to be present in the same zone area). FIG. 47(b) is a recording image diagram assuming the positional relationship between the preceding extent and the succeeding extent in the DVD-RAM, keeping the above in mind.

[0294] Here, since the AV file A_f including the preceding extent is cut out by executing the "SPLIT" command, there is a free area behind the preceding extent (in this way, there is a free space existing behind the preceding

extent. An area that exists in the same zone area as the preceding extent is called an Out area). As described above, the audio/audio data recorded in the AV file before being cut out is actually recorded in this Out area, but since the "SPLIT" command has already been issued, the AV It is treated as an empty area by the file system unit 11.

[0295] Further, since the AV block including the subsequent extent is cut out by executing the "SPLIT" command, there is a free area in front of the subsequent extent (the free area existing in front of the subsequent extent in this way). That is, what exists in the same zone area as the subsequent extent is called In area.) The In area is actually physically recorded with the audiovisual data recorded in the AV file before clipping, but since the "SPLIT" command has already been executed, it is treated as an empty area from the outside.

[0296] In this figure, the preceding extent is recorded before the succeeding extent, but this is merely an example for convenience of drawing, and the succeeding extent may be recorded before the preceding extent. An extent of another file exists between the recording areas of the preceding extent and the succeeding extent. The In area and the Out area are optimal for recording the in-memory data as described above, but the continuous length of the In area and the Out area is restricted due to the presence of the third extent. Is assumed.

[0297] First, in step S62 in the flowchart of FIG. 49, the AV file system unit 11 calculates the data size of the Out area and the data size of the In area. When the data size of the In area and the Out area is obtained as described above, it is determined whether or not an underflow occurs in the preceding extent by referring to the data size m of the preceding extent and the data size n of the subsequent extent. To do.

[0298] (3-2-7-1-4-1) Processing when the preceding extent m is less than the AV block length If the preceding extent m is less than the AV block length and the following extent n is more than the AV block length, the preceding extent m is Since there is a risk of underflow, the process proceeds to step S70 in FIG. FIG. 50 is a flowchart when the preceding extent is shorter than the AV block length and the succeeding extent is longer than the AV block length. 51, 52, and 53 are explanatory views for supplementarily explaining the processing of the AV file system unit 11 in the flowchart of FIG. These figures show the relationship between extent data size m,n and In area, Out area data size i,j, in-memory data size k, and AV block data size B. It is specified which area is the recording destination and the moving destination of each data when the above is satisfied.

[0299] Since the data size of the preceding extent is smaller than the AV block, if the preceding extent is left as it is, underflow will occur in the preceding extent. Where to set the recording positions of both the preceding extent and the in-memory data is the process to be performed in the flow chart of FIG. In step S70, it is first determined whether the total size of the preceding extent and the in-memory data is equal to or larger than the AV block length. If it is equal to or longer than the AV block length, the process proceeds to step S71, and it is first determined whether the Out area is larger than the in-memory data. If it is larger, the in-memory data is written to the Out area and the continuous length of the preceding extent is set to the AV block length or more. FIG. 51A is a diagram showing an arrangement example of the preceding extent, the following extent, the In area, and the Out area on the DVD-RAM when the relationship of $i \geq k$ and $m+k \geq B$ is established. In this case, if the data in the memory is recorded in the Out area as shown in FIG. 51(b), the continuous length of the preceding extent can be made longer than the AV block length.

[0300] On the other hand, if the Out area is smaller than the in-memory data, the move process is performed. FIG. 52A is a diagram showing an arrangement example of the preceding extent, the following extent, the In area, and the Out area on the DVD-RAM when the relationship of $i < k$ and $m+k \geq B$ is established. In such a state, as shown in FIG. 52B, the preceding extent is first read into the memory, and the preceding extent is written into the empty area existing in the same zone area as the preceding extent, thereby making the preceding extent into the empty area. Moving. After the movement, as shown in FIG. 52(c), the in-memory data is written to the end of the moved preceding extent.

[0301] If the total size of the preceding extent and the in-memory data is less than 1 AV block length, step S70 becomes No and the process proceeds to step S72. In step S72, it is determined whether the total size of the preceding extent, the following extent, and the in-memory data is equal to or larger than the 2AV block length. If the total size is less than one AV block, even one AV block cannot be filled even if the moving process is performed, and underflow occurs. If the total data size of the preceding extent, in-memory data, and subsequent extent is less than the 2AV block length, recording time will not be too long even if the preceding extent, in-memory data, and subsequent extent are written to the logical block at once. .. In the flowchart of FIG. 50, if the total size of the in-memory data, the preceding extent, and the succeeding extent is less than the 2AV block

length, the process proceeds from step S72 to step S73, and the preceding extent and the succeeding extent are processed. To move both.

[0302] FIG. 53A shows an arrangement example of the preceding extent, succeeding extent, In area, and Out area on the DVD-RAM when the relationship of $i \leq k$, $m+k \leq B$, and $B \leq m+n+k \leq 2B$ is established. It is a figure. In this case, a free area existing in the same zone area as the preceding-succeeding extent is searched. When the empty area is obtained, as shown in FIG. 53(b), the preceding extent is first read into the memory, and this is again written in the empty area to move the preceding extent to the empty area. After the movement, as shown in FIG. 53C, the in-memory data is written to the end of the moved preceding extent. When the data in the memory is written, as shown in FIG. 53(d), the subsequent extent is first read into the memory, and the subsequent extent is written immediately after the area occupied by the in-memory data after the movement so that the subsequent extent is a free area. Move to.

[0303] If the total size of the in-memory data, the preceding extent, and the subsequent extent is equal to or larger than the 2AV block length, the process proceeds from step S72 to step S74. If the total size is 2 AV blocks or more, the time required for writing the logical block becomes enormous, and the method of simply moving the preceding extent and writing the in-memory data to the destination should not be accepted from the viewpoint of access speed. However, it should be noted that the transition from step S72 to step S74 is performed because the relation that the total size of the in-memory data and the preceding extent is less than the AV block length is established. When the total size of the in-memory data and the preceding extent is less than the AV block length, but the total size of the in-memory data, the preceding extent, and the subsequent extent is 2AV block length or more. The relationship is established that the data size of the subsequent extent is large and the data size of (successive extent-AV block) is also a considerable amount. Since the data size of (subsequent extent-AV block) is a considerable amount, the data size of the subsequent extent can be obtained even if the amount of less than the AV block when the preceding extent and the in-memory data are added is supplemented by the subsequent extent. There is no shortage of money.

[0304] Therefore, when the total size of the in-memory data, the preceding extent, and the subsequent extent is equal to or more than the 2AV block length, the process proceeds from step S72 to step S74 and the concatenation process is performed by the procedure shown in FIGS. 54(a) to 54(d). FIG. 54A is a diagram showing an arrangement example of the preceding extent, the following extent, the In area, and the Out area on the DVD-RAM when the relations of $m+k \leq B$ and $m+n+k \geq 2B$ are established. In this case, a free area existing in the same zone area as the preceding and succeeding extents is obtained by searching. When the free area is obtained, as shown in FIG. 54(b), the preceding extent is first read into the memory, and the preceding extent is written into the empty area again to move the preceding extent to the empty area. After the movement, the in-memory data is written to the end of the moved preceding extent as shown in FIG. 54(c). When the in-memory data is written, an extent having a data size of (subsequent extent-AV block) is moved to the recording destination of the in-memory data, as shown in FIG.

[0305] After concatenating the preceding extent, in-memory data, and subsequent extent through the above processing, the file entry of the AV file Af containing the preceding extent and the file entry of the AV file Af+1 containing the following extent are integrated and combined. A single file entry is obtained, and the processing ends. (3-2-7-1-4-2) Processing when the subsequent extent n is less than the AV block length If step S63 is No in the flowchart of FIG. 49, the process proceeds to step S64 and the preceding It is determined whether the extent m is longer than the AV block length and the subsequent extent n is shorter than the AV block length. In this step, it is determined whether there is a risk of underflow in the subsequent extent n.

[0306] FIG. 55 shows a flowchart in the case where the subsequent extent is shorter than the AV block length and the preceding extent is longer than the AV block length. FIG. 56, FIG. 57, FIG. 58, and FIG. 59 are explanatory diagrams for supplementarily explaining the processing of the AV file system unit 11 in the flow chart of FIG. These figures show the relationship between extent data size m,n and In area, Out area data size i,j, in-memory data size k, and AV block data size B. It is specified which area is the recording destination and the moving destination of each data when the above is satisfied.

[0307] In step S75, it is first determined whether the total size of the subsequent extent and the in-memory data is equal to or larger than the AV block length. If it is equal to or longer than the AV block length, the process proceeds from step S75 to step S76, and it is first determined whether the In area is larger than the in-memory data. FIG. 56A is a diagram showing an arrangement example of the preceding extent, the succeeding extent, the In area, and the Out area on the DVD-RAM when the relationship of $j \geq k$ and $n+k \leq B$ is established. In this case,

if the data in the memory is recorded in the In area as shown in FIG. 56(b), the continuous length of the subsequent extents can be made longer than the AV block length.

[0308] On the other hand, if the In area and Out area are smaller than the in-memory data, the moving process is performed. FIG. 57A is a diagram showing an arrangement example of the preceding extent, the following extent, the In area, and the Out area on the DVD-RAM when the relationship of $j(k \text{ and } n+k \geq B)$ is established. In this case, a free area existing in the same zone area as the preceding-succeeding extent is searched. When the empty area is obtained, the in-memory data is written in the empty area as shown in FIG. 57(b). Subsequently, as shown in FIG. 57C, the subsequent extent is first read into the memory and written immediately after the recording area of the data in the memory.

[0309] If the total size of the subsequent extent and the in-memory data is less than 1 AV block length, the process proceeds from step S75 to step S77, and in step S77, whether the total size of the preceding extent, the subsequent extent, and the in-memory data is 2 AV block length or more. judge. If it is less than the 2AV block length, the process proceeds to step S78. FIG. 58A is a diagram showing an arrangement example of the preceding extent, succeeding extent, In area, and Out area on the DVD-RAM when the relationship of $j(k, n+k(B, \text{ and } m+n+k(2B$ is established. is there. In step S78, the AV file system unit 11 searches for a free area existing in the same zone area as the preceding-succeeding extent. In such a state, as shown in FIG. 58(b), the preceding extent is first read into the memory and then written again in the empty area to move the preceding extent to the empty area. After the movement, as shown in FIG. 58C, the in-memory data is written to the end of the moved preceding extent. When the data in the memory is written, as shown in FIG. 58D, the subsequent extent is first read into the memory, and the subsequent extent is written immediately after the area occupied by the data in the memory after the movement so that the subsequent extent is preceded. Move to a free area existing in the same zone area as the subsequent extent.

[0310] On the other hand, if the length is equal to or larger than the 2AV block length, the process proceeds from step S77 to step S79, and the connection process is performed according to the procedure shown in FIGS. 59(a) to 59(d). FIG. 59A is a diagram showing a layout example of the preceding extent, the following extent, the In area, and the Out area on the DVD-RAM when the relationship of $n+k(B \text{ and } m+n+k \geq 2B$ is established. In this case, a free area existing in the same zone area as the preceding-succeeding extent is searched. When the free area is obtained, as shown in FIG. 59B, the end part mend of the extent having the data size of (AV block-($n+k$)) is moved to the recording destination of the in-memory data. As shown in FIG. 59C, the in-memory data is written to the end of the moved preceding extent. When the in-memory data is written, as shown in FIG. 59(d), the subsequent extent is moved to immediately after the recording area of the in-memory data.

[0311] If No in step S64 of FIG. 49, the process moves to step S65, and the preceding extent m is less than the AV block length and the following extent n is less than the AV block length, that is, the preceding extent m and the following extent n . It is determined whether there is a risk of underflow on both sides. FIG. 60 is a flowchart showing the processing contents when both the preceding extent and the succeeding extent are less than the AV block length. 61, 62, 63, and 64 are explanatory views for supplementarily explaining the processing of the AV file system unit 11 in the flowchart of FIG. These figures show the relationship between extent data size m, n and In area, Out area data size i, j , in-memory data size k , and AV block data size B . It is specified which area is the recording destination and the moving destination of each data when the above is satisfied.

[0312] In this flowchart, first, in step S80, it is determined whether the total size of the in-memory data, the preceding extent and the succeeding extent is equal to or larger than the AV block length. If the total size is less than the AV block length, the process proceeds to step S81. In this case, even if the preceding extent, the in-memory data, and the subsequent extent are added together, the AV block cannot be filled, so it is determined whether or not the subsequent extent is followed by the extent. If it is not succeeding, the succeeding extent is effectively the extent that constitutes the end of the AV file created after concatenation, so you can leave it as it is, but if the extent is succeeding, the preceding extent-in memory Underflow occurs because the data-subsequent extent pair cannot fill the AV block. In order to avoid this, when there is an extent subsequent to the subsequent extent, the concatenation process is performed according to the procedure shown in FIG. FIG. 61A is a diagram showing a layout example of the preceding extent, the following extent, the In area, and the Out area on the DVD-RAM when the relationship of $m+n+k(B$ is established. In step S81, the AV file system unit 11 writes the in-memory data in the In area as shown in FIG. 61(b). When the data in the memory is written, as shown in FIG. 62(c), the subsequent extent is first read into the memory, and the subsequent extent is written immediately after the area occupied by the in-memory data after the movement, whereby the subsequent extent is a free area. Move to.

[0313] Finally, as shown in FIG. 61D, data is extracted from the extent subsequent to the subsequent extent by the data size of (AV block-(preceding extent+data in memory+successive extent)), and the extracted data is the preceding extent, Connect to in-memory data and subsequent extents. If the total size of the preceding extent, the following extent, and the in-memory data is equal to or larger than the AV block length, the process proceeds to step S82. In step S82, the AV file system unit 11 determines whether the data size of the Out area subsequent to the preceding extent is smaller than the total size of the subsequent extent and the in-memory data. If it exceeds, the process proceeds to step S83. FIG. 62A is a diagram showing an arrangement example of the preceding extent, succeeding extent, In area, and Out area on the DVD-RAM when the relationship of $i \geq n+k$, $m+n+k \geq B$ is established. In step S83, the AV file system unit 11 writes the in-memory data in the In area as shown in FIG. When the data in the memory is written, as shown in FIG. 62(c), the subsequent extent is first read in the memory and is written immediately after the area occupied by the in-memory data after the movement, whereby the preceding extent is vacant. Move to.

[0314] If the Out area is smaller, the process proceeds from step S82 to step S84, and it is determined in step S84 whether the data size of the In area preceding the subsequent extent is smaller than the total size of the preceding extent and the in-memory data. If it exceeds, the process proceeds to step S85. FIG. 63A is a diagram showing an arrangement example of the preceding extent, the following extent, the In area, and the Out area on the DVD-RAM when the relationship of $i < n+k$, $m+n+k \geq B$ is established. In step S85, the AV file system unit 11 writes the in-memory data in the Out area as shown in FIG. 63(b). When the in-memory data is written, as shown in FIG. 63(c), the preceding extent is first read into the memory, and the preceding extent is written immediately before the area occupied by the moved in-memory data, whereby the preceding extent is set to the In area. Move to.

[0315] When step S84 is No, it transfers to step S86. FIG. 64A shows an arrangement example of the preceding extent, succeeding extent, In area, and Out area on the DVD-RAM when the relationship of $i < n+k$, $j < m+k$, $m+n+k \geq B$ is established. It is a figure. In step S86, it is determined whether or not the total size of the preceding extent, the following extent, and the in-memory data exceeds the 2AV block length. In the case of no, the AV file system unit 11 searches for a free area existing in the same zone area as the preceding extent. When the empty area is obtained, as shown in FIG. 64(b), the preceding extent is first read into the memory, and the preceding extent is written into the empty area again to move the preceding extent to the empty area. After the movement, as shown in FIG. 64(c), the in-memory data is written to the end of the moved preceding extent. When the data in the memory is written, as shown in FIG. 64(d), the subsequent extent is first read in the memory, and the subsequent extent is written immediately after the area occupied by the data in the memory after the movement, so that the subsequent extent is a free area. Move to.

[0316] When the total size of the preceding extent, the subsequent extent, and the in-memory data is 2 AV blocks, it is determined which of the Out area and the In area has a larger data size. If the data size of the Out area is large, the in-memory data is recorded in the Out area until the AV block length is reached. After that, the rest of the data in the memory is recorded in the free area, and the subsequent extent is moved to the recording destination.

[0317] When the data size of the In area is large, the AV file system unit 11 moves the preceding extent to a free area, and the data in the memory (in-memory data-In area) from the beginning of the in-memory data is moved to the free area. Is recorded at the destination of the preceding extent. After that, the remaining portion of the data in the memory is recorded in the In area. Through the moving process as described above, the total moving amount can be suppressed to 2 AV block length or less in step S86.

[0318] After concatenating the preceding extent, in-memory data, and subsequent extent through the above processing, the file entry of the AV file Af containing the preceding extent and the file entry of the AV file Af+1 containing the following extent are integrated and combined. A single file entry is obtained, and the processing ends. (3-2-7-1-4-3) Processing when both the preceding and succeeding extents are equal to or longer than the AV block length If step S65 of FIG. 49 is determined as No, the AV file system unit 11 stores the memory Determine whether the internal data is less than the AV block length. If it is equal to or longer than the AV block length in step S67, the data in the memory is recorded in the empty area and the process is ended.

[0319] When step S66 is No, the AV file system unit 11 determines that the preceding extent m is the AV block length or more, the subsequent extent n is the AV block length or more, and the data size of the in-memory data k is In area i and Out. It is determined whether it is smaller than the total length of the area j. FIG. 65 is a flow chart when the preceding extent and the succeeding extent have a length equal to or longer than the AV block length.

[0320] Further, FIG. 66 is an explanatory diagram for supplementarily explaining the processing of the AV file system unit 11 in the flowchart of FIG. In the explanatory diagram (a), an example of recorded contents in which both the subsequent extent and the preceding extent are equal to or longer than the AV block length is shown in the upper stage. Also, (b) to (d) show how in-memory data and extents are recorded in the In area, Out area, and other free areas when the steps in FIG. 65 are executed. ..

[0321] In this case, there is no fear that underflow will occur in the preceding extent and the succeeding extent. Speaking of desire, if the in-memory data can be recorded in either or both of the Out area located behind the AV file Af and the In area located ahead of the AV file Af+1, the preceding extent and the succeeding extent are free. Data in the memory can be recorded without moving to the area.

[0322] In the flowchart of FIG. 65, it is determined in step S87 whether the data size of the Out area is larger than the data size of the in-memory data. If it exceeds, in step S88, the data in the memory is recorded in the Out area as shown in FIG. If it is below the threshold, the process proceeds to step S89, and it is determined whether or not the data size of the In area is larger than the data size of the in-memory data. If it exceeds, in step S90, the data in the memory is recorded in the In area as shown in FIG. If the in-memory data cannot be recorded in only one of the In area and the Out area, the process proceeds from step S89 to step S91, and in step S91, as shown in FIG. It is divided into areas, and each divided area is recorded in each of the In area and Out area.

[0323] After concatenating the preceding extent, in-memory data, and subsequent extent through the above processing, the file entry of the AV file Af containing the preceding extent and the file entry of the AV file Af+1 containing the following extent are integrated and combined. A single file entry is obtained, and the processing ends. (3-2-7-1-4-4) Processing when both the preceding and succeeding extents are equal to or larger than the AV block length In step S69 in FIG. 49, the preceding extent m is equal to or larger than the AV block length and the succeeding extent n is equal to or larger than the AV block length. It is determined whether or not the block length is equal to or larger than the block length and the data size of the in-memory data k is larger than the total length of the In area i and the Out area j.

[0324] FIG. 67 is a flowchart showing the processing when the data size of both the preceding extent and the subsequent extent is equal to or larger than the AV block, and the total size of the In area and the Out area is smaller than the size of the in-memory data. FIG. 68 is an explanatory diagram for supplementarily explaining the processing of the AV file system unit 11 in the flowchart of FIG. In the explanatory diagram (a), an example of recorded contents in which both the subsequent extent and the preceding extent are equal to or longer than the AV block length is shown in the upper stage. Also, (b) to (d) show how in-memory data and extents are recorded in the In area, Out area, and other free areas during the execution of each step in FIG. 67. ..

[0325] In this case, underflow does not occur in the preceding extent and the succeeding extent, but the continuous length of the recording area of the in-memory data must be equal to or longer than the AV block length. In step S92, it is determined whether the total data size of the preceding extent and the in-memory data is 2 AV blocks or more.

[0326] If the total size is equal to or greater than 2 AV block lengths, the process proceeds from step S92 to step S93 to read data of size (AV block length-data size k of in-memory data) from the end of the preceding extent and move it to a free area. At the same time, the in-memory data is recorded at the destination. By this recording, the empty area is filled with in-memory data and extents as shown in FIG. 68(b).

[0327] If the total size of the in-memory data and the preceding extent is less than the 2AV block length, the process proceeds from step S92 to step S94. In step S94, it is determined whether the total data size of the subsequent extent and the in-memory data is 2 AV blocks or more. This determination is performed in the same manner as in step S92, in order to avoid an excessive amount of time for writing the logical block, and if data of a considerable data size is moved from the preceding extent. This is because there is a high possibility that the data size of the remaining extents can be kept longer than 1 AV block length.

[0328] From this point of view, if the total size is 2 AV block lengths or more, the process proceeds to step S95, the size (AV block length-data size k of data in memory) of the subsequent extent is read, and this is preceded. - Move to an empty area existing in the same zone area as the subsequent extent, and record the in-memory data at the destination. By this recording, the empty area is filled with in-memory data and extents as shown in FIG. 68(c).

[0329] If the total size of in-memory data and subsequent extents is less than 2AV block length, and the total size of in-memory data and preceding extents is less than 2AV block length, the total write amount of logical block is 2AV blocks. Therefore, even if the moving process is positively performed, the speed is not affected. Therefore, if the total size of the in-memory data and the subsequent extent is less than the 2AV block length and the total size of the in-memory data and the subsequent extent is less than the 2AV block length, the process proceeds to step S96. The extent or the subsequent extent having the larger data size is determined. If the total size of the in-memory data and the subsequent extent is less than 2AV block length, and the total size of the in-memory data and the subsequent extent is less than 2AV block length, the preceding extent and the subsequent extent are satisfied. Although any of the above may be moved, in the present embodiment, since the amount of movement is more motivated to reduce, the process of determining the one with the smaller data size is performed. If the preceding extent is smaller, the preceding extent is first moved in step S97, and then the in-memory data is written to the movement destination. By this recording, the empty area of 2AV block length is filled with in-memory data and extents as shown in FIG. 68(d).

[0330] If the subsequent extent is smaller, the in-memory data is first written in step S98, and the subsequent extent is moved to the write destination. By this recording, the empty area of 2AV block length is filled with in-memory data and extents, as shown in FIG. 68(e). After concatenating the preceding extent, in-memory data, and subsequent extent through the above processing, the file entry of the AV file Af containing the preceding extent and the file entry of the AV file Af+1 containing the following extent are integrated and combined. A single file entry is obtained, and the processing ends. The "MERGE" processing in various cases has been shown in the flowcharts, but in any case, the data size to be moved can be kept to 2 AV block length or less at worst. However, there is not an exception in which the total amount of data written exceeds 2 AV blocks, and the total amount of data written exceeds 2 AV blocks when the following two exceptions occur.

[0331] The first exception is that when two consecutive empty AV block areas are required, only one AV block that is isolated exists, and in order to create two consecutive empty AV blocks, the data of one AV block is This is the case when moving occurs. The second exception is a case where a new data movement occurs when the portion left after the data is extracted from the subsequent extent is less than the AV block length in step S81 of FIG. In this case, the amount of data moved as a whole exceeds 2 AV blocks.

[0332] It should be noted that although only the connection processing of two AV files and data in memory has been described so far, one AV file and data in memory can be connected when the MERGE command is executed. In this case, since the process is equivalent to adding data to the end extent of the AV file, it is not necessary to satisfy the condition that the extent after concatenation is the AV block length or more. Therefore, as a process, the data in the memory is recorded in the Out area following the last extent, and if all the data in the memory cannot be recorded in the Out area, an empty AV block is allocated and remains there. It is sufficient to record the data in the memory.

[0333] Further, although the description has been given on the premise of seamless reproduction within a file in the concatenation processing, the concatenation processing on the premise of seamlessness between files may be performed. Inter-file seamless playback refers to playback in which video display is not interrupted even when branching from playback of one AV file to playback of another AV file. In the case of seamless playback between files, it is necessary to make the continuous length of all extents equal to or longer than the AV block length when linking the two AV files and the data in memory shown above, and perform a more thorough linking process. There is a need. The long sentence has been described above, but the description of the connection processing by the AV file system unit 11 is finished. (3-2-7-1-5) Update VOB information and PGC information How to update VOB information (time map table, seamless connection information) and PGC information (cell information) during execution of SPLIT command and MERGE command Will be explained.

[0334] First, the update of the above information accompanying the SPLIT command execution processing will be described. Of the plurality of AV files obtained by the SPLIT command execution processing, one AV file is given the same AV_File_ID as the AV file in which the VOB of the extraction source was recorded. New identifiers must be added to the AV_File_IDs of other AV files.

[0335] Since the VOB that was once recorded in the AV file has lost several subsections due to the SPLIT command execution processing, it is necessary to delete the mark that specified this lost subsection. Similarly, the cell information with such marks as the starting point and the ending point must be deleted from the RTRW management file. It is necessary to delete the mark point, specify the video display start frame of the AV file as C_V_S_PTM, and newly generate the cell information that specifies the video display end frame of the AV file as C_V_E_PTM and add it to the RTRW management file.

[0336] The VOB information including the seamless connection information and the time map table is divided into a plurality of pieces according to the division of the VOB. That is, if mx VOBs are obtained by the above division, the time division is divided into mx time map tables and seamless connection information. The video display start time VOB_V_S_PTM and video display end time VOB_V_E_PTM of the VOB generated by the SPLIT command execution process are updated based on C_V_S_PTM and C_V_E_PTM that have specified the start and end points of the cell information, and LAST_SCR in the seamless connection information. , FIRST_SCR is also updated.

[0337] How to update the above information during the MERGE command execution process will be described. Even if it is said that multiple AV files become one AV file by executing the MERGE command, each VOB included in these multiple AV files is composed of frame data that does not have mutual correlation. As a result, time stamp discontinuity occurs between the two AV files. To manage multiple VOBs originally recorded in different AV files as different VOBs, different VOB IDs are assigned to these multiple VOBs.

[0338] Except for these processes, the process is the same as in the second embodiment. On the other hand, the number of frames included in the re-encoded preceding VOB is added to C_V_E_PTM in the cell information specifying the cutout range. C_V_S_PTM in the cell information specifying the cut-out range of the subsequent AV file is deleted by the number of frames included in the re-encoded subsequent VOB.

[0339] (3-2-3) Fragmentation elimination unit 16 The fragmentation elimination unit 16 is connected to the fixed magnetic disk device, and the extents before and after the recording area among the extents already recorded in the DVD-RAM and subjected to the concatenation processing and the like. Data having a free area is read and written to the fixed magnetic disk device to create backup data in the disk device. After writing all the extents to the fixed magnetic disk device, the backup data is read again, and the extents are written so as to fill the empty areas existing before and after the recorded extents. Here, the extent having an empty area before and after the recording area is generated by sequentially executing the "SPLIT" command and the "SHORTEN" command by the AV file system unit 11, and executing the "MERGE" command. It is assumed that it is left unattended because it does not become the recording destination of the in-memory data or the movement destination of other extent at some time.

[0340] FIG. 69 is an explanatory diagram for supplementarily explaining the processing content by the fragmentation eliminating unit 16. In the figure, an extent #x is shown in the figure as an extent having free areas i and j before and after the recording area. The fragmentation eliminating unit 16 detects such an extent as shown in FIG. 69A, reads it to the DVD recorder 70, and writes it to the fixed magnetic disk device.

[0341] By such writing, backup data is created in the disk device as shown in FIG. 69(b). Thereafter, as shown in FIG. 69(c), the backup data is read from the fixed magnetic disk device, and the extents are written so as to fill the empty areas j existing before and after the recorded extents. Since the empty area is filled, the data size of the empty area located behind the extent #x is i+j, and the continuous length can be increased. The size of the empty area can be further expanded by performing such processing on the extent #y subsequent to the empty area.

[0342] The recording by the defragmentation unit 16 is performed after the backup data of the extents already recorded in the DVD-RAM is once created in the fixed magnetic disk device. Therefore, the recording by the DVD recorder 70 is performed in the middle of the writing period in the DVD-RAM. Even if the power is cut off, it is possible to retry writing the extent that was interrupted during the next power-on. As described above, the backup data is created in the disk device and the work of packing the extents is performed. Therefore, even if the power of the DVD recorder 70 is cut off during writing, the extents are not lost.

[0343] As described above, according to the present embodiment, even if the operator arbitrarily edits a plurality of AV files and a plurality of fragmentary AV files having a short continuous length are generated, the DVD recorder 70 does not perform such continuous recording. Since AV files with a length longer than the AV block are generated by concatenating short AV files, fragmentation of the AV files can be eliminated, and the audiovisual data recorded in the AV files can be continuously played back. It can be done.

[0344] Further, in the concatenation process, it is determined whether the total amount of data to be written is equal to or larger than the 2AV block length, and if the total amount of the write data size is equal to or larger than the 2AV block length, the movement amount of the recorded AV file is further reduced. Since the

movement amount is limited, it is guaranteed that the total amount of write data size is less than the 2AV block length, whereby fragmentation can be eliminated in a short time.

[0345] Further, even if the operator arbitrarily edits a plurality of AV files and as a result, it becomes necessary to record the re-encoded data having a short continuous length, the DVD recorder 70 does not record such re-encoded data having a short continuous length. , It is possible to prevent the re-encoded data from being recorded in pieces because the recording position is selected so that it is connected to the audiovisual data to be reproduced before and after that, and the video recorded in the AV file can be prevented. It is possible to continuously reproduce the acoustic data.

[0346] It should be noted that the data movement is not limited to the case where a predetermined amount of continuous data is generated and the two audiovisual data are connected, and the two audiovisual data are too far apart from each other on the disc. The data may be moved. This is because the data created by connecting the audiovisual data physically separated from each other is arranged so that continuous reproduction can be guaranteed when normally reproduced. However, when fast-forwarding of special reproduction is performed, if the data to be reproduced is too far apart, the reproduction becomes jerky.

[0347] In order to make this smooth, when connecting two audiovisual data, one data is continuous data of a size of several times a predetermined fixed amount, and the two audiovisual data are approximately evenly spaced. If there is a free area in the AV block, move the data to that area. This makes it possible to smoothly perform special reproduction while guaranteeing normal reproduction.

[0348] Alternatively, the time code may be extracted from the cell information mark, the information such as the address may be extracted from the time map table, and the table may be managed and displayed on the initial state screen or the like to be used as selection assistance information for the user. Furthermore, reduced images of the respective marks may be created, these may be recorded in separate files, pointer information for these reduced images may be given to the respective marks, and this may be used as auxiliary information when displaying cell information in the initial state or the like. ..

[0349] In addition, in the present embodiment, moving image data and audio data are handled, but the present invention is not limited to this, and sub-data such as subtitles used in DVD-ROM, compressed sub-picture data, and still image data. Image data may be handled. Finally, the procedure of the AV file system described with reference to the flowchart in the third embodiment (FIG. 48(a), FIG. 48(b), FIG. 49 to FIG. 50, FIG. 55, FIG. 60, FIG. 65, FIG. 67).) Or the like may be realized by a machine language program, and this may be recorded in a recording medium for distribution or sale. Such recording media include IC cards, optical disks, floppy disks, etc., but the machine language programs recorded on these are used by being installed in a general-purpose computer. This general-purpose computer sequentially executes the installed machine language program to realize the function of the video data editing apparatus shown in this embodiment.

[0350] (Fourth Embodiment) The fourth embodiment is an embodiment in which hierarchical video editing including temporary editing and main editing is realized by using two types of program chains of user-defined PGC-original PGC. User-defined PGC-A new table is added to the RTRW management file shown in the first embodiment to define the original PGC (4-1) RTRW management file Structure of the RTRW management file in the fourth embodiment Will be described. In the fourth embodiment, the RTRW management file is recorded in the same directory (RTRW directory) as the AV file, and contains the contents shown in FIG. 70(a).

[0351] FIG. 70A is a diagram in which the recorded contents of the RTRW management file in the fourth embodiment are detailed step by step. That is, in the figure, the logical format located on the right side is a detailed version of the logical format located on the left side, and the leader line shown by the broken line indicates that the logical format on the right side is within the logical format on the left side. It clarifies which part of the is detailed.

[0352] Referring to the VOB logical format in this figure in accordance with such notation, the RTRW management file shows that the original PGC information table, the user-defined PGC information table, and the title search pointer, in addition to the VOB information shown in the first embodiment. You can see that they are recorded. (4-1-2) Contents of original PGC information The "original PGC information table" is composed of a plurality of original PGC information.

[0353] The original PGC information is information that specifies each of a plurality of VOBs recorded in an AV file existing in the RTRW directory or a partial section in each VOB according to the arrangement order.

The original PGC information is associated with each VOB recorded in the AV file existing in the RTRW directory, and when the AV file is recorded in the RTRW directory, the original PGC information is the video data at that time. Generated by the editing device and recorded in the RTRW management file.

[0354] The data format of the original PGC information is shown in FIG. 70(b). The original PGC information is composed of a plurality of cell information, and the cell information is a cell ID that is an identifier uniquely assigned to each cell information (CELL#1,#2,#3,#4... *), AV file ID (AVF_ID in the figure), VOB_ID, C_V_S_PTM, and C_V_E_PTM. The AV file ID is a field in which the identifier of the AV file corresponding to the cell information is entered.

[0355] VOB_ID is a field for entering the VOB identifier included in the AV file. When the AV file corresponding to the cell information includes a plurality of VOBs, it has a role of clearly indicating which of the plurality of VOBs the cell information corresponds to. "Cell start time C_V_S_PTM (abbreviated as C_V_S_PTM in the figure)" is information indicating the start point of the partial section specified by the cell information, and is attached to the start time of the video field located at that start point. It has an entry field for entering the created PTS in the PTM description format.

[0356] "Cell end time C_V_E_PTM (abbreviated as C_V_E_PTM in the figure)" is information indicating the end point of the partial section specified by the cell information, and the end time of the video field located at the end point is PTM. It has an entry field for entering in the description format. The time information in the "cell start time C_V_S_PTM" and the "cell end time C_V_E_PTM" means the start point of the encoding operation by the video encoder, the end point of the encoding operation, the mark point inserted by the operator, and the like.

[0357] The "cell end time C_V_E_PTM" of each cell information of the original PGC information matches the "cell start time C_V_S_PTM" of the cell information arranged next in the original PGC information. Since the "cell end time C_V_E_PTM" and "cell start time C_V_S_PTM" of each cell information have such a matching relationship, in the original PGC, some partial sections are not dropped, and all of them are recorded in the VOB. The subsection of is specified. In addition, the original PGC cannot specify subsections in an order in which the order in VOB and the order before and after are interchanged.

[0358] (4-1-3) Contents of user-defined PGC information The "user-defined PGC information table" consists of multiple user-defined PGC information. The data format of the user-defined PGC information is shown in FIG. 70(c). Similar to the original PGC information, the user-defined PGC information is composed of plural pieces of cell information, and the cell information is composed of AV file ID, VOB_ID, C_V_S_PTM, and C_V_E_PTM.

[0359] The user-defined PGC information is composed of a plurality of pieces of cell information like the original PGC information, but what kind of cell information these cells have and how they are arranged differ from the original PGC information. The original PGC information instructs that the sub-intervals of the video object are sequentially played back according to the arrangement order, whereas the user-defined PGC information is in the order that the sub-intervals of the video object are not constrained by the arrangement order. You can instruct to play.

[0360] Here, the partial section specified by the cell in the user-defined PGC is the partial section itself (entire section) specified by the cell information in the original PGC information, or the part specified by the cell information in the original PGC information. It is further inside (partial section) than the section. Moreover, another cell information may be redundantly designated for a partial section designated by one cell information. That is, there may be overlap between cells. Further, the partial section specified by certain cell information and the partial section specified by another cell information may be separated. That is, there may be a gap between cells. In the user-defined PGC information, it is not necessary to specify all the partial sections in the VOB, and some partial sections in the VOB may not be specified.

[0361] In the original PGC, the playback order is significantly limited, whereas in the user-defined PGC, no such limitation is imposed, and the playback order of cells can be freely defined. Specifically, the order may be reverse to the order in VOB. Further, it is possible to specify the VOB subsections recorded in different AV files so as to straddle them. Since the original PGC specifies the sub-sections in one AV file and VOB according to the order in the AV file and VOB, it respects the order of each sub-section in the AV file and VOB that is the specification source. However, the user-defined PGC is not restricted by the order of the sub-sections in the VOB, and the operator wants to view which sub-section in what order, that is, the sub-section is designated

according to the viewing intention of the user. be able to. Therefore, it is understood that the user-defined PGC is suitable for the purpose of storing the order of determination when tentatively determining in what order the plurality of sub-sections included in the VOB should be connected during video editing work.

[0362] The original PGC is associated with the AV file and the VOB in the AV file, and the cells in the original PGC specified only the partial section of the VOB, but the user-defined PGC is associated with the specific VOB. There is no constraint that it is not possible, and the cell information included in the user-defined PGC information may specify different VOB subsections.

[0363] Further, the original PGC is generated at the time of recording the AV file, but the user-defined PGC may be generated at any time after the time when the AV file is recorded. (4-1-4) PGC information-VOB information-AV file integrity The following describes how the AV file, VOB, time map table, and PGC information described above have mutual relationships. FIG. 71 shows the interrelationships among AV files, VOBs, VOB information, original PGC information, and user-defined PGC information, of which the ones that have integrity are arranged in a bold frame (note that FIG. In 71, PGC information is abbreviated as PGC information).

[0364] In FIG. 71, original PGC information #1 including AV file #1 including VOB#1, VOB information #1, cell information #1-cell information #2-cell information #3 is arranged in the same bold frame. The original PGC information #2 consisting of AV file #2 including VOB#2, VOB information #2, cell information #1-cell information #2-cell information #3 is arranged in the same bold line frame. I understand.

[0365] A set of an AV file (VOB)-VOB information-original PGC information surrounded by these bold frames is called an original PGC in the DVD-RAM standard. The video data editing device conforming to the DVD-RAM standard recognizes this unit of original PGC as a management unit of video title. In the example of FIG. 71, one set of AV file #1, VOB information #1 and original PGC information #1 arranged in the same thick line frame is named original PGC#1 and is set in the same thick line frame. A set of AV file #2, VOB information #2, and original PGC information #2 arranged in is named original PGC#2.

[0366] When recording the original PGC, it is necessary to record the encoded VOB on the DVD-RAM, generate VOB information, and also generate the original PGC information for the VOB. It is considered that the recording of the original PGC is completed for the first time by recording the three in the AV file-VOB information table-original PGC information on the DVD-RAM. Conversely, recording the encoded VOB as an AV file on the DVD-RAM does not mean that the recording of the original PGC is completed.

[0367] The same applies when erasing, and the original PGC is erased together. In other words, if any one of the AV file, VOB information, and original PGC information is deleted, the ones that together with the original PGC are deleted at the same time. Then, depending on what unit the original PGC is reproduced, the reproduction of the original PGC is performed by the original PGC information being designated by the operator. Conversely, the operator does not directly specify the AV file and VOB to instruct the reproduction.

[0368] Although the original PGC can be partially reproduced, the partial reproduction of the original PGC is performed by the operator designating the cells included in the original PGC, and For example, VOB is not directly specified and partial playback is not ordered. The unity in the original PGC information is as described above. Next, how the user-defined PGC information is managed as a video title will be described. In FIG. 71, the original PGC is arranged in the same thick line frame as the original PGC information-VOB information table-AV file, whereas cell information #1, cell information #2, cell information #3, cell information It can be seen that the user-defined PGC information #3 in the figure composed of #4 is enclosed by the bold line frame alone. This indicates that in the DVD-RAM standard, user-defined PGC information is managed as a title by itself, not as actual AV data.

[0369] Therefore, it can be said that the generation of the user-defined PGC is completed only by the video data editing device defining the user-defined PGC information in the RTRW management file. That is, in the user-defined PGC, the relationship "production of user-defined PGC equal definition of user-defined PGC information" is established. The same is true at the time of deletion, and if the user-defined PGC information is deleted from the RTRW management file, it is considered that the user-defined PGC constituted by it does not exist.

[0370] The reproduction unit of the user-defined PGC is the same as that of the original PGC. The reproduction of the user-defined PGC is performed by the user specifying the user-defined PGC. The user-defined PGC can

also be partially played. Partial reproduction of the user-defined PGC is performed by the operator designating a cell included in the user-defined PGC.

[0371] Although it is clear that the original PGC-user-defined PGC is different as described above, from the operator's point of view, the original PGC-user-defined PGC is designated as PGC information and cell information, and is reproduced in its entirety. -Since partial playback is performed, it is not necessary to be aware of the difference between the two. Therefore, without discriminating the difference between the original PGC and the user-defined PGC, these are uniformly managed in units of video titles.

[0372] Next, how the original PGC and the user-defined PGC are reproduced will be described. The broken line arrow in FIG. 71 represents the relationship between the data on the referenced side and the data on the referenced side. The arrows y2, y4, y6, y8 clearly indicate the reference relationship between each VOB in the VOB and the time code included in the time map table in the VOB information, and the arrows y1, y3, y5, y7 Specifies the reference relation between each time code included in the time map table in the VOB information and the cell information.

[0373] It is assumed that the operator has designated one of the PGCs to instruct the reproduction of the video title. When the designated PGC is the original PGC#1, the cell information #1 located at the beginning of the original PGC#1 is retrieved by the playback device. Then, by referring to the AV file and VOB identifier included in the extracted cell information #1, the AV file corresponding to the cell information, AV file #1 as VOB, VOB #1, and its The time map table #1 for the VOB is specified.

[0374] The specified time map table #1 describes the size of each VOB that makes up the VOB and the playback time of those VOBs. To further improve the access performance, a representative VOB is set at regular intervals, for example, in units of several tens of seconds. Is selected and has the address and elapsed time from the VOB head, the cell start time included in the cell information #1 is referred by referring to the time map table using the cell start time C_V_S_PTM as shown by arrow y1. Identify which VOB in the AV file C_V_S_PTM corresponds to, and identify its start address. As a result, the start address of the VOB corresponding to the cell start time C_V_S_PTM is determined, so the playback device accesses VOB#1 as indicated by arrow y2, and the VOB#1 to VOB column indicated by this start address Start reading.

[0375] On the other hand, since the cell information #1 includes the cell start time C_V_S_PTM and the cell end time C_V_E_PTM, by referring to the time map table using the cell end time C_V_E_PTM as shown by the arrow y3, the cell information #1 is set. Specify which VOB in the AV file the included cell end time C_V_E_PTM corresponds to. As a result, the start address of the VOB corresponding to the cell end time C_V_E_PTM is found. Assuming that the VOB specified here is VOB#10, as shown by the arrow y4, the reading of the VOB string is terminated when the VOB#10 is reached.

[0376] As described above, if cell information #1-VOB information #1 is accessed to the AV file, the portion specified by cell information #1 in VOB#1 recorded in AV file #1 Only the section can be read. If such partial sections are read for cell information #2, cell information #3, and cell information #4, all VOBs included in VOB #1 are read and reproduced.

[0377] As described above, in the reproduction based on the original PGC information, the partial sections in the VOB can be reproduced in the order of arrangement. On the other hand, it is assumed that the operator has designated one of the user-defined PGCs to instruct the reproduction of the video title. When the designated PGC is the user-defined PGC#1, the playback device extracts the cell information #1 located at the beginning of the user-defined PGC information #1. Then, by referring to the time map table #1 using the cell start time C_V_S_PTM included in the cell information as indicated by the arrow y5, the cell start time C_V_S_PTM included in the cell information #1 is VOB. Identify which VOB in #1 it corresponds to. As a result, it is found that the VOB corresponding to the cell start time C_V_S_PTM is VOB#11. Therefore, the playback device accesses VOB#11 as indicated by arrow y6, and the VOB#11 indicated by this head address is reached. The reading of the VOB string is started from.

[0378] On the other hand, the cell information #1 of the user-defined PGC#1 includes the cell start time C_V_S_PTM and the cell end time C_V_E_PTM, so refer to the time map table using the cell end time C_V_E_PTM as shown by the arrow y7. This identifies which VOB in VOB#1 the cell end time C_V_E_PTM included in the cell information #1 corresponds to. Assuming that the VOB specified here is VOB#21, as shown by arrow y8, the reading of the VOB string is terminated when VOB#21 is reached.

[0379] After the access via the cell information #1-VOB information #1 to the AV file as described above, the same processing is performed on the cell information #2 and the cell information # included in the user-defined PGC information #1. 3. Perform on cell information #4. When the cell information #2 located next to the cell information #1 is taken out by the playback device, the AV file identifier included in the taken out cell information #2 is referenced to correspond to that cell information. The AV file #2 and the time map table #2 corresponding to the AV file are specified.

[0380] The specified time map table describes the size of each VOB that makes up the VOB and the playback time of those VOBs. To further improve access performance, a representative VOB is selected at regular intervals, for example, in units of several tens of seconds. The cell start time C_V_S_PTM included in the cell information #2 can be obtained by referring to the time map table by using the cell start time C_V_S_PTM as shown by arrow y9 because the address and the elapsed time from the VOB head are included. Identify which VOB in the AV file corresponds. As a result, the start address of the VOB corresponding to the cell start time C_V_S_PTM is found, so the video data editing apparatus accesses VOB#2 as indicated by arrow y10, and the VOB#1 to VOB indicated by this start address. Start reading a column.

[0381] On the other hand, since the cell information #2 includes the cell start time C_V_S_PTM and the cell end time C_V_E_PTM, by referring to the time map table using the cell end time C_V_E_PTM as shown by the arrow y11, the cell information #2 Which cell end time C_V_E_PTM included in the VOB corresponds to which VOB in the VOB. As a result, the start address of the VOB corresponding to the cell end time C_V_E_PTM is found. Assuming that the VOB specified here is VOB#11, as shown by the arrow y12, the reading of the VOB sequence is terminated when the VOB#11 is reached.

[0382] In the reproduction by the user-defined PGC information, it is possible to reproduce arbitrary partial sections of VOB recorded in two AV files in a predetermined order. This completes the description of the integrity of the AV file-VOB information-PGC information. Next, the title search pointer shown in FIG. 70(d) will be described. (4-1-5) Contents of the title search pointer The "title search pointer" contains the VOB information, time map table, PGC information, and AV file recorded on this DVD-RAM in the unit of the video title described above. This is information for management, and is configured by associating a PGC number assigned to the original PGC information and the user-defined PGC information with a title type and a title recording history.

[0383] "Title type" is set to 00 bytes to indicate that the video title having each PGC information is the original type. When set to 01 byte, the video title consisting of each PGC information is user-defined. This is information in which a flag indicating the type is associated with each PGC number. The "title recording history" is information indicating the date of recording of the PGC information, the month and the day of the year, and the recording time from the hour, the minute, and the second.

[0384] When the RTRW directory in the DVD-RAM is specified, the DVD-RAM standard compliant video data editing device reads this title search pointer from the RTRW management file and writes the original PGC to each directory of the DVD-RAM. It is possible to immediately recognize how much user-defined PGC is recorded and when these video titles are recorded in the RTRW directory.

[0385] (4-1-6) Compatibility between user-defined and original PGC information in main edit The user-defined PGC information defined in the temporary edit specifies the connection order of cells in the main edit as shown in the fourth embodiment. Can be used for. Further, after the main edit shown in the fourth embodiment is performed, if the user-defined PGC information is updated to the original PGC information, the original PGC information about the VOB obtained by the connection can be easily created. .. This is because the user-defined PGC information and the original PGC information have the same data structure except that the title type value is different, and the VOB partial section obtained after the main editing is the user-defined PGC information before the main editing. It was because it was specified.

[0386] Hereinafter, the procedure of main editing in the fourth embodiment and how the user-defined PGC information is updated to the original PGC information before and after the main editing will be described. FIG. 72 is a diagram showing an example of the user-defined PGC-original PGC. In this figure, the original PGC information #1 includes only the cell #1, and the VOB#1 and VOB information are integrated to form the original PGC. On the other hand, the user-defined PGC information #2 forms the user-defined PGC only with the cell #1, the cell #2, and the cell #3.

[0387] Cell #1 designates a partial section from VOB#1 to VOB#i as indicated by dashed arrows y51 and y52, and cell #2 indicates VOB# as indicated by dashed arrows y53 and y54. The partial section from i+1 to VOB#j is specified. Cell #3 designates a partial section from VOB#j+1 to VOB#k+2, as indicated by dashed arrows y55 and y56. Of these, only cell #2 in the user-defined PGC information is deleted, and the main editing is instructed using the user-defined PGC information after deletion, that is, user-defined PGC information #2 consisting of cell #1-cell #3. It is assumed that FIG. 73 is a diagram in which the parts corresponding to the cells in the deleted range are hatched.

[0388] The cell #2 deleted here designates any one video frame among the plurality of picture data included in VOB#i+1 as C_V_S_PTM, as shown inside the frame w11. Further, as shown inside the frame w12, any one video frame among the plurality of picture data included in VOB#j+1 is designated as C_V_E_PTM. When this editing is performed using this user-defined PGC information #2, VOB#i, VOB#i+1, VOB#i+2 located at the end of cell #1 and the end of cell #2 are located. Re-encoding for VOB#j, VOB#j+1, and VOB#j+2 to be performed is performed according to the procedure described in the first embodiment to the second embodiment, and the extent concatenation processing is This is performed according to the procedure shown in the third embodiment.

[0389] FIG. 74(a) shows which ECC block on the DVD-RAM is released to a free area by the main edit using the user-defined PGC information #2. Referring to the second row of FIG. 74(a), VOB#i, VOB#i+1, VOB#i+2 are recorded on the AV block #m, and VOB#j, VOB#j+1, VOB#j+2 are recorded. It can be seen that #j+2 is recorded in AV block #n. As shown in FIG. 73, in cell #2, the picture data contained in VOB#i+1 is designated as C_V_S_PTM, and the picture data contained in VOB#j+1 is designated as C_V_E_PTM. Therefore, as shown inside the frames w13 and w14, the SPLIT command and the SHORTEN command shown in the third embodiment are from the ECC block occupied by VOB#i+2 to the ECC block occupied by VOB#j. Is released to the free area. On the other hand, the ECC blocks occupied by VOB#i and VOB#i+1 and the ECC blocks occupied by VOB#j+1 and VOB#j+2 are not released to the free area.

[0390] FIG. 74B shows an example of VOB, VOB information, and PGC information after the main editing. Since the part corresponding to cell #2 has been deleted, VOB#1 is divided into (new) VOB#1-VOB#2. When the SPLIT command is issued, the VOB information about VOB#1 is divided into VOB information #1 and VOB information #2. The time map table included in these VOB information is also divided into time map table #1 and time map table #2. Although not shown, the seamless connection information is similarly divided.

[0391] VOBs in VOB#1-VOB#2 are respectively referred to via the divided time map table. The user-defined PGC information and the original PGC information have the same data structure except that the title type values are different, and the VOB partial section obtained after this editing is the user-defined PGC information #2 before this editing. Since it was specified, the user-defined PGC information #2 has been updated to the original PGC information. Since the original PGC information is defined using the user-defined PGC information #2 that specified the partial section before the main editing, there is no need to define the original PGC information again after the main editing. (4-2) Functional Block Diagram of DVD Recorder 70 FIG. 75 is a functional block diagram showing the configuration of the DVD recorder 70 in the fourth embodiment. Each function in the figure is realized by the CPU 1a in the control unit 1 executing the program of the ROM 1e to control the hardware shown in FIG.

[0392] In FIG. 75, the DVD player includes a disc recording unit 100, a disc reading unit 101, a common file system unit 10, an AV file system unit 11, and a recording/editing/playback control unit 12. In common with the video data editing device shown in the third embodiment, the AV data recording unit 13 edits the title recording control unit 22, the AV data reproducing unit 14 edits the title reproduction control unit 23, and the AV data editing unit 15 edits. It is different from the third embodiment in that it is replaced by the hierarchization control unit 26. Further, a PGC information table work area 21, an RTRW management file work area 24, and a user-defined PGC information generator 25 are newly provided in place of the fragmentation eliminating unit 16 shown in the third embodiment.

[0393] (4-2-1) Recording/Editing/Playback Control Unit 12 The recording/editing/playback control unit 12 in the fourth embodiment receives from the operator the designation of the directory to be operated in the directory structure on the DVD-RAM. When the designation of the operation target is accepted, the operation content by the operator is specified based on the user operation notified from the remote control signal receiving unit 8 and the operation content process is performed for the directory specified as the operation target. The unit 22 and the title reproduction control unit 23 are instructed to perform the operations.

[0394] FIG. 77A is a diagram showing an example of graphics data displayed on the television receiver 72 under the control of the recording/editing/playback control unit 12. When any one of the directories is set to the focus state, the recording/editing/playback control unit 12 waits for the confirmation key on the remote controller 71 to be pressed. The recording/editing/playback control unit 12 specifies the directory in the focus state at the time when the enter key is pressed as the current directory.

[0395] (4-2-2) PGC information table work area 24 The PGC information table work area 24 is a memory area in which a logical format is defined so that PGC information is sequentially defined. The internal area of the PGC information table work area 24 is managed in a matrix. In the PGC information table work area 24, a plurality of PGC information are arranged in the row direction, and a plurality of cell information are arranged in the column direction. Arbitrary cell information in the PGC information stored in the PGC information table work area 24 is accessed using a set of a row number and a column number.

[0396] FIG. 76 is an example of the original PGC information stored in the PGCI table work area 24. The user-defined PGC information table is empty (null) when the AV file is recorded. Of the PGC information in this figure, the original PGC information #1 includes cell information #1 with time T0-time T1 as the start point-end point of the partial section, and time T1-time T2 as the start point-end of the partial section. Cell information #2 that is a point, cell information #3 that uses time T2-time T3 as the start point-end point of the partial section, and cell information #4 that has time T3-time T4 as the start point-end point of the partial section. You can see that it contains.

[0397] (4-2-3) Title Recording Control Unit 22 The title recording control unit 22 records the VOB on the DVD-RAM like the AV data recording unit 13 in the third embodiment. 24, a time map table and VOB information are generated, original PGC information is generated and stored in the PGCI table work area 24.

[0398] Generation of the original PGC information is realized by the title recording control unit 22 through the following procedure. First, when the recording/editing/playback control unit 12 notifies that the recording key has been pressed, the title recording control unit 22 secures a line area in the PGC information table work area 14. Next, when the AV file recording control unit 13 assigns an AV file identifier and a VOB identifier to a VOB to be newly generated, the title recording control unit 22 acquires them and associates them with the newly assigned PGC number. And store it in the newly secured row area.

[0399] Then, at the start of VOB encoding, the MPEG encoder 2 is instructed to output the PTS of the first video frame, and when the encoder control unit 2g outputs the PTS of the first video frame, this is held and the operator Waiting for marking operation by. FIG. 80(a) is a diagram showing how data input/output between the components shown in FIG. 75 is performed when a marking operation is performed. It is assumed that the operator presses the mark key while watching the video displayed on the television receiver 72. Then, the marking operation is notified to the title recording control unit 22 through, in Fig. 80(a), and the title recording control unit 22 uses the PTS at the time of pressing as shown in Fig. 80(a) as the time information. It is acquired from the control unit 2g.

[0400] The above process is repeated while VOB encoding is being performed, but if an operation to stop recording is performed during generation, the playback end time for the last encoded video frame will be output. When the encoder control unit 2g outputs a reproduction end time for the last video frame to the encoder control unit 2g, the encoder control unit 2g holds the reproduction end time.

[0401] When the above processing is repeated until the VOB encoding is completed, the title recording control unit 22 determines that the AV file identifier, the VOB identifier, the reproduction start time of the first video frame, and the video frame at the time when the marking operation is performed. The reproduction start time and the reproduction end time of the last video frame are held. Of the time information held in this way, an AV file identifier and a VOB identifier are attached to one set of the start point-end point of the partial section and newly secured in the PGC information table work area 14 as one cell information. Stored in the specified row area. Thereby, the original PGC information is newly generated.

[0402] After the above generation is completed, the type information indicating that this PGC information is the original PGC information and the record indicating the recording date and time after the recording of the original PGC information are associated with the PGC number assigned to this original PGC information. A title search pointer indicating history information is generated on the PGC information table work area 21. When the title reproduction control unit 23 can detect a time point when the content of the scene changes significantly, the

user-defined PGC information generator 25 automatically acquires the PTS at the time point when the scene change is made, so that the cell information is automatically acquired. You may set it.

[0403] Further, the creation of the time map table and the VOB information is not the main purpose of this embodiment, so the description thereof will be omitted. (4-2-4) Title Playback Control Unit 23 The title playback control unit 23 plays the entire playback of any one of the video titles recorded in the current directory designated by the recording/editing/playback control unit 12. , Or partial playback is performed.

[0404] Specifically, as shown in FIG. 77(a), the title reproduction control unit 23 allows the operator to reproduce the video title recorded in the directory when any directory is selected as the current directory. 77 is displayed, the screen shown in FIG. 77(b) is displayed and the original PGC information table or the user-defined PGC information table in the RTRW management file in that directory is read and the original PGC or the entire user-defined PGC in the current directory is read. The operator is made to specify whether to perform reproduction or partial reproduction. 77B is a diagram showing PGCs and cells displayed as a list of operation targets, and PGC information and cell information appearing here are the same as those shown in the example of FIG. 76. In this dialogue screen, the original PGC is displayed as a simple graph with the horizontal axis as the time axis, and is displayed with the recording date and time of the original PGC. The menu at the bottom right of the figure shows whether the video title in the current directory is to be fully or partially played back. The operator can press the 1 key or 2 key on the remote controller 71. Either of these can be selected. If the whole reproduction is instructed, the title reproduction control unit 23 allows the operator to designate any PGC as the operation target, and if the partial reproduction is instructed, the title reproduction control unit 23 selects any cell as the operation target. And let the operator specify.

[0405] When the PGC and the cell to be wholly reproduced are designated, the title reproduction control unit 23 takes out the cell included in the PGC designated as the operation target and refers to the time map table as shown in FIG. By doing so, the partial section is reproduced. When the reproduction of the partial section is completed, the interactive screen of FIG. 77(b) is displayed and the selection of the next cell information is waited for.

[0406] FIG. 78(a) is a flow chart showing the processing contents when the cell information is partially reproduced. First, in step S271, C_V_S_PTM and C_V_E_PTM are read from the original PGC information and the cell information to be reproduced in the user-defined PGC information. Succeedingly, in a step S272, the address of the VOB(START) including the picture data to which C_V_S_PTM is added is specified. In step S273, the address of VOB(END) including the picture data with C_V_E_PTM is specified, and in step S274, the range from VOB(START) to VOB(END) is read from VOB. In step S276, the MPEG decoder 4 is instructed to decode the VOB in the read range. In step S277, the title reproduction control unit 23 issues a decoding processing request to the decoder control unit 4k in the MPEG decoder 4 together with cell reproduction start time information (C_V_S_PTM) and cell reproduction end time information (C_V_E_PTM) as valid reproduction section information. Is output.

[0407] The reason why the effective reproduction section is output to the MPEG decoder 4 in this way is that the decoder control unit 4k in the MPEG decoder 4 attempts to decode even picture data outside the partial section designated by the cell. That is, the unit in which the MPEG decoder 4 can perform the decoding process is the VOB unit, in which the entire range from VOB(START) to VOB(END) is decoded and the picture data outside the partial section specified by the cell is decoded. Even it will be replayed. Since a cell is specified in video field units, picture data outside the partial section must be prohibited by some method. The title reproduction control section 23 outputs the valid section information to the MPEG decoder 4 in order to prohibit reproduction outside the section. In FIG. 78(b), in the range from VOB(START) to VOB(END), only the section from cell playback start time information (C_V_S_PTM) to cell playback end time information (C_V_E_PTM) is output. FIG.

[0408] Due to the output of the valid playback section, the MPEG decoder 4 stops the display output of the multiple video fields from the beginning of the VOB to C_V_S_PTM among all the VOBs instructed to be decoded, and then the multiple video fields from C_V_E_PTM to the end of the VOB. Stop display output. As a result, the VOB sequence read from the disk access unit 3 via the logical connection line (1) in the hardware configuration diagram shown in FIG. 17 is the target of the decoding process by the MPEG decoder 4. In the decoding result, reproduction output is prohibited in the section before C_V_S_PTM and the section after C_V_E_PTM. As a result, only the partial section designated by the cell information is reproduced.

[0409] As for the original PGC information or the user-defined PGC information, since a plurality of cell information is included in one PGC information, the procedure of FIG. 78(a) is applied to all the cell information included in one PGC information. Just repeat. (4-2-5) RTRW management file work area 24 The RTRW management file work area 24 includes an original PGC information table composed of a plurality of original PGC information generated on the PGC information table work area 24, and a plurality of user-defined PGC information. This is a work area for arranging a user-defined PGC information table consisting of, a title search pointer, and VOB information in accordance with the logical format shown in FIG. 70. Writing to the RTRW directory as a non-AV file means that the RTRW management file was recorded in the RTRW directory.

[0410] (4-2-6) User-defined PGC information generator 25 The user-defined PGC information generator 25 generates user-defined PGC information based on any one of the PGC information recorded in the RTRW management file in the current directory. .. In the cell information in the user-defined PGC information (user-defined cell information), one that further specifies the inside of the partial section specified by the cell information of the existing PGC information (1), specified by the existing cell information The user-defined PGC information generator 25 generates these pieces of cell information by different methods.

[0411] The generation of the user-defined cell information (1) that further specifies the inside of the partial section specified by the existing cell information is performed by the title reproduction control unit 23 with partial reproduction using the cell information. That is, during the period of partial reproduction using the existing cell information, the user-defined PGC information generator 25 monitors when the marking operation is performed by the operator, and the marking operation time point is the start point and the end point. The generation of the cell information as points is repeated, and the user-defined PGC information including such cell information is generated.

[0412] 79(a) and 79(b) are diagrams showing how the operator uses the television receiver 72 and the remote controller 71 when generating the user-defined PGC information. FIG. 80B is a diagram showing how data input/output between the components shown in FIG. 75 is performed when a marking operation is performed. It is assumed that, while watching the video displayed on the television receiver 72 as shown in FIG. 79(a), the video becomes a scene that the user likes and the operator depresses the mark key. After that, as shown in FIG. 79(b), it is assumed that the scene in which the image is liked by the user ends and the scene not so interested starts. Therefore, it is assumed that the operator has pressed the mark key.

[0413] Then, the marking operation is notified to the user-defined PGC information generator 25 through, in FIG. 80(b), and the user-defined PGC information generator 25 displays the PTS at the time of pressing as shown in (b) of FIG. From the decoder controller 4k. The user-defined PGC information generator 25 attaches the AV file identifier and the VOB identifier to one set of the start point-end point of the partial section among the PTSs held in this way, and indicates it as one cell information. The PGC information table is stored in the work area 24 newly secured in the row area.

[0414] When generating the user-defined cell information that specifies the partial section itself specified in the existing cell information, the user-defined PGC information generator 25 uses the cell information already stored in the row area in the PGC information table work area 24. Copy to another line area. Specifically, the user-defined PGC information generator 25 secures a row area for one row in the PGC information table work area 24, and allocates a new user-defined PGC information identifier to this row area. Of the cell information in the PGC information already stored in the PGC information table work area 24, if the cell information to be used as one element of the user-defined PGC information is designated using a set of row number and column number. , The cell information specified by this set is read and copied to the newly secured row area.

[0415] (4-2-7) Editing Hierarchical Control Unit 26 The editing hierarchical control unit 26 displays the temporary editing work realized by the definition of the user-defined PGC information and what kind of video is obtained when the main editing is performed according to the temporary editing result. A preview work for allowing the operator to view in advance whether or not it will be obtained, the seamless connection shown in the first and second embodiments, and the main editing realized by the connection processing between the AV files shown in the third embodiment. The title reproduction control unit 23 and the user-defined PGC information generator 25 are controlled so that the work is performed hierarchically.

[0416] (4-2-7-1) Hierarchical Editing Processing Procedure by Editing Hierarchical Control Unit 26 Hereinafter, a specific processing procedure of hierarchical control by the editing hierarchical control unit 26 will be described. When temporary editing is instructed by pressing the interactive screen remote controller 71 of FIG. 77(a), the editing hierarchy control unit 26 accesses the RTRW directory, and the editing hierarchy control unit

26 causes the common file system unit 10 to access the RTRW directory. It is instructed to read the RTRW management file from the RTRW directory and store it in the RTRW management file work area 24. After that, the original PGC information table, the user-defined PGC information table, and the title search pointer in the RTRW management file read out to the RTRW management file work area 24 are transferred to the PGC information table work area 24.

[0417] Based on the transferred original PGC information table, the edit layering control unit 26 displays the dialog screen shown in FIG. 85 and waits for an instruction from the operator. FIG. 85 is an example of an interactive screen displayed on the television receiver 72 to accept an operation of selecting a cell that is a constituent element of the user-defined PGC in the temporary editing. In this dialogue screen, the original PGC and the user-defined PGC are represented as a simple graph with the horizontal axis as the time axis, and displayed with the recording date and time of the original PGC and the user-defined PGC. Further, in the interactive screen, a plurality of cell information is represented as a rectangle arranged in the horizontal direction, and the operator is made to perform an operation of selecting one of the rectangles arranged in the horizontal direction by using the cursor key. .. These original PGCs and cells are the same as those shown in FIG. 76, and the state where the original PGC information table, the user-defined PGC information table, and the title search pointer are updated will be described below with FIG. 76 as the initial state. ..

[0418] FIG. 81 is a flowchart showing the processing contents of the edit layering control unit 26 when defining a user-defined PGC. In this flowchart, the variable j is a variable for instructing each of a plurality of original PGCs arranged in the vertical direction on the interactive screen, and the variable k is a variable of multiple cells arranged in the horizontal direction on the interactive screen. It is a variable for indicating each.

[0419] The variable m is the PGC number to be added to the user-defined PGC information to be defined in the RTRW management file, and the variable n is the cell number to be added to the cell information to be defined in the RTRW management file. Is. In step S201, the value obtained by adding 1 to the last number of the original PGC information in the RTRW management file is substituted into the variable m and 1 is substituted into the variable n. In step S202, a column for the m-th user-defined PGC information is added to the user-defined PGC information table, and in step S203, a key operation waiting state is entered. When a key operation is performed, in step S204, among the flags assigned to each key, the one corresponding to the pressed key is set to "1". In step S205, it is determined whether the flag indicating that the ENTER key has been pressed, Enter_Flag, is 1, and in step S206, it is determined whether the flag indicating that the end key has been pressed, End_Flag, is 1. When all of these flags are "0", in step S207, the following values are set using Right_Flag, Left_Flag, Down_Flag, and Upper_Flag which are flags indicating that the up key, the left key, the right key, and the down key are pressed. The calculation shown in the formula is performed, and the calculation results are substituted into variables k and j, respectively.

[0420] $k \leftarrow k + 1 * (\text{Right_Flag}) - 1 * (\text{Left_Flag})$ $j \leftarrow j + 1 * (\text{Down_Flag}) - 1 * (\text{Upper_Flag})$ If the right key is pressed and Right_Flag becomes "1", the variable k is incremented. It When the upper key is pressed and Upper_Flag becomes "1", the variable j is decremented. When the left key is pressed and Left_Flag becomes "1", the variable k is decremented. When the Down key is pressed and Down_Flag becomes "1", the variable j is incremented. After the variables j and k have been updated in this way, the cell graphic at row j and column k is displayed in focus in step S208, and all the flags assigned to the remote controller 71 are cleared to zero in step S209. After the transition, the key operation waits again. By repeating the above steps S203 to S209, the cell graphics corresponding to the front, rear, left, and right cells are brought into the focus state according to the depression of the key on the remote controller 71.

[0421] If the ENTER key is pressed while any cell is set to the focus state while the above processing is repeated, the process proceeds to step S251 in FIG. In step S251 of FIG. 82, the operator is instructed whether to use the cell information of the j-th row and the k-th column as it is, or to use the inner portion of the partial section specified by the cell information, and make the operator designate any one of them. When the cell information is used as it is, the cell graphic of j row and k column is copied to m row and n column in step S252, and Original_PGC#j.CELL#k is defined as User_Defined_PGC#m.CELL#n in step S253. After the definition, the variable n is incremented in step S254, and then the process proceeds to step S209 in FIG.

[0422] When the inside of the partial section specified by the cell information of the j-th row and the k-th column is used further, the process proceeds to step S255 to cause the title reproduction control unit 23 to start the partial reproduction based on the cell information of the j-th row and the k-th column. In step S255, it is determined whether or not the cell information of the j-th row and the k-th column has already been reproduced. Such a determination is made when the partial section specified by the cell information is reproduced halfway, it

is not wasteful to reproduce the same partial section from the beginning. In this case, This is because it is desirable for the operator to start the partial reproduction of the j-th row and k-th column cell information from the time when the reproduction is interrupted (this time is referred to as the reproduction interruption time t) (step S266).

[0423] On the other hand, if the cell information of the j-th row and the k-th column is not reproduced, the partial reproduction is started from the beginning of the cell information of the j-th row and the k-th column in step S265, and then the process proceeds to step S256 to loop from step S256 to step S257. It becomes a state. Step S256 is a step of waiting for the end of reproduction by the cell, and step S257 is a step of waiting for the pressing of the marking key. When step S257 becomes Yes, the time information at the time of pressing at step S258 is acquired, and then the process proceeds to step S259.

[0424] In step S259, it is determined whether or not the acquired time information is two, and if not, the process returns to step S256 without generating the cell information, and if there is, the two time information acquired in step S260 is set as the start point, Set as the end point. The one time information acquired here is the time when the image displayed on the television receiver 72 is the scene that the user likes, and the other time information is the time when the scene that the user likes is finished. And Such time information is considered to be a partial section that should be particularly selected as video editing material inside the original PGC provided by the original PGC information. In order to generate user-defined PGC information for designating these partial sections, cell information is generated in the PGC information table work area 24, and the process proceeds to step S261.

[0425] In step S261, the user-defined PGC information generator 25 acquires VOB_ID and AV file ID in Original_PGC#j.CELL#k. User_Defined_PGC#m.CELL#n is generated using the start point-end point time information, VOB_ID, and AV file ID acquired in step S262. In step S263, the end point time information is held as the reproduction interruption time point t, then the variable n is incremented in step S254, and the process proceeds to step S209.

[0426] Through the above processing, new user-defined cell information is generated from the j-th row and k-th column cell information. After that, when the next different cell information is set to the focus and the user-defined cell information is generated using this as the generation source, the cell information configuring the user-defined PGC information is defined one by one. In the loop state of steps S256 to S257 of FIG. 82, when the reproduction by the j-th row and k-th column cell information is completed without operating the mark key, the process proceeds to step S254.

[0427] If it is determined that the END key is pressed, step S206 in FIG. 80(b) becomes Yes and the process moves to step S213. In step S213, whether to define the next UserDefined_PGC is presented in a menu display. If the operator has the intention to define and gives an affirmative instruction, the variable m is incremented in step S214, the variable n is initialized, and the process proceeds to steps S209 and S203.

[0428] (4-2-7-2) Specific Example of User-Defined PGC Information Definition The operation when defining the user-defined PGC information from a plurality of original PGC information shown in the dialog screen shown in FIG. 85 will be described below. FIG. 86 is a diagram showing a relationship between a manual operation on the remote controller 71 and a display process performed in accordance with the manual operation. The drawings from FIG. 87 to FIG. 90 are also drawn for the same purpose, and the operation will be described below with reference to these drawings.

[0429] After the cell #1 existing in the first row and the first column is set in the focus state as shown in FIG. 85 and the ENTER key is pressed by the operator as shown in FIG. 86(b), step S205 becomes Yes. , To the flow chart of FIG. In steps S251 to S266 of this flowchart, the first cell information CELL#1A of UserDefined_PGC#1 is generated based on Original_PGC#1.CELL#1 as shown in FIG. 86(a). After the generation, the variable n is incremented in step S254, the variable n is set to 2, and the process proceeds to step S203 via step S209. Here, when the down key is pressed once as shown in FIG. 87(b) and the right key is pressed twice as shown in FIGS. 87(c) and 87(d), the keys are assigned to each key in step S204. The flag corresponding to the pressed key is set to "1".

[0430] By pressing the down key for the first time, $k=1(=1+1*0-1*0)$ $j=2(=1+1*1-1*0)$, and by pressing the right key for the first time, $k=2(=1+1*1-1*0)$ $j=2(=2+1*0-1*0)$ By pressing the right key a second time, $k=3(=2+1*1-1*0)$ $j=2(=2+1*0-1*0)$, and the cell #7 located in the second row and third column becomes the focus state as shown in FIG. 87(a).

[0431] 2If the operator presses the ENTER key as shown in FIG. 88(b) after the cell in the third row and the row is set in the focus state, the step S205 becomes Yes, and the flow chart in FIG. And the second cell information CELL#7A of UserDefined_PGC#1 is generated based on Original_PGC#2.CELL#7 located in the second row and third column in the original PGC information table (FIG. 88(a)). reference).

[0432] After the second cell information is generated, the above processing is repeated. As shown in FIG. 89(b), when the operator presses the ENTER key, the third cell information CELL#11A and the fourth cell information CELL#3A of UserDefined_PGC#1 are generated. After that, it is assumed that the operator depresses the stop key at the time of shifting to step S203. Then, End_Flag, which indicates that the stop key is pressed, becomes "1", and the process proceeds to step S213. By pressing the stop key as described above, the edit layering control unit 26 considers that the definition of the user-defined PGC information #1 is completed. In step S213, the operator is asked whether to define the user-defined PGC information #2 following the user-defined PGC information #1. If the operator has the intention, the variable m is incremented in step S214, and the variable After n is initialized to 1, the process proceeds to step S209.

[0433] By repeating such processing, as shown in FIG. 91, the user-defined PGC information #2 including CELL#2B, CELL#4B, CELL#10B and CELL#5B is defined, and CELL#3C and CELL#6C are defined. It is assumed that the user-defined PGC information #3 including CELL#8C and CELL#9C is defined. FIG. 91 is a diagram showing the contents of the user-defined PGC information table, the original PGC information table, and the title search pointer at the end of temporary editing.

[0434] When the end key is pressed in this state, the dialog screen shown in FIG. 90 is displayed in step S215 shown in FIG. 81, the user waits for selection of user-defined PGC information by pressing the up key or down key, and the preview is pressed by pressing the play key. Waiting for the specification of, the specification for pressing the main editing key, and the recording of the user-defined PGC information table. When the operation to record the user-defined PGC is performed, the user-defined PGC information table containing the new user-defined PGC information generated in the PGC information table work area 24 is transferred to the RTRW management file work area 24. Then, the RTRW management file read in the RTRW management file work area 24 is written in a portion corresponding to the user-defined PGC information table. At the same time, the title search pointer for the newly generated user-defined PGC information is transferred to the RTRW management file work area 24 and added to the title search pointer already existing in the RTRW management file. After writing the user-defined PGC information table and additionally writing the title search pointer, a file system command is issued so that the RTRW management file stored in the RTRW management file work area 24 can be written in the RTRW directory.

[0435] FIG. 83 is a flow chart showing the processing contents at the time of preview and at the time of main editing. The operation for previewing the VOB connection work will be described below with reference to this flowchart. 92 and 93 are diagrams showing the relationship between the manual operation on the remote controller 71 and the display processing performed in accordance with the manual operation.

[0436] In step S220 of the flowchart in FIG. 83, the head number in the user-defined PGC information table is assigned to variable j, and in step S221 a key operation wait state is entered. When the key operation is performed, in step S222, the flag corresponding to the pressed key among the flags assigned to each key is set to "1". In step S223, it is determined whether the flag indicating that the play key has been pressed, Play_Flag, is 1, and in step S224, whether the flag indicating that the main edit key has been pressed, main edit_Flag, is 1 or not. To judge. When all of these flags are "0", in step S225, the calculation shown in the following formula is performed using Down_Flag and Upper_Flag, which are flag groups indicating that the up and down keys are pressed, and the calculation result is set as a variable. Substitute in j respectively.

[0437] $j \leftarrow j+1*(Down_Flag)-1*(Upper_Flag)$ When the upper key is pressed and Upper_Flag becomes "1", the variable j is decremented. When the Down key is pressed and Down_Flag becomes "1", the variable j is incremented. After the variable j is updated in this way, the graphic corresponding to the PGC information located on the j-th line is displayed in focus in step S226, and all the flags assigned to the remote controller 71 are cleared to zero in step S227, and then step The process shifts to S221, and the key operation is waited again. By repeating the above steps S221 to S227, the figure corresponding to the preceding and following user-defined PGC information is brought into the focus state according to the pressing of the key on the remote controller 71.

[0438] While the above process is being repeated, if the play key is pressed while any user-defined PGC information is set to the focus state, Play_Flag becomes 1, step S223 becomes Yes, and the process proceeds to step S228. To do. In step S228, the title reproduction control unit 23 is instructed to reproduce the VOB according to the PGC designated by the operator among the user-defined PGCs. If the PGC specified by the operator is a user-defined PGC, the cells included in the user-defined PGC are those selected from any of the plurality of sub-intervals in at least one VOB in any order. Such reproduction does not satisfy the conditions required for the seamless reproduction shown in the first and second embodiments, so that video display and audio output are interrupted between cells. However, it can be said that the purpose of previewing the connection of multiple scenes has been achieved for the time being.

[0439] (4-2-7-3) Processing procedure at the time of preview of layered editing and at the time of main editing
The operation at the time of connecting VOBs in the main editing will be described below. FIG. 94 is a diagram showing a relationship between a manual operation on the remote controller 71 and a display process performed in accordance with the manual operation. When the operator presses the up key as shown in FIG. 94(b), cell #1A becomes the focus, and the interactive screen shown in FIG. 94(a) is displayed on the television receiver 72. In this state, when the main edit key is pressed as shown in FIG. 94(c), the main edit_Flag becomes "1", and the step S224 in FIG. 83 becomes Yes and the step shown in FIG. The processing from step S8 to step S16 in the flowchart of FIG.

[0440] After performing the processing of the third embodiment, the process proceeds to step S237 in FIG. After setting the variable n to 1 in step S237, in step S238 it is searched for Original_PGC#j.CELL#k that was the generation source of UserDefined_PGC#m.CELL#n, and in step S239 it is determined whether Original_PGC#j exists. judge. If it exists, Original_PGC#j is deleted in step S240, and UserDefined_PGC#q that originally generated Original_PGC#j is searched in step S241. In step S242, it is determined whether there is at least one UserDefined_PGC#q, and in step S243 all UserDefined_PGC#q are deleted. In step S244, it is determined whether or not the variable n is the last number of the cell information, and if not, the process proceeds to step S245, and in step S245, the variable n is updated to the next cell information in the PGC information #m. The process moves to S238. The loop processing including the above steps S238 to S245 is repeated until the variable n becomes the last number of the cell information in the PGC information #q.

[0441] It is understood that the partial sections specified by the user-defined PGC information #1 are all VOB#1, VOB#2, and VOB#3, and these are the targets of this editing. The original PGC information, which is the generation source of the cell information included in the user-defined PGC information #1, is deleted because the designated VOB is the target of the main editing. The user-defined PGC information that generated the original PGC information is also deleted because the designated VOB is the target of this editing.

[0442] When step S244 becomes Yes and the process proceeds to step S246, the PGC number #e, which is the smallest number among the free PGC numbers obtained by deleting the original PGC information, is acquired. After the acquisition, the cell information is updated with the AV file ID and VOB_ID given to the AV file after MERGE in step S247, and then the PGC number of UserDefined_PGC#q is updated with PGC number #e in step S248, and the title is updated. The type information in the search pointer is updated to the original type.

[0443] FIG. 95 is a diagram showing an example of the PGC information table and the title search pointer after the original PGC information-user defined PGC information has been deleted in accordance with this editing. Since VOB#1, VOB#2, and VOB#3 whose subsections were specified by user-defined PGC information #1 were subject to this editing, the original PGC information #1 and original PGC that specified these subsections Information #2, original PGC information #3, user-defined PGC information #2, and user-defined PGC information #3 have already been deleted, but former user-defined PGC information #1 is defined as original PGC information #1. I understand.

[0444] When the PGC information is updated in the PGC information table work area 24 as described above, the updated original PGC information is transferred to the RTRW management file work area 24 and read to the RTRW management file work area 24. Overwrite the RTRW management file. At the same time, the title search pointer for the newly generated original PGC information is transferred to the RTRW management file work area 24 to overwrite the title search pointer already existing in the RTRW management file.

[0445] When the user-defined PGC information table-title search pointer is overwritten, a file system command is issued so that the RTRW management file stored in the RTRW management file work area 24 can be written in the RTRW directory. As described above, according to the present embodiment, among the partial sections in

the AV data, an appropriate editing material is designated by using the user-defined cell information, and by arranging them freely, the playback order is provisionally determined. can do.

[0446] If you want to decide the playback order of the edited work, you can easily edit the video in a short period because you do not have to prototype the VOB once. Since it is not necessary to temporarily record the prototype on the recording medium, the capacity of the recording medium need not be so large. Since the scene connection can be provisionally determined only by defining the user-defined PGC information, it is possible to create many variations of the reproduction order in a short period. Since the user-defined cell information specifies a partial section in the VOB by using the time information, the VOB can maintain the state at the time of recording.

[0447] By creating a plurality of user-defined PGC information having different playback orders and previewing them, it is possible to perform a narrowing down work from a plurality of candidates. As a result of the narrowing down, particularly satisfactory playback is selected as the target of this editing, and the VOB is processed according to the user-defined PGC information narrowed down from a plurality of candidates. Even if the original VOB disappears from the optical disc due to a bold video editing that directly rewrites it, it will not be regretted.

[0448] After the main editing is done, the title type of the user-defined PGC information targeted for the main editing is set in the title search pointer to the original PGC information, so that a new video editing can be started based on this. .. With only one optical disk and one video data editing device, it is possible to realize advanced video editing by narrowing down the better ones from multiple candidates, so until then we thought of video editing as a flower of Takamine. The video enthusiasts, who used to be ordinary households, can now actually take on the challenge of video editing, and can stimulate the creativity of many people.

[0449] As for the ratio between VOB and original PGC information, it is desirable to provide one original PGC information for each VOB. Further, the time information may be extracted from the cell information mark, the information such as the address may be extracted from the time map table, and may be displayed on the initial state screen or the like by being managed in the table to serve as selection assistance information for the user.

[0450] Furthermore, reduced images of the respective marks may be created, these may be recorded in separate files, pointer information for these reduced images may be given to the respective marks, and this may be used as auxiliary information when displaying cell information in the initial state or the like. .. Finally, the procedure of the title reproduction control section 23 (FIG. 78), the procedure of the editing hierarchy control section 26 (FIGS. 81 to 84), etc. described with reference to the flowchart in the fourth embodiment are realized by a machine language program. Alternatively, this may be recorded in a recording medium to be distributed or sold. Such recording media include IC cards, optical disks, floppy disks, etc., but the machine language programs recorded on these are used by being installed in a general-purpose computer. This general-purpose computer sequentially executes the installed machine language program to realize the function of the video data editing apparatus shown in this embodiment.

[0451] As described above, according to the present invention, it is possible to specify that the chain information of the original type on the optical disk reproduces the sub-sections in the order faithful to the arrangement order of the video objects, and the user-defined. The type chain information can specify a playback order provisionally determined in the video editing work for a plurality of partial sections included in the video object.

[0452] The chain information of the original type is the final playback order that should be determined when the video data editing device processes the video object of the data area according to the chain information of the user-defined type or overwrites the video object of the data area. Can be specified. Since the chain information is used for these purposes in video editing work, the operator can tentatively decide the playback order according to the image imagined in the head by defining the user-defined type chain information. By the reproduction based on the information, it is possible to confirm what kind of reproduced video is displayed in the temporarily decided order.

[0453] By defining the user-defined type chain information, the work of temporarily determining the playback order can be easily performed in a short period of time. Moreover, since the data size of the user-defined type chain information is small, the video object recorded in the data area is not accidentally overwritten. Even if the video object recorded in the data area is a valuable video recording a commemorative event such as a child's entrance ceremony, athletic meet, family trip, graduation ceremony, etc., these videos will not be overwritten. It is possible to tentatively determine the reproduction order for the recording medium on which the video of FIG.

[0454] By defining multiple pieces of user-defined type chain information and selecting the one that was particularly satisfyingly reproduced as the processing target for the main editing, the video object already recorded on the optical disc can be directly rewritten. Even if such a bold video editing is done and the original video object disappears from the optical disc, this will not be regretted.

[0455] Here, one or more of the user-defined type chain information is designated as the main editing target, and the file recorded in the data area is designated as any of the user-defined type chain information as the main editing target. At this time, the boundaries of all the partial sections designated by the user-defined type chain information are processed so as to be the start position-end position of the video object.

[0456] Also, when any of the user-defined type chains is designated as the main editing target, the original type chain information and other user-defined type chain information recorded in the index area are deleted and designated as the main editing target. User-defined type chain information is converted to original type chain information. Each of the original type chain information and the user-defined type chain information is a cell information string composed of a plurality of cell information, and the index area is further set to identification information of each cell information string and a first value. Indicates that the cell information string indicated by the identification information is the original type chain information, and the cell information string indicated by the identification information by setting the second value is the user-defined type chain information. And a search pointer area in which a flag group including a flag indicating that is recorded is recorded, and the flag set to the second value in the flag group has the user-defined type chain information corresponding to the flag as a target for main editing. When specified, the second value is updated to the first value.

[0457] Upon receiving the reproduction instruction of the cell information, a set of reproduction start time information and reproduction end time information and mapping information are read from the index area, and the mapping information is searched using the reproduction start time information and the reproduction end time information. By doing so, the access position identification for identifying the recording position of the leading video object unit including the picture data indicated by the reproduction start time information and the recording position of the end video object unit including the picture data indicated by the reproduction end time information. Means and reading means for reading the video object unit sequence recorded between the specified recording positions are provided, and the read video object unit sequence is decoded, and the boundary portion of the partial section corresponding to the cell information is detected. If the start position-end position of the video object unit does not match, of the decoding results, the first video field to the last field indicated by the cell information is output, and the output of other decoding results is prohibited. According to the video data editing apparatus including the decoding means for performing the cell information, since the cell information specifies the partial section to be used as the edit target with the time accuracy of the video field, the partial section to be used as the edit target with high time accuracy is specified. be able to.

JP2000152180A OPTICAL DISK, VIDEO DATA EDITOR, RECORDING MEDIUM RECORDING EDIT PROGRAM AND READ BY COMPUTER, REPRODUCING DEVICE FOR OPTICAL DISK, RECODING MEDIUM RECORDING REPRODUCTION PROGRAM AND READ BY COMPUTER

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The wording below is an initial machine translation of the original publication. To generate a version using the latest translation technology, go to the original language text and use Patent Translate.

1. The original type chain information is provided with a data area in which a file including one or more video objects is recorded, an original type chain information, and an index area in which one or more user-defined type chain information is recorded. , The file is managed as an array of a plurality of sub-sections, and each of the user-defined type chain information specifies a plurality of sub-sections in the file in a reproduction order that is not restricted by the arrangement order in the file. The partial section managed by the information is a section whose boundary is a combination of two of the start position, the end position of the video object, and the predetermined position inside the video object, and the reproduction order is specified by the user-defined type chain information. Each partial section is a section specified by a combination of internal positions of the video object as a boundary portion, and the combination of internal positions is a combination of a predetermined position inside the video object and another position inside the video object, the object An optical disk, which is either a combination of different internal positions or a combination of the predetermined positions.
2. When one of the one or more user-defined type chain information is designated as the main editing target and the file recorded in the data area is designated as any of the user-defined type chain information as the main editing target, The optical disc according to claim 1, wherein the boundary portions of all the partial sections designated by the user-defined type chain information are processed so as to be a start position-end position of the video object.
3. When any user-defined type chain is specified as the main editing target, the original type chain information and other user-defined type chain information recorded in the index area are deleted, and the user-defined type specified as the main editing target The optical disc according to claim 2, wherein the type chain information is converted into original type chain information.
4. Each of the original type chain information and the user-defined type chain information is a cell information string composed of a plurality of cell information, and the index area is further set to identification information of each cell information string and a first value. Indicates that the cell information string indicated by the identification information is the original type chain information, and the cell information string indicated by the identification information by setting the second value is the user-defined type chain information. A flag group including a flag indicating that is recorded, and a flag set to a second value in the flag group is specified by the user-defined type chain information corresponding to the flag as the main edit target. 4. The optical disc according to claim 3, wherein when the writing is performed, the second value is updated to the first value.
5. The video object has a plurality of video object units arranged therein, and the video object unit has therein a plurality of picture data to be displayed in a plurality of video frames included in a predetermined time zone. The cell information includes a set of time information indicating display start and display end of video data in a partial section of the video object, and identification information for identifying which video object the partial section is included in. The mapping information for specifying the recording position of the video object unit including the picture data to be displayed at the time information is recorded on the optical disc from each time information. Optical disc.
6. A video data editing device using an optical disc as an editing medium, wherein the optical disc has a data area in which a file including one or more video objects is recorded, original type chain information, and one or more user-defined type chain information. And an index area in which is recorded, the original type chain information manages the file as an array of a plurality of partial sections, each user-defined type chain information, a plurality of partial sections in the file, It is specified by the playback order that is not restricted by the arrangement order in the file, and the partial section managed by the original type chain information is the boundary of the combination of two of the beginning position, the ending position of the video object and the predetermined position inside the video object. Each partial section whose section is a section and whose reproduction order is specified by the user-defined type chain information is a section which is specified by a combination of internal positions of video objects as a boundary section, and the combination of internal

positions is the video. It is any one of a combination of a predetermined position inside the object and another position inside the video object, a combination of other positions inside the object, and a combination of the predetermined positions. When the accepting means accepts an operation and the accepting means accepts an operation for which one of the user-defined type chain information recorded on the optical disc is subject to this editing, the part specified by the user-defined type chain information The processing means for processing the file so that the start-end position of the section is the boundary part of the video object, and the user-defined type chain information already written in the index area when the file is processed is changed to the original type chain information. A video data editing device, comprising:

7. When any one of the user-defined type chain information is designated as the main editing target, the updating means deletes the original type chain information and other user-defined type chain information recorded in the index area, and the main editing target 7. The video data editing apparatus according to claim 6, wherein the user-defined type chain information designated as is converted into original type chain information.

8. Each of the original type chain information and the user-defined type chain information is a cell information string composed of a plurality of cell information, and the index area is further set to identification information of each cell information string and a first value. Indicates that the cell information string indicated by the identification information is the original type chain information, and the cell information string indicated by the identification information by setting the second value is the user-defined type chain information. A flag group including a flag indicating that the search pointer area has been recorded, and the updating means sets the flag to a second value when the user-defined type chain information corresponding to the flag is designated as the main editing target. 8. The video data editing device according to claim 7, wherein the video data editing device updates the video data to the first value.

9. When the accepting means accepts an operation for subjecting one of the user-defined type chain information recorded on the optical disc to the main editing, the processing means includes a predetermined number of videos including the start position-end position of the partial section. The object unit is read by the reading means, the read video object unit becomes the start position-end position of the video object, and these two video objects are re-encoded so as to be seamlessly reproduced, and then re-encoded. 9. The video data editing apparatus according to claim 8, wherein the data area is overwritten by using a predetermined number of video object units.

10. The video object has a plurality of video object units arranged therein, and the video object unit has therein a plurality of picture data to be displayed in a plurality of video frames included in a predetermined time zone, Each cell information includes a set of time information indicating a display start and a display end of video data in a partial section of a video object, and identification information for identifying which video object the partial section is included in. When the video data editing device receives the reproduction instruction of the user-defined type chain information, the reception means receives the reproduction instruction for each user-defined type chain information, and the video data editing device includes the reproduction instruction for the user-defined type chain information. The reproduction start time information and the reproduction end time information in the cell information and the mapping information are read from the index area, and the reproduction start time information and the reproduction end time information are used to search the mapping information to reproduce the reproduction information. Access position specifying means for specifying the recording position of the leading video object unit including the picture data indicated by the start time information and the recording position of the ending video object unit including the picture data indicated by the reproduction end time information; The video object unit sequence recorded between the recorded recording positions is read, the read video object unit sequence is decoded, and the boundary portion of the partial section corresponding to the cell information is the start position-end of the video object unit. If the position does not match, a decoding means for outputting the first video field to the last field indicated by the cell information in the decoding result and for inhibiting the output of other decoding results is provided. 7. The video data editing apparatus according to claim 6, wherein the video data editing apparatus is a video data editing apparatus.

11. In an optical disc, a data area in which at least one or more video objects each having a plurality of video object units including a plurality of picture data to be reproduced in a predetermined time zone are recorded and a partial section of the video object Cell information including a set of reproduction start time information indicating a display video field of picture data to be reproduced first and reproduction end time information indicating a display video field of picture data to be reproduced last in the partial section. And an index area in which mapping information for specifying a recording position of the video object unit from each time information is recorded.

12. An optical disc reproducing apparatus, wherein the optical disc has a data area in which at least one video object including a plurality of video object units including a plurality of picture data to be reproduced in a predetermined time zone is recorded. , A set of reproduction start time information indicating a display video field of picture data to be reproduced first in a partial section of a video object and reproduction end time information indicating a display video field of picture data to be reproduced last. It has a cell information including, and an index area in which mapping information for specifying the recording position of the video object unit from each time information is recorded, and the reproducing device is a reception unit that receives an operation from an operator. When a reproduction instruction of cell information is received, a set of reproduction start time information and reproduction end time information and mapping information are read out from the index area, and the reproduction start time information and the reproduction end time information are used to search the mapping information. By doing so, the access position that specifies the recording position of the leading video object unit including the picture data indicated by the reproduction start time information and the recording position of the end video object unit including the picture data indicated by the reproduction end time information. The video object unit string recorded between the specifying means and the specified recording position is read, the read video object unit string is decoded, and the boundary of the partial section corresponding to the cell information is a video object unit. If the start position-the end position of No. 1 does not match, the decoding means for outputting the first video field to the last field of the decoding result and prohibiting the output of other decoding results A playback device comprising:

13. A computer-readable recording medium for recording a video data editing program using an optical disc as an editing medium, wherein the optical disc has a data area in which a file including one or more video objects is recorded and an original type chain information. And an index area in which one or more pieces of user-defined type chain information are recorded. The original type chain information manages the file as an array of a plurality of partial sections, The information specifies a plurality of subsections in the file in a playback order that is not restricted by the arrangement order in the file. The subsections managed by the original type chain information are the start position, end position of the video object, and the inside of the video object. Each of the sub-sections is a section whose boundary is a combination of two of the predetermined positions and whose playback order is specified by the user-defined type chain information is a section which is specified by the combination of the internal positions of the video objects as the boundary. Yes, the combination of internal positions is any one of a combination of a predetermined position inside the video object and another position inside the video object, a combination of different positions inside the object, and a combination of the predetermined positions, When the editing program receives an operation for accepting an operation from an operator and an operation for accepting one of the user-defined type chain information recorded on the optical disc for the main editing, the user-defined type chain The processing step of processing the file so that the start-end position of the partial section specified by the information becomes the boundary part of the video object, and the user-defined file which is already written in the index area when the file is processed. And a step of updating the type chain information to the original type chain information.

14. A computer-readable recording medium for recording a reproduction program of an optical disc, wherein the optical disc has at least one video object including a plurality of video object units including a plurality of picture data to be reproduced in a predetermined time period. The data area recorded above, the reproduction start time information indicating the display video field of the picture data to be reproduced first in the partial section of the video object, and the reproduction indicating the display video field of the picture data to be reproduced last. The reproduction program has an index area in which cell information including a set of end time information and mapping information for specifying a recording position of the video object unit from each time information is recorded. When receiving a reproduction instruction of the cell information and a reception step of receiving an operation from, the set of the reproduction start time information and the reproduction end time information and the mapping information are read from the index area, and the reproduction start time information and the reproduction end time are read. By searching the mapping information using the information, the recording position of the leading video object unit including the picture data indicated by the reproduction start time information and the end video object unit including the picture data indicated by the reproduction end time information An access position specifying step of specifying a recording position and a video object unit string recorded between the specified recording positions is read, the read video object unit string is decoded, and a portion corresponding to the cell information is read. If the section boundary does not match the start position-end position of the video object unit, the first video field to the last field indicated by the cell information in the decoding result is output, and other decoding is performed. And a decoding step for inhibiting output of the result.

15. A data area in which a plurality of video segments are recorded, an original type chain information, and an index area in which user-defined type chain information is recorded, the original type chain information

defining the original type chain The original type chain defines a first video segment sequence by describing a playback order, and the user-defined type chain information defines a user-defined type chain. Defines a second video segment sequence by describing a reproduction order, the first video segment sequence is arranged in the data area in the reproduction sequence of the first video segment, and the second video segment sequence is An optical disc characterized by being arranged in the data area in an order independent of the reproduction order of the second video segment.