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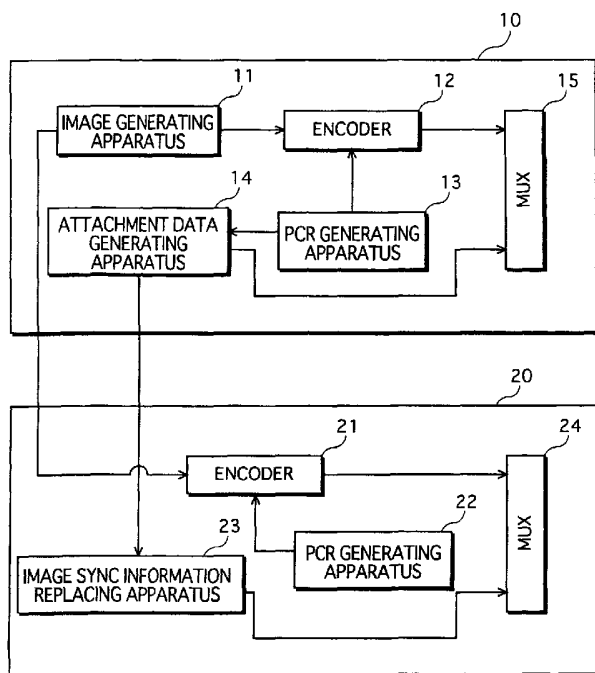
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(54) Title: BROADCAST SYSTEM AND APPARATUS, SYNC INFORMATION REPLACING APPARATUS AND METHOD, PROGRAM, AND RECORDING MEDIUM RECORDING THE PROGRAM



(57) Abstract: A broadcast system composed of a first broadcast apparatus and a second broadcast apparatus. The first broadcast apparatus broadcasts a broadcast program composed of contents stream data and attachment data, and provides the second broadcast apparatus with the broadcast program. The attachment data contains information that indicates timing with which the attachment data is to be reproduced in synchronization with the contents stream data. The image sync information contains PCRs generated by the PCR generating apparatus of the first broadcast apparatus based on the standard time for the first broadcast apparatus. The image sync information replacing apparatus of the second broadcast apparatus replaces the PCRs with other PCRs which are newly generated based on the standard time for the second broadcast apparatus so that it can correctly reproduce the attachment data in synchronization with the encoded contents stream data.



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DESCRIPTION

BROADCAST SYSTEM AND APPARATUS, SYNC INFORMATION

REPLACING APPARATUS AND METHOD, PROGRAM, AND

5 RECORDING MEDIUM RECORDING THE PROGRAM

Technical Field

The present invention relates to a broadcast system including two broadcast apparatuses: a first broadcast apparatus that broadcasts a program composed of contents data and attachment data by digital broadcasting; and a second broadcast apparatus that is supplied with the broadcast program and broadcasts the program by digital broadcasting.

15 Background Art

In recent years, many countries have pursued changes from analog to digital in the terrestrial television broadcasting. Digital broadcasts have such merits as (1) frequency resources can be effectively used, and (2) high-quality images can be provided. In digital broadcasts, it is also possible to use attachment data in the broadcast programs, where the attachment data can be reproduced in synchronization with the images or voices and is written in a language such as BML (Broadcasting Markup Language).

25 Now, a brief description will be provided to explain the procedure of digital-broadcasting a program composed of image data and attachment data conforming to MPEG2-TS (Moving Picture Experts Group 2-Transport Stream) defined in the ISO/IEC13818. First, an encoder encodes (compresses) image data, which is a

image file in a baseband form, a DV format or the like containing images captured with a digital video recorder or the like, to an MPEG2 format defined in the ISO/IEC13818. With this encoding, the image data is packetized into a plurality of image PESs
5 (Packetized Elementary Streams) which are each 64-byte or smaller.

A plurality of image PESs make up one access unit. A DTS (Decoding Time Stamp) is attached to each image PES to be reproduced first in each access unit. The DTS contains a value
10 called PCR (Program Clock Reference), which is one of PCRs sequentially generated by a PCR generating apparatus of a broadcasting station and is used to manage the time when the encoded image data is decoded.

The PCRs are values "0" to " $2^{33}-1$ " that are generated by
15 counting based on a standard clock frequency of 90KHz. The PCRs are used for the DTS as described above, and are used in generating the image sync information that indicates the timing with which the attachment data is to be reproduced in synchronization with the image data.

20 The image PESs are further packetized by the encoder into a plurality of TS packets with a fixed length of 188Kbyte. The TS packets of the image data and the attachment data are multiplexed by a multiplexing apparatus, digitally modulated by a modulator, and are broadcast.

25 Meanwhile, in the terrestrial television broadcasting, a broadcast program supply system has been established. In the broadcast program supply system, a key station, or a main broadcasting station supplies local broadcasting stations with broadcast programs. The key station broadcasts a program

produced by itself, and at the same time supplies the local broadcasting stations with the broadcast program. The local broadcasting stations broadcast the supplied broadcast program as has been incorporated in their broadcasting schedules.

5 However, as the experience in conversion from analog to digital increases, a problem in such a broadcast program supply system in digital broadcasting has been found.

 That is to say, when the local broadcasting stations broadcast a broadcast program received from the key station as
10 they are in digital broadcasting, receivers that receive and reproduce the broadcast program cannot synchronize reproduction of the attachment data with that of the image data.

 The cause of the above problem is considered as follows. The digital broadcast programs transferred from the key station to the local stations are composed of image data and attachment
15 data that should be reproduced in synchronization. The attachment data contains image sync information, which contains PCRs generated by a PCR generating apparatus of the key station. On the other hand, the transferred image data is encoded by the
20 local stations and DTSSs containing PCRs generated by the PCR generating apparatuses of the local stations are attached to the image PESs. In general, a different standard time is set by each PCR generating apparatus in each broadcasting station, where the counting of the PCRs starts based on the standard time.
25 As a result, the key station and the local stations generate different PCRs which are also contained in DTSSs and attached to image PESs. In these circumstances, the local stations fail to reproduce attachment data in synchronization with image PESs encoded by the local stations since they use the image sync

information transferred from the key station as it is.

Disclosure of the Invention

It is an object of the present invention to provide a
5 broadcast system in which when a local station broadcasts a
program composed of image data and attachment data supplied from
a key station, a receiver for receiving and reproducing the
program controls to reproduce the attachment data in
synchronization with the image data, and various techniques
10 related to the broadcast system.

The above object can be achieved by a broadcast system
comprising a first broadcast apparatus and a second broadcast
apparatus, the first broadcast apparatus broadcasting a
broadcast program including contents stream data and attachment
15 data and providing the second broadcast apparatus with the
broadcast program, the attachment data containing information
that indicates timing with which the attachment data is to be
reproduced in synchronization with the contents stream data,
the first broadcast apparatus including: a first time value
20 generating means for sequentially generating first time values
that indicate current times relative to a first standard time;
a first time value attaching means for sequentially attaching
the generated first time values to a first encoded contents stream
data generated by the first broadcast apparatus by encoding the
25 contents stream data; a first sync information generating means
for generating first sync information to be contained in the
attachment data, the first sync information indicating, relative
to one of the first time values, timing with which the attachment
data is to be reproduced in synchronization with the first encoded

contents stream data having the first time values attached thereto; and a first broadcast means for digitally broadcasting the attachment data and the first encoded contents stream data with the first time values attached thereto, the second broadcast apparatus including: a second time value generating means for sequentially generating second time values that indicate current times relative to a second standard time; a second time value attaching means for sequentially attaching the generated second time values to a second encoded contents stream data generated by the second broadcast apparatus by encoding the contents stream data provided from the first broadcast apparatus; a second sync information generating means for generating second sync information indicating timing which corresponds to the timing indicated by the first sync information and with which the attachment data is to be reproduced in synchronization with the second encoded contents stream data having the second time values; and a second broadcast means for digitally broadcasting (a) the attachment data containing the second sync information instead of the first sync information and (b) the second encoded contents stream data with the second time values attached thereto.

With the above construction, when the first broadcast apparatus is provided in a key station, and the second broadcast apparatus in a local station, a receiver can correctly reproduce a program broadcast by the local station by reproducing the attachment data in synchronization with the image data since the local station attaches the second time values to the encoded contents stream data and replaces the sync information before broadcasting the program.

In the above broadcast system, each piece of first sync information may further contain one of the first time values, the second broadcast apparatus further including a difference value storing means for storing in advance a difference value
5 between the first standard time and the second standard time, and the second sync information generating means generates the second sync information based on the difference value and each first time value contained in the first sync information in the attachment data provided from the first broadcast apparatus.

10 With the above construction, when the first broadcast apparatus is provided in a key station, and the second broadcast apparatus in a local station, a receiver can correctly reproduce a program broadcast by the local station by reproducing the attachment data in synchronization with the image data since
15 the local station stores in advance a difference value between the standard times of the key and local stations, generates the second sync information based on the difference value, and replaces the first sync information with the second sync information, before broadcasting the program.

20 In the above broadcast system, the attachment data may be formed as a stream, and the first time value attaching means further sequentially attaches the generated first time values to the attachment data stream, the second broadcast apparatus further including: a first time value detecting means for sequentially
25 detecting the first time values from the attachment data stream provided from the first broadcast apparatus; and a difference value storing means for, for each of the detected first time values, calculating a difference between a detected first time value and a second time value that is generated by the second

sync information generating means when the first time value is detected, and storing the calculation result as a difference value, and the second sync information generating means generates the second sync information based on the difference values and the first time values attached to the attachment data stream provided from the first broadcast apparatus.

With the above construction, when the first broadcast apparatus is provided in a key station, and the second broadcast apparatus in a local station, a receiver can correctly reproduce a program broadcast by the local station by reproducing the attachment data in synchronization with the image data since the local station calculates, for each detected first time value, a difference between a detected first time value and a second time value that is generated by the second sync information generating means when the first time value is detected, and generates the second sync information based on the difference values.

In the above broadcast system, each piece of first sync information may further contain one of the first time values, the first broadcast apparatus further includes a first time value transferring means for transferring the first time values generated by the first time value generating means to the second broadcast apparatus via a route different from a route for the attachment data, and the second broadcast apparatus further includes a difference value storing means for, for each of the first time values transferred by the first time value transferring means, calculating a difference between a first time value and a second time value that is generated by the second sync information generating means when the first time value is

received, and storing the calculation result as a difference value, the second sync information generating means generates the second sync information based on each difference value and each first time value contained in the first sync information
5 in the attachment data provided from the first broadcast apparatus.

With the above construction, when the first broadcast apparatus is provided in a key station, and the second broadcast apparatus in a local station, a receiver can correctly reproduce
10 a program broadcast by the local station by reproducing the attachment data in synchronization with the image data since the local station calculates, for each first time value transferred from the first time value transferring means of the key station, a difference between a first time value and a second
15 time value that is generated by the second sync information generating means when the first time value is received, and generates the second sync information based on the difference values.

In the above broadcast system, the first sync information may
20 contain program start information that indicates a program start time based on the first standard time, the broadcast system further comprises a program start trigger sending means for sending a program start trigger so that the second broadcast apparatus receives, a predetermined time period earlier than
25 a scheduled program start time, a program start trigger indicating that a broadcast program starts a predetermined time period later, and the second broadcast apparatus further includes a program start time value storing means for obtaining a second time value that is generated by the second time value generating

means when the second broadcast apparatus receives the program start trigger, calculating the scheduled program start time from the obtained second time value, and storing the calculation result as a program start time value, the second sync information
5 generating means generates the second sync information based on the program start time value if the first sync information containing the program start information is detected from the attachment data provided from the first broadcast apparatus, and the second broadcast means for digitally broadcasting (a)
10 the attachment data containing the second sync information instead of the first sync information containing the program start information and (b) the second encoded contents stream data with the second time values attached thereto.

With the above construction, when the first broadcast
15 apparatus is provided in a key station, and the second broadcast apparatus in a local station, a receiver can correctly reproduce a program broadcast by the local station by reproducing the attachment data in synchronization with the image data since the local station receives a program start trigger indicating
20 the start of a broadcast program.

In the above broadcast system, the contents stream data and the attachment data may be transferred from the first broadcast apparatus to the second broadcast apparatus via different lines, the first sync information contains one of the first time values
25 generated by the first time value attaching means, the first broadcast apparatus further includes a first time value transferring means for transferring the first time values generated by the first time value generating means to the second broadcast apparatus, and the second broadcast apparatus further

includes a transfer delay value storing means for storing in advance a transfer delay value that indicates a time period, recognized as a transfer delay, required for transferring the contents stream data from the first broadcast apparatus to the second broadcast apparatus, and the second sync information generating means generates the second sync information based on the transfer delay value and the first time value contained in the first sync information in the attachment data provided from the first broadcast apparatus.

10 With the above construction, a receiver can correctly reproduce a program broadcast by the local station by reproducing the attachment data in synchronization with the image data since the local station generates the second sync information based on the transfer delay of the contents stream data, and replaces
15 the first sync information with the second sync information.

 In the above broadcast system, the contents stream data and the attachment data are transferred from the first broadcast apparatus to the second broadcast apparatus via different lines, the first sync information contains one of the first time values
20 generated by the first time value attaching means, the first broadcast apparatus further includes a first time value transferring means for transferring the first time values generated by the first time value generating means to the second broadcast apparatus, and the second broadcast apparatus further
25 includes: a first transfer delay value storing means for storing in advance a transfer delay value that indicates a time period, recognized as a first transfer delay, required for transferring the first time value from the first broadcast apparatus to the second broadcast apparatus; and a second transfer delay value

storing means for storing in advance a transfer delay value that indicates a time period, recognized as a second transfer delay, required for transferring the contents stream data from the first broadcast apparatus to the second broadcast apparatus, and
5 the second sync information generating means generates the second sync information based on the first and second transfer delay values and the first time value contained in the first sync information in the attachment data provided from the first broadcast apparatus.

10 With the above construction, a receiver can correctly reproduce a program broadcast by the local station by reproducing the attachment data in synchronization with the image data since the local station generates the second sync information based on the transfer delay of the contents stream data and the transfer
15 delay of the first time value, and replaces the first sync information with the second sync information.

In the above broadcast system, the first sync information may contain (i) one of the first time values generated by the first time value generating means, (ii) a relative time value to the
20 first time value, and (iii) a value indicating an increasing rate of the relative time value to the first time value, and both the first and second time values are repeatedly counted and generated in sequence in a range from a value "0" to an upper limit value, returning to 0 from the upper limit value, the first
25 broadcast apparatus further includes a first time value transferring means for transferring the first time values to the second broadcast apparatus; the second broadcast apparatus further includes: a time values comparing means for comparing the first time value received from the first broadcast apparatus

with a second time value generated by the second time value generating means when the first time value is detected; and a time period calculating means for, when the time values comparing means recognizes as a result of the comparison that the second
5 time value is larger than the first time value, calculating a time period between the second time value and the upper limit value; a timer means for measuring time during the time period calculated by the time period calculating means; a third sync information generating means for, when the timer means measures
10 time and reaches the upper limit value, generating third sync information indicating timing which corresponds to the timing indicated by the first sync information and with which the attachment data is to be reproduced in synchronization with the second encoded contents stream data having the second time values,
15 and the second broadcast means digitally broadcasts (a) the attachment data additionally containing the third sync information and (b) the second encoded contents stream data with the second time values attached thereto.

With the above construction, a receiver can correctly
20 reproduce a program broadcast by the local station by reproducing the attachment data in synchronization with the image data since the local station generates new sync information when a return-to-zero occurs, and additionally inserts the new sync information into the attachment data.

25 In the above broadcast system, each of the first and second broadcast apparatuses may have an encoder for encoding the contents stream data, the first sync information contains one of the first time values generated by the first time value attaching means, the first broadcast apparatus further includes:

a first encode-delay value storing means for storing in advance a first encode-delay value that indicates a time period, recognized as a first encode-delay, required by the encoder of the first broadcast apparatus for encoding the contents stream data; and a third sync information generating means for generating third sync information based on a result of adding the first time value contained in the first sync information to the first encode-delay value, and the first broadcast means digitally broadcasts (a) the attachment data containing the third sync information and (b) the first encoded contents stream data with the first time values attached thereto, the second broadcast apparatus further includes: a second encode-delay value storing means for storing in advance a second encode-delay value that indicates a time period, recognized as a second encode-delay, required by the encoder of the second broadcast apparatus for encoding the contents stream data; and a difference value storing means for storing in advance a difference value between the first standard time and the second standard time, and the second sync information generating means generates the second sync information based on the difference value, the second encode-delay value, and the first time value contained in the first sync information in the attachment data provided from the first broadcast apparatus.

With the above construction, a receiver can correctly reproduce a program broadcast by the key or local station by reproducing the attachment data in synchronization with the image data since each broadcast station generates sync information taking into an encoding delay for contents stream data into account, and replaces old sync information with the new one.

The above object is also achieved by a broadcast apparatus for digitally broadcasting a broadcast program that is provided from an external apparatus and includes encoded contents stream data and attachment data, the attachment data containing information
5 that indicates timing with which the attachment data is to be reproduced in synchronization with the contents stream data, the broadcast apparatus comprising: a detecting means for detecting first sync information from the provided attachment data, the first sync information indicating, relative to one
10 of first time values, timing with which the attachment data is to be reproduced in synchronization with a first encoded contents stream data having the first time values, the first time values indicating current times relative to a first standard time and having been sequentially attached to the first encoded contents
15 stream data by the external apparatus; a time value generating means for sequentially generating second time values that indicate current times relative to a second standard time; a time value attaching means for sequentially attaching the generated second time values to a second encoded contents stream
20 data generated by the broadcast apparatus by encoding the contents stream data; a sync information generating means for generating second sync information indicating timing which corresponds to the timing indicated by the first sync information and with which the attachment data is to be reproduced in
25 synchronization with the second encoded contents stream data having the second time values; and a broadcast means for digitally broadcasting (a) the attachment data containing the second sync information instead of the first sync information and (b) the second encoded contents stream data with the second time values

attached thereto.

With the above construction, when the external apparatus is provided in a key station, and the broadcast apparatus in a local station, and when the local station broadcasts a program
5 composed of image data and attachment data supplied from the key station in digital broadcasting, a receiver can correctly reproduce the program broadcast by the local station by reproducing the attachment data in synchronization with the image data.

10 The above object is also achieved by a sync information replacing apparatus, comprising: a receiving means for receiving attachment data that contains first sync information indicating timing with which the attachment data is to be reproduced in synchronization with a first encoded contents stream data having
15 first time values, the first time values indicating current times relative to a first standard time and having been sequentially attached to the first encoded contents stream data by an external apparatus; a detecting means for detecting the first sync information from the received attachment data; a sync information
20 generating means for generating second sync information indicating timing which corresponds to the timing indicated by the first sync information and with which the attachment data is to be reproduced in synchronization with a second encoded contents stream data having second time values; and an outputting
25 means for outputting the attachment data containing the second sync information instead of the first sync information.

With the above construction, when the sync information replacing apparatus is provided in a local station, and when the local station broadcasts a program composed of image data

and attachment data supplied from the key station in digital broadcasting, a receiver can correctly reproduce the program broadcast by the local station by reproducing the attachment data in synchronization with the image data.

- 5 The above object is also achieved by a sync information replacing method, comprising: a receiving step for receiving attachment data that contains first sync information indicating timing with which the attachment data is to be reproduced in synchronization with a first encoded contents stream data having
- 10 first time values, the first time values indicating current times relative to a first standard time and having been sequentially attached to the first encoded contents stream data by an external apparatus; a detecting step for detecting the first sync information from the received attachment data; a sync information
- 15 generating step for generating second sync information indicating timing which corresponds to the timing indicated by the first sync information and with which the attachment data is to be reproduced in synchronization with a second encoded contents stream data having second time values; and
- 20 an outputting step for outputting the attachment data containing the second sync information instead of the first sync information.

With the above construction, when the sync information replacing method is achieved in a local station, and when the

25 local station broadcasts a program composed of image data and attachment data supplied from the key station in digital broadcasting, a receiver can correctly reproduce the program broadcast by the local station by reproducing the attachment data in synchronization with the image data.

The above object is also achieved by a program for causing a computer to execute a sync information replacing process, the sync information replacing process including: a receiving step for receiving attachment data that contains first sync
5 information indicating timing with which the attachment data is to be reproduced in synchronization with a first encoded contents stream data having first time values, the first time values indicating current times relative to a first standard time and having been sequentially attached to the first encoded
10 contents stream data by an external apparatus; an extracting step for extracting the first sync information from the received attachment data; a sync information generating step for generating second sync information indicating timing which corresponds to the timing indicated by the first sync information
15 and with which the attachment data is to be reproduced in synchronization with a second encoded contents stream data having second time values; and an outputting step for outputting the attachment data containing the second sync information instead of the first sync information.

20 With the above construction, when the program causes a computer provided in a local station to execute the sync information replacing method, and when the local station broadcasts a program composed of image data and attachment data supplied from the key station in digital broadcasting, a receiver
25 can correctly reproduce the program broadcast by the local station by reproducing the attachment data in synchronization with the image data.

The above object is also achieved by a recording medium in which a program for causing a computer to execute a sync information

replacing process is recorded, the sync information replacing process including: a receiving step for receiving attachment data that contains first sync information indicating timing with which the attachment data is to be reproduced in synchronization
5 with a first encoded contents stream data having first time values, the first time values indicating current times relative to a first standard time and having been sequentially attached to the first encoded contents stream data by an external apparatus; an extracting step for extracting the first sync information
10 from the received attachment data; a sync information generating step for generating second sync information indicating timing which corresponds to the timing indicated by the first sync information and with which the attachment data is to be reproduced in synchronization with a second encoded contents stream data
15 having second time values; and an outputting step for outputting the attachment data containing the second sync information instead of the first sync information.

With the above construction, when the program recorded in the recording medium causes a computer provided in a local
20 station to execute the sync information replacing method, and when the local station broadcasts a program composed of image data and attachment data supplied from the key station in digital broadcasting, a receiver can correctly reproduce the program broadcast by the local station by reproducing the attachment
25 data in synchronization with the image data.

Brief Description Of The Drawings

Fig. 1 shows the construction of the broadcast system in Embodiment 1.

Fig. 2 is a block diagram showing the construction of the image sync information replacing apparatus in Embodiment 1.

Fig. 3 shows an image PES stream encoded by the first broadcast apparatus that supplies broadcast programs.

5 Fig. 4 shows an attachment data stream.

Fig. 5 shows a transport stream generated by the first broadcast apparatus that supplies broadcast programs.

Fig. 6 shows an image PES stream encoded by the second broadcast apparatus that receives the supplied broadcast
10 programs.

Fig. 7 shows the attachment data stream after the image sync information replacement process.

Fig. 8 shows a transport stream generated by the second broadcast apparatus that receives the supplied broadcast
15 programs.

Fig. 9 is a flowchart showing the procedure of the image sync information replacement process in Embodiment 1.

Fig. 10 shows the construction of the broadcast system in Embodiment 2.

20 Fig. 11 is a functional block diagram showing the construction of the image sync information replacing apparatus in Embodiment 2.

Fig. 12 shows the attachment data stream generated by the attachment data generating apparatus 14 of the first broadcast
25 apparatus 10.

Fig. 13 is a flowchart showing the procedure of the image sync information replacement process in Embodiment 2.

Fig. 14 shows the construction of the broadcast system in Embodiment 3.

Fig. 15 is a functional block diagram showing the construction of the image sync information replacing apparatus in Embodiment 3.

Fig. 16 is a flowchart showing the procedure of the image sync information replacement process in Embodiment 3.

Fig. 17 shows the construction of the broadcast system in Embodiment 4.

Fig. 18 is a block diagram showing the construction of the image sync information replacing apparatus in Embodiment 4.

Fig. 19 is a flowchart showing the procedure of the image sync information replacement process in Embodiment 4.

Fig. 20 is a functional block diagram showing the construction of the image sync information replacing apparatus in Embodiment 5.

Fig. 21 is a flowchart showing the return-to-zero monitoring process in Embodiment 5.

Fig. 22 is a flowchart showing the procedure of the return-to-zero process in Embodiment 5.

Fig. 23 shows the construction of the broadcast system in Embodiment 6.

Best Mode for Carrying Out the Invention

The following describes broadcast systems in Embodiments 1-6 of the present invention. Note that in these embodiments, it is supposed that the digital broadcasts conform to MPEG2-TS defined in the ISO/IEC13818. Note also that each broadcast program is composed of image data and attachment data. A first broadcast apparatus provides a second broadcast apparatus with

a broadcast program, and these broadcast apparatuses broadcast the broadcast program substantially at the same time based on the absolute time.

5 Embodiment 1

 The following describes Embodiment 1 of the present invention in detail with reference to the attached drawings. Note that in Embodiment 1, (a) the transfer delay that occurs when data is transferred, (b) the encoding delay that occurs
10 when image data is encoded, and (c) "return-to-zero" which will be described in Embodiment 5 are not considered.

Construction 1

 Fig. 1 shows a main construction of a broadcast system 1 in Embodiment 1. The broadcast system 1 is composed of a first
15 broadcast apparatus 10 and a second broadcast apparatus 20. The first broadcast apparatus 10 is situated in a broadcasting station such as a key station that provides broadcast programs. The second broadcast apparatus 20 is situated in a local station or the like that broadcast the provided broadcast programs. The
20 first broadcast apparatus 10 is connected with the second broadcast apparatus 20 via a dedicated communication line. It should be noted here that there may be a plurality of first broadcast apparatuses 10 or a plurality of second broadcast apparatuses 20.

25 The broadcast system 1 is composed of a CPU, ROM, RAM, hard disk, decoder, filter or the like in terms of hardware, and a computer program is stored in the ROM or the hard disk, where each function of the system is achieved as a result of the CPU operation in accordance with the computer program. This

also applies to Embodiments 2-5 which will be described later.

The first broadcast apparatuses 10 is composed of an image generating apparatus 11, an encoder 12, a PCR generating apparatus 13, an attachment data generating apparatus 14, and
5 a multiplexing apparatus 15.

The image generating apparatus 11 has (a) a function to generate image data in the base band form, the DV format or the like from images captured by a digital video recorder or the like, and (b) a function to transfer the generated image data
10 to the encoder 21 in the broadcast apparatus 20, as well as to the encoder 12.

The encoder 12 has (a) a function to encode the transferred image data into the MPEG2 format to generate image PESs, (b) a function to attach a PCR, as a DTS, to the initial image PES
15 of an access unit, and (c) a function to divide the generated image PESs to TS packets. The TS packets are sequentially transferred to the multiplexing apparatus 15.

The PCR generating apparatus 13 counts values "0" to " $2^{33}-1$ " based on the standard clock frequency of 90KHz and sequentially
20 sends the counted values as the PCR values to the encoder 12 and the attachment data generating apparatus 14. A standard time, a time when a counting of PCR values starts, is set for each broadcasting station. A predetermined standard time is also set in the PCR generating apparatus 13.

25 The attachment data generating apparatus 14 generates attachment data and outputs the generated attachment data, where the generated attachment data is for example character information written in the BML or the like and is to be displayed together with an image. The attachment data includes (a) image

sync information that indicates the timing with which the attachment data is displayed in synchronization with the reproduction of the image data, and (b) receiver trigger information that indicates the timing with which the attachment data is displayed, as well as the information displayed together with an image. An STCR (System Time Clock Reference) is written in the image sync information. Note that hereinafter the STCR is referred to as the PCR since the STCR is equivalent to the PCR generated by the PCR generating apparatus 13. The attachment data is divided into TS packets. The TS packets are repeatedly transferred, as a stream, to the multiplexing apparatus 15 by the DSM-CC (Digital Storage Media Command and Control) method. The TS packets are also transferred to the second broadcast apparatus 20.

15 The multiplexing apparatus 15 multiplexes the TS packets sequentially transferred from the encoder 12 and the attachment data generating apparatus 14, into a transport stream by the time-division multiplex. The transport stream containing the multiplexed TS packets is digitally modulated by a modulator not illustrated, and is broadcast.

Now, the second broadcast apparatus will be described. The second broadcast apparatus is composed of an encoder 21, a PCR generating apparatus 22, an image sync information replacing apparatus 23, and a multiplexing apparatus 24.

25 The encoder 21 has the same function as the encoder 12 of the first broadcast apparatus 10.

The PCR generating apparatus 22 has the same function as the PCR generating apparatus 13 of the first broadcast apparatus 10. Note however that a standard time is set in the PCR generating

apparatus 22, independent from the PCR generating apparatus 13.

The multiplexing apparatus 24 multiplexes the TS packets sequentially transferred from the encoder 21 and the image sync information replacing apparatus 23.

5 The image sync information replacing apparatus 23 receives the attachment data sequentially from the attachment data generating apparatus 14 of the first broadcast apparatus 10 and replaces the PCR written in the image sync information contained in the attachment data with a replacement PCR by executing an
10 image sync information replacement process which will be described later. Now, the construction of the image sync information replacing apparatus 23 will be explained.

Fig. 2 is a block diagram showing the construction of the image sync information replacing apparatus 23. The image sync
15 information replacing apparatus 23 includes hardware such as a CPU and a memory and also includes functional units such as an attachment data receiving unit 201, a detecting unit 202, a replacement PCR calculating unit 203, a PCR replacing unit 204, and an attachment data outputting unit 205. Each function
20 of the image sync information replacing apparatus 23 is achieved as a result of the CPU operation in accordance with the computer program. This also applies to the image sync information replacing apparatuses which will be described later in Embodiments 2-6.

25 The attachment data receiving unit 201 receives the attachment data sequentially from the attachment data generating apparatus 14 of the first broadcast apparatus 10. The attachment data receiving unit 201 transfers the received attachment data to the detecting unit 202.

The detecting unit 202 detects image sync information from the attachment data received by the attachment data receiving unit 201. The detecting unit 202 further reads a PCR written in the image sync information, and transfers the read PCR to
5 the replacement PCR calculating unit 203.

The replacement PCR calculating unit 203 calculates a replacement PCR by adding the PCR received from the detecting unit 202 to a difference d0 that is held by the replacement PCR calculating unit 203 beforehand. Detailed operations of the
10 replacement PCR calculating unit 203 will be described later. The calculated replacement PCR is transferred to the PCR replacing unit 204.

The PCR replacing unit 204 replaces the PCR in the image sync information with the replacement PCR transferred from the
15 replacement PCR calculating unit 203.

The attachment data outputting unit 205 transfers the attachment data stream with the replacement PCR to the multiplexing apparatus 24.

Data 1

20 Fig. 3 shows an image PES stream encoded by the encoder 12 of the first broadcast apparatus 10. The image PES stream is in reality a stream of TS packets making up the image PESs. Each box in the image PES stream 300 represents an image PES. A plurality of image PESs make up an access unit that is a unit
25 of decoding/reproduction. A PCR, as a DTS, is attached to the initial image PES of an access unit. In this example shown in Fig. 3, image PESs 301, 302, and 303 are initial image PESs of respective access units.

Fig. 4 shows an attachment data stream generated by the

attachment data generating apparatus 14 of the first broadcast apparatus 10. Each box in the attachment data stream 400 represents a section that is a unit of transferring the attachment data. Note that in reality, the attachment data stream is a stream of TS packets making up the sections.

The section 401 contains image sync information, which in this example indicates that NPT=0 when PCR=100. The NPT (Normal Play Time) is a relative value to the PCR, and is used for a reproduction control of the attachment data.

The section 402 contains receiver trigger information that specifies the timing with which the characters, still pictures or the like contained in the attachment data are displayed, which in this example is NPT=200.

Fig. 5 shows a transport stream generated by the multiplexing apparatus 15 of the first broadcast apparatus 10. Each box in the transport stream 500 represents a data unit such as a section, an image PES, etc. Note that in reality, the transport stream is a stream of TS packets making up the sections, image PESs or the like. The transport stream 500 is digitally modulated by a modulator of the first broadcast apparatus 10, and then broadcast. The broadcast transport stream 500 is demodulated by a receiver, where the data contained in the transport stream is recognized by the receiver in the flow of time shown in the Fig. 5.

The receiver refers to the PCR attached to the initial image PES of the access unit to recognize the time to start the access unit containing the referred image PES; the receiver refers to the image sync information to recognize the timing with which the reproduction of the image data is synchronized

with the reproduction of the attachment data; and the receiver refers to the receiver trigger information contained in the attachment data to recognize the timing with which the characters, still pictures or the like contained in the attachment data are
5 displayed. The receiver then displays the attachment data simultaneously with the reproduction of the image PES attached with the predetermined PCR, according to the image sync information.

The following is the description of the image data and
10 the attachment data transferred from the first broadcast apparatus 10 to the second broadcast apparatus 20.

The image data transferred from the first broadcast apparatus 10 is encoded by the encoder 21 of the second broadcast apparatus 20 and image PESs are generated. Fig. 6 shows an image
15 PES stream 600 generated as a result of encoding by the encoder 21. The image PES stream is in reality a stream of TS packets making up the image PESs. This image PES stream is different from that generated by the encoder 12 of the first broadcast apparatus 10 in that the PCR attached to the initial image PES
20 of each access unit is a PCR sent from the PCR generating apparatus 22 of the second broadcast apparatus 20. In this example, as shown in Fig. 6, the initial image PESs 601, 602, and 603 of the access units in the image PES stream 600 have PCRs with values 1500, 1600, and 1700, respectively.

25 The attachment data stream transferred from the first broadcast apparatus 10 is subjected to the image sync information replacement process executed by the image sync information replacing apparatus 23 of the second broadcast apparatus 20. Fig. 7 shows the attachment data stream after the image sync

information replacement process. The attachment data stream is in reality a stream of TS packets making up the sections. In this example, as shown in Fig. 7, the value of the PCR written in the image sync information in the section 701 has been changed
5 from 100 to 1500 by the image sync information replacement process.

Fig. 8 shows a transport stream 800 generated by the multiplexing apparatus 24 of the second broadcast apparatus 20. A receiver receives the transport stream 800, and refers to the
10 image sync information having the replacement PCR to recognize correct sync timing with which reproduction of an image PES having a PCR sent from the PCR generating apparatus 22 of the second broadcast apparatus 20 is synchronized with reproduction of the attachment data.

15 Operation 1

The image sync information replacement process executed by the image sync information replacing apparatus 23 in Embodiment 1 will be described with reference to a flowchart. Fig. 9 is a flowchart showing the procedure of the image sync
20 information replacement process in Embodiment 1.

First, in the image sync information replacing apparatus 23 shown in Fig. 2, when the detecting unit 202 detects the image sync information from the attachment data stream received by the attachment data receiving unit 201 (judged as "Yes" in step
25 S1), the replacement PCR calculating unit 203 first adds a PCR written in the image sync information received from the detecting unit 202 to a difference d0 that is held by the replacement PCR calculating unit 203 beforehand, then performs a modular multiplication denoted as " $X \bmod 2^{33}$ " where X represents the

result value of the addition. The result of the modular multiplication is transferred to the PCR replacing unit 204 as a replacement PCR. It should be noted here that the difference d0 is a difference, represented in terms of PCRs, between the standard time for the PCR generating apparatus 13 and the standard time for the PCR generating apparatus 22. Receiving the replacement PCR, the PCR replacing unit 204 replaces the PCR in the image sync information with the replacement PCR (step S2). After step S2 is completed, the control returns to step S1.

More specifically, in the image sync information replacing apparatus 23 shown in Fig. 2, when the detecting unit 202 detects the image sync information contained in the section 401 shown in Fig. 4, the detecting unit 202 reads the PCR (=100) and transfers the read PCR to the replacement PCR calculating unit 203. The replacement PCR calculating unit 203 adds the transferred PCR to the difference d0 that is held by the replacement PCR calculating unit 203 beforehand. If d0=1500, the addition result is 1500+100=1600. The replacement PCR calculating unit 203 then performs a modular multiplication " $1600 \bmod 2^{33}$ ", and transfers the result value of the addition. The result of the modular multiplication to the PCR replacing unit 204 as a replacement PCR. In this example, the PCR replacing unit 204 replaces the PCR value "200" with "1600" in the image sync information contained in the section 401.

Embodiment 2

Embodiment 2 of the present invention is almost the same as Embodiment 1 in terms of the construction and data.

Accordingly, only differences will be described here. Note that in Embodiment 2, as is the case with Embodiment 1, (a) the transfer delay that occurs when data is transferred, (b) the encoding delay that occurs when image data is encoded, and (c)
5 "return-to-zero" which will be described in Embodiment 5 are not considered.

In the broadcast system in Embodiment 2, the first broadcast apparatus being a broadcast program provider further attaches to the attachment data a standard PCR which is a PCR
10 generated by the PCR generating apparatus of the first broadcast apparatus. Also, the second broadcast apparatus being a broadcast program receiver calculates a difference d1 between the received standard PCR and a PCR generated by the PCR generating apparatus of the second broadcast apparatus, and stores the
15 calculated difference d1. The second broadcast apparatus then reads a PCR written in the image sync information contained in the attachment data, calculates a replacement PCR by adding the read PCR to the difference d1, and replaces the PCR in the image sync information with the calculated replacement PCR.

20 Construction 2

The broadcast system 2 shown in Fig. 10 is different from the broadcast system 1 in Embodiment 1 in that the PCR generated by the PCR generating apparatus 13 is attached to the attachment data stream as the standard PCR, and that the image sync
25 information replacing apparatus 33 of the second broadcast apparatus 30 sequentially receives PCRs generated by the PCR generating apparatus 32.

Fig. 11 is a functional block diagram showing the construction of the image sync information replacing apparatus

33.

A detecting unit 1102 detects the standard PCR and the image sync information from the attachment data stream received by a PCR receiving unit 1101. The detecting unit 1102 also reads
5 the detected standard PCR and transfers the read standard PCR to the replacement PCR calculating unit 1104. When detecting the image sync information, the detecting unit 1102 reads the PCR from the image sync information and transfers the read PCR to the replacement PCR calculating unit 1104.

10 The PCR receiving unit 1103 sequentially receives PCRs transferred from the PCR generating apparatus 32, and sequentially transfers the received PCRs to the replacement PCR calculating unit 1104.

The replacement PCR calculating unit 1104 calculates a
15 difference d1 between the standard PCR read by the detecting unit 1102 and the PCR received by the PCR receiving unit 1103 and stores the calculated difference d1. The replacement PCR calculating unit 1104 also calculates a replacement PCR by adding the difference d1 to the PCR written in the image sync information
20 read by the detecting unit 1102. The calculated replacement PCR is sent to the PCR replacing unit 1105.

Data 2

The only difference from Embodiment 1 is that the standard PCR is attached to the attachment data stream.

25 Fig. 12 shows the attachment data stream generated by the attachment data generating apparatus 14 of the first broadcast apparatus 10. The attachment data stream 1200 contains a packet 1201 and a packet 1203 both containing the standard PCR. The packets 1201 and 1203 containing the standard PCR are positioned

immediately before the sections 1202 and 1204 containing the image sync information, respectively.

Operation 2

The image sync information replacement process executed
5 by the image sync information replacing apparatus 33 in Embodiment 2 will be described with reference to a flowchart. Fig. 13 is a flowchart showing the procedure of the image sync information replacement process in Embodiment 2.

First, in the image sync information replacing apparatus
10 33 shown in Fig. 11, when the detecting unit 1102 detects the standard PCR from the attachment data stream received by the attachment data receiving unit 1101 (judged as "Yes" in step S11), the replacement PCR calculating unit 1104 receives the standard PCR from the detecting unit 1102, calculates a
15 difference d1 between the standard PCR and the PCR received by the PCR receiving unit 1103 and stores the calculated difference d1 (step S12).

When it is judged that the standard PCR is not detected (judged as "No" in step S11), the control skips to step S13.

20 In step S13, it is judged whether the difference d1 is stored: if stored (judged as "Yes" in step S13), the control goes to step S14; and if not stored (judged as "No" in step S13), the control returns to step S11.

When the detecting unit 1102 detects the image sync
25 information (judged as "Yes" in step S14), the replacement PCR calculating unit 1104 receives from the detecting unit 1102 a PCR read by the detecting unit 1102 from the image sync information, adds the received PCR to the difference d1 as denoted by an expression " $P2+d1$ ", where P2 represents the received PCR, and

performs a modular multiplication denoted as " $X \bmod 2^{33}$ " where X represents the result value of the addition. The replacement PCR calculating unit 1104 transfers the result of the modular multiplication to the PCR replacing unit 1105 as a replacement
5 PCR. Receiving the replacement PCR, the PCR replacing unit 1105 replaces the PCR in the image sync information with the replacement PCR (step S15), and returns to step S11.

When the detecting unit 1102 does not detect the image sync information (judged as "No" in step S14), the control returns
10 to step S11.

More particularly, in the image sync information replacing apparatus 33 shown in Fig. 11, when the replacement PCR calculating unit 1104 receives the standard PCR (=0) contained in the section 1201 shown in Fig. 12, and when the PCR transferred
15 from the PCR receiving unit 1103 is "5000", the difference d1 calculated by the replacement PCR calculating unit 1104 is "5000". Then when the PCR written in the image sync information detected later is "100", the replacement PCR calculating unit 1104 adds the received PCR (100) to the difference d1 (5000), and performs
20 a modular multiplication denoted " $5100 \bmod 2^{33}$ " where "5100" is the result value of the addition. The replacement PCR calculating unit 1104 transfers the result (5100) of the modular multiplication to the PCR replacing unit 1105 as a replacement PCR. Receiving the replacement PCR, the PCR replacing unit 1105
25 replaces the PCR (100) in the image sync information with the replacement PCR (5100).

Embodiment 3

Embodiment 3 of the present invention is almost the same

as Embodiment 1 in terms of the construction and data. Accordingly, only differences will be described here. Note that in Embodiment 3, as is the case with Embodiment 1, (a) the transfer delay that occurs when data is transferred, (b) the encoding
5 delay that occurs when image data is encoded, and (c) "return-to-zero" which will be described in Embodiment 5 are not considered.

In the broadcast system in Embodiment 3, the second broadcast apparatus being a broadcast program receiver further
10 includes a program start trigger generating apparatus. When the program start trigger generating apparatus generates and notifies a program start trigger, the image sync information replacing apparatus in Embodiment 3 calculates a PCR that is N seconds after the standard time of a PCR sent from the PCR
15 generating apparatus in the second broadcast apparatus, and stores the calculated PCR as a program start PCR, and replaces the PCR in the image sync information having the NPT value of "0" with the program start PCR. The image sync information replacing apparatus in Embodiment 3 also calculates a difference
20 d between the program start PCR and the PCR written in the image sync information having the NPT value of "0", and stores the difference d which is used in calculating a replacement PCR to replace a PCR in the image sync information transferred later. Note that the above feature of Embodiment 3 is based on the premise
25 that the second broadcast apparatus receives the image sync information having the NPT value of "0", which indicates a program start time, from the first broadcast apparatus.

Construction 3

The broadcast system 3 shown in Fig. 14 is different from

the broadcast system 1 in Embodiment 1 in that the program start time in the second broadcast apparatus 40 is calculated based on the time when the program start trigger generating apparatus 45 generates a program start trigger.

5 The program start trigger generating apparatus 45 generates a program start trigger that notifies a program start a predetermined time period before the program start. For example, the program start trigger indicates that a broadcast program starts 5 seconds later. The program start trigger is
10 sent to the image sync information replacing apparatus 43.

Fig. 15 is a functional block diagram showing the construction of the image sync information replacing apparatus 43.

A detecting unit 1502 detects the image sync information
15 from attachment data stream received by the attachment receiving unit 1501. When it detects the image sync information, the detecting unit 1502 reads the PCR and NPT written in the image sync information, and transfers the read PCR and NPT to the PCR calculating unit 1505.

20 The PCR receiving unit 1503 sequentially receives PCRs transferred from the PCR generating apparatus 42, and sequentially transfers the received PCRs to the replacement PCR calculating unit 1505.

The program start trigger receiving unit 1504 receives
25 the program start trigger generated by the program start trigger generating apparatus 45, and transfers the program start trigger to the replacement PCR calculating unit 1505.

The replacement PCR calculating unit 1505 has (a) a function to calculate, when it receives a program start trigger

that indicates that a broadcast program starts N seconds later, where N is a positive value, a PCR that indicates a time N seconds after the PCR received by the PCR receiving unit 1503, and store the calculated PCR as the program start PCR, (b) a function to transfer the program start PCR to the replacing unit 1506 when the NPT contained in the image sync information detected by the detecting unit 1502 is "0" and perform a calculation "P3-P2", where P3 represents the program start PCR and P2 represents the PCR written in the image sync information having the NPT value of "0", and store the calculation result as a difference d, and (c) a function to add the difference d to the PCR written in the image sync information to calculate a replacement PCR when the NPT value of the image sync information detected by the detecting unit 1502 is not "0". The calculated replacement PCR is transferred to the PCR replacing unit 1506.

Operation 3

The image sync information replacement process executed by the image sync information replacing apparatus 43 in Embodiment 3 will be described with reference to a flowchart. Fig. 16 is a flowchart showing the procedure of the image sync information replacement process in Embodiment 3. It is presumed in this flowchart that a program starts 5 seconds after a program start trigger is generated.

First, in the image sync information replacing apparatus 43 shown in Fig. 15, if the program start trigger receiving unit 1504 receives the program start trigger (judged as "Yes" in step S21), the control goes to step S22 in which the replacement PCR calculating unit 1505 receives the program start trigger from the program start trigger receiving unit 1504, calculates a PCR

that is 5 seconds after the PCR received by the PCR receiving unit 1503, and stores the calculated PCR as the program start PCR (step S22). The control then goes to step S23. More specifically, since MPEG2 defines that the PCR value increases every 1/90,000 seconds by "1", the increase in the PCR value during 5 seconds is calculated as $90,000 \times 5 = 450,000$. Accordingly, if the PCR received by the PCR receiving unit 1503 has a value of "100" when the replacement PCR calculating unit 1505 receives the program start trigger, the program start PCR is calculated as $100 + 450,000 = 450,100$.

When the program start trigger receiving unit 1504 does not receive the program start trigger (judged as "No" in step S21), the control skips to step S25.

If the detecting unit 1502 detects the image sync information with NPT=0 written therein (judged as "Yes" in step S23), the control goes to step S24 in which the replacement PCR calculating unit 1505 performs a calculation "P3-P2", where P3 represents the program start PCR and P2 represents the PCR written in the image sync information having the NPT value of "0", stores the calculation result as a difference d, and transfers the program start PCR to the PCR replacing unit 1506. The PCR replacing unit 1506 receives the program start PCR and replaces the PCR in the image sync information having the NPT value of "0" with the received program start PCR (step S24).

If it is judged that the difference d is stored in step S25 (judged as "Yes" in step S25), the control goes to step S26. If it is judged that the difference d is not stored in step S25 (judged as "No"), the control returns to step S21.

If it is judged in step S26 that the detecting unit 1502

has detected the image sync information (judged as "Yes" in step S26), the control goes to step S27 in which the replacement PCR calculating unit 1505 adds the difference d to the PCR written in the detected image sync information to calculate a replacement PCR and transfers the calculated replacement PCR to the PCR replacing unit 1506. The PCR replacing unit 1506 receives the replacement PCR and replaces the PCR in the detected image sync information with the replacement PCR (step S27). The control then returns to step S21.

10 If it is judged in step S26 that the detecting unit 1502 has not detected the image sync information (judged as "No" in step S26), the control returns to step S21.

Embodiment 4

15 Embodiment 4 of the present invention is almost the same as Embodiment 1 in terms of the construction and data. Accordingly, only differences will be described here. Note that in Embodiment 4, as is the case with Embodiment 1, (a) the transfer delay that occurs when data is transferred, (b) the encoding delay that occurs when image data is encoded, and (c)
20 "return-to-zero" which will be described in Embodiment 5 are not considered.

 In the broadcast system in Embodiment 4, the second broadcast apparatus sequentially receives PCRs as standard PCRs
25 from a PCR generating apparatus of the first broadcast apparatus being a broadcast program provider, via a dedicated line. In Embodiment 2, standard PCRs are attached to the attachment data stream and transferred together with the attachment data stream. In contrast, in Embodiment 4, standard PCRs are transferred via

a dedicated line. Receiving a standard PCR, the second broadcast apparatus calculates a difference d_2 using (i) a PCR that is generated by a PCR generating apparatus of the second broadcast apparatus simultaneously as the standard PCR is received, (ii) the received standard PCR, and (iii) a transfer delay time indicating a time period required to transfer a standard PCR, and stores the calculated difference. The second broadcast apparatus also calculates a replacement PCR using (i) a PCR written in the image sync information contained in the received attachment data, (ii) the difference d_2 , and (iii) a transfer delay time that indicates a time period required to transfer image data and is stored in a memory beforehand. The PCR written in the image sync information is replaced with the calculated replacement PCR.

15 Construction 4

The broadcast system 4 shown in Fig. 17 is different from the broadcast system 1 in Embodiment 1 in that the image sync information replacing apparatus 53 of the second broadcast apparatus 50 sequentially receives PCRs as standard PCRs from the PCR generating apparatus 13 via a dedicated line, and also sequentially receives PCRs from the PCR generating apparatus 52.

Fig. 18 is a block diagram showing the construction of the image sync information replacing apparatus 53.

25 A PCR receiving unit 1801 sequentially receives standard PCRs from the PCR generating apparatus 13. The PCR receiving unit 1801 transfers the received standard PCRs to the replacement PCR calculating unit 1803.

A PCR receiving unit 1802 sequentially receives PCRs from

the PCR generating apparatus 52. The PCR receiving unit 1802 sequentially transfers the received PCRs to the replacement PCR calculating unit 1803.

5 A detecting unit 1805 detects the image sync information from the attachment data stream received by the PCR receiving unit 1801. The detecting unit 1805 transfers the PCR contained in the detected image sync information to the replacement PCR calculating unit 1803.

The replacement PCR calculating unit 1803 has (a) a
10 function to calculate a difference d_2 using (i) a PCR that is received from the PCR receiving unit 1802 simultaneously as a standard PCR is received from the PCR receiving unit 1801, (ii) the received standard PCR, and (iii) a transfer delay time "a" indicating a time period required to transfer a standard PCR,
15 and store the calculated difference d_2 , and (b) a function to calculate a replacement PCR using (i) a PCR written in the image sync information read by the detecting unit 1805, (ii) the difference d_2 , and (iii) a transfer delay time "b" that indicates a time period required to transfer image data and is stored in
20 a memory beforehand. The calculated replacement PCR is transferred to the PCR replacing unit 1806.

Operation 4

The image sync information replacement process executed by the image sync information replacing apparatus 53 in
25 Embodiment 4 will be described with reference to a flowchart. Fig. 19 is a flowchart showing the procedure of the image sync information replacement process in Embodiment 4.

First, in the image sync information replacing apparatus 53 shown in Fig. 18, if the PCR receiving unit 1801 receives

a standard PCR (P4) (judged as "Yes" in step S31), the control goes to step S32 in which the replacement PCR calculating unit 1803 stores (a) P4 and (b) a PCR (P5) that was received from the PCR generating apparatus 52 when the PCR receiving unit 1801
5 received the P4 (step S32). The control then goes to step S33 in which the replacement PCR calculating unit 1803 obtains a difference d2 by performing a calculation "P5-P4-a", where "a" represents a transfer delay time "a" that indicates a time period required to transfer a standard PCR and is stored in a memory
10 beforehand, and stores the calculated difference d2 (step S33). The control then goes to step S34.

When the PCR receiving unit 1801 does not receive the standard PCR (P4) (judged as "No" in step S31), the control skips to step S34.

15 If it is judged in step 34 that the difference d2 is stored (judged as "Yes" in step S34), the control goes to step S35. If it is judged in step 34 that the difference d2 is not stored, (judged as "No" in step S34), the control returns to step S31.

If it is judged in step 35 that the detecting unit 1805
20 detected the image sync information from the attachment data stream (judged as "Yes" in step S35), the control goes to step S36 in which the replacement PCR calculating unit 1803 receives a PCR (P6) from the detecting unit 1805, performs a calculation "P6+d2+b", where "d2" represents the stored difference d2 and
25 "b" represents the transfer delay time b indicating the time period required for the image data transfer, and further performs a modular multiplication " $X \bmod 2^{33}$ ", where X represents the result value of the addition. The result of the modular multiplication is transferred as a replacement PCR to the PCR

replacing unit 1806. The PCR replacing unit 1806 replaces the PCR in the image sync information with the received replacement PCR (step s36). The control then returns to step S31.

5 If it is judged in step S35 that the detecting unit 1805 did not detect the image sync information from the attachment data stream (judged as "No" in step S35), the control returns to step S31.

More specifically, the image sync information replacing apparatus 53 stores in advance the values of the transfer delay times "a" and "b" expressed in units of the PCR clock (for example, 100 and 1100, respectively). For example, when the image sync information replacing apparatus 53 receives the PCR value of 1600 from the PCR generating apparatus 52, at the same time receiving the standard PCR value of 100 from the PCR generating apparatus 13, the difference d2 is calculated as
15 1600-100-100=1400.

Then if the detecting unit 1805 detects the image sync information having a PCR (P6) of a value 100, the replacement PCR calculating unit 1803 receives P6 from the detecting unit 1805, and performs a calculation " $P6+d2+b$ ", which results in 1000+1400+1100=3500. The replacement PCR calculating unit 1803 further performs a modular multiplication " $3500 \bmod 2^{33}$ ", and transfers the result of the modular multiplication to the PCR replacing unit 1806 as a replacement PCR. The PCR replacing unit 1806 replaces the PCR (100) in the image sync information with the received replacement PCR (3500).
25

Embodiment 5

Embodiment 5 of the present invention is almost the same

as Embodiment 4 in terms of the construction and data. Accordingly, only differences will be described here. Note that in Embodiment 5, (a) the transfer delay that occurs when data is transferred and (b) the encoding delay that occurs when image data is encoded are not considered.

In the broadcast system in Embodiment 5, the image sync information replacing apparatus of the second broadcast apparatus further includes a timer so that only when a "return-to-zero" occurs to the PCR generating apparatus of the second broadcast apparatus, a 0-obit process is executed.

It should be noted here that since the PCR generating apparatus repeatedly counts (generates) "0" to " $2^{33}-1$ " as PCR values, it naturally happens that after counting " $2^{33}-1$ " it counts "0" returning to the starting value. The term "return-to-zero" means such a return of the PCR value to 0. The occurrence of return-to-zero may cause the following problem. In Embodiments 2 and 4, the image sync information replacing apparatus calculates a difference between two PCRs respectively generated by the first and second broadcast apparatuses, and then if the image sync information is detected, adds the difference to a PCR written in the detected image sync information, and generates a replacement PCR by performing a modular multiplication " $X \bmod 2^{33}$ " where X represents the result of the addition. However, when a return-to-zero occurs to the PCR generating apparatus of the second broadcast apparatus, the reproduction of the image data is not synchronized with the reproduction of the attachment data until the next piece of image sync information is transferred to the second broadcast apparatus. The present embodiment provides a broadcast system that solves the above-described

problem of the return-to-zero.

Construction 5

The broadcast system of Embodiment 5 has the same construction as Embodiment 4 shown in Fig. 17.

5 Fig. 20 is a functional block diagram showing the construction of the image sync information replacing apparatus 2000. The image sync information replacing apparatus 2000 differs from the image sync information replacing apparatus in Embodiment 4 shown in Fig. 18 in that it has a timer 2004. The
10 following describes the timer 2004 and functions of the functional units which are different from those in Embodiment 4.

The timer 2004 measures the time during a time period until a return-to-zero occurs, the time period being converted from
15 a PCR value set by the replacement PCR calculating unit 2003, and notifies the replacement PCR calculating unit 2003 of the occurrence of the return-to-zero when the set time period has passed.

The replacement PCR calculating unit 2003 has (a) a
20 function to, as it receives a standard PCR (P4) from the PCR receiving unit 2001, compare P4 with a PCR (P5) received from the PCR receiving unit 2002, and if the comparison result is $P5 > P4$, performs a calculation " $2^{33} - P5$ ", and sets the timer 2004 to the calculation result, (b) a function to store a difference
25 d3 which is a result of a calculation " $P5 - P4$ ", (c) a function to calculate a replacement PCR using the stored difference d3 and a PCR written in the image sync information read by the detecting unit 2006, and (d) a function to perform the return-to-zero process when being notified of the return-to-zero

from the timer 2004. The return-to-zero process will be described later. The calculated replacement PCR is transferred to the PCR replacing unit 2007.

Operation 5

5 The image sync information replacement process performed by the image sync information replacing apparatus 2000 in Embodiment 5 is the same as the operation described in Embodiment 4 except for the return-to-zero monitoring process. Fig. 21 is a flowchart showing the return-to-zero monitoring process.

10 In the image sync information replacing apparatus 2000, if the PCR receiving unit 2001 receives a standard PCR (P4) (judged as "Yes" in step S41), the control goes to step S42 in which the replacement PCR calculating unit 2003 holds a PCR (P5) which was received from the PCR generating apparatus 52 when P4 was
15 received (step S42). The replacement PCR calculating unit 2003 then compares P4 with P5.

 If it is judged as $P5 > P4$ (judged as "Yes" in step S43), the control goes to step S44 in which the replacement PCR calculating unit 2003 performs a calculation " $2^{33} - P5$ ", and sets
20 the timer 2004 to the calculation result (step S44).

 If it is not judged as $P5 > P4$ (judged as "No" in step S43), the control returns to step S41.

 If it is judged that the replacement PCR calculating unit 2003 is notified of return-to-zero from the timer 2004 (judged as "Yes" in step S45), the control returns to step S46 in which
25 the return-to-zero process is performed. The control then returns to step S41. If it is judged that the replacement PCR calculating unit 2003 is not notified of return-to-zero from the timer 2004 (judged as "No" in step S45), the process enters

the wait state.

Now, the return-to-zero process will be described with reference to a flowchart. Fig. 22 is a flowchart showing the procedure of the return-to-zero process.

5 When it is notified of a return-to-zero from the timer 2004, the replacement PCR calculating unit 2003 performs a calculation " $n1 + 2^{33} - (P6 + P5 - P4) \times i$ ", where "P6" represents a PCR written in the most recently received image sync information, "n1" the NPT, "i" the NPT increasing rate, "P4" the standard
10 PCR received by the PCR receiving unit 2001, and "P5" the PCR received from the PCR generating apparatus 52 (step S51).

 The replacement PCR calculating unit 2003 generates image sync information having a description: "PCR=0, NPT=n2, NPT increasing rate=i", and additionally inserts the generated image
15 sync information into the attachment data stream (step S52).

 With the above-described operation, even if a return-to-zero occurs to the second broadcast apparatus, a new piece of image sync information is generated and additionally inserted into the attachment data stream. This enables a
20 receiver that receives a broadcast program composed of the above attachment data and image data to refer to the new piece of image sync information to synchronize the image data with the attachment data with correct timing.

25 Embodiment 6

 Embodiment 6 of the present invention is almost the same as Embodiment 1 in terms of the construction and data. Accordingly, only differences will be described here. Note that in Embodiment 6, (a) the transfer delay that occurs when

attachment data is transferred and (b) "return-to-zero" which is described in Embodiment 5 are not considered.

In the broadcast system in Embodiment 6, the first broadcast apparatus changes the image sync information by reflecting the encoding delay by the encoder, and the second broadcast apparatus calculates a replacement PCR reflecting (a) a difference between PCRs respectively generated by the first and second broadcast apparatuses and (b) the encoding delay by the encoder, and replaces the PCR written in the image sync information with the calculated replacement PCR. This arrangement aims to deal with a problem that occurs when the encoders of the first and second broadcast apparatuses have different encoding performances.

Construction 6

The broadcast system 6 shown in Fig. 23 is different from the broadcast system 1 in Embodiment 1 in that the first broadcast apparatus 80 further includes an image sync information replacing apparatus 86. Accordingly, only the image sync information replacing apparatus 86 will be described here.

The image sync information replacing apparatus 86 calculates a replacement PCR reflecting the encoding delay that occurs when the encoder 82 encodes image data, and replaces a PCR in the image sync information generated by the attachment data generating apparatus 84 with the calculated replacement PCR.

Operation 6

The image sync information replacing apparatus 86 reads a PCR written in the image sync information contained in the attachment data stream, calculates a replacement PCR by adding

to the read PCR a PCR value that is equal to an encoding delay that occurs when the encoder 82 encodes image data, and replaces the PCR in the image sync information with the calculated replacement PCR.

5 For example, when the encoding delay is 0.5 seconds and the PCR written in the image sync information has a value of "100", then the PCR value that is equal to the encoding delay is calculated as " $0.5 \times 90,000 = 45,000$ ", and the replacement PCR is calculated as " $100 + 45,000 = 45,100$ ".

10 The image sync information replacing apparatus 93 has almost the same function as the image sync information replacing apparatus 23 in Embodiment 1, but differs from it in that the image sync information replacing apparatus 93 generates a replacement PCR that reflects the encoding delay that occurs
15 when the encoder 91 encodes.

 The image sync information replacing apparatus 93 reads a PCR written in the image sync information contained in the attachment data stream, calculates a replacement PCR by adding to the read PCR (a) a PCR value that is equal to an encoding
20 delay that occurs when the encoder 91 encodes image data and (b) a difference between a standard time of the PCR generating apparatus 83 and a standard time of the PCR generating apparatus 92, and replaces the PCR in the image sync information with the calculated replacement PCR.

25 For example, when the difference between a standard time of the PCR generating apparatus 83 and a standard time of the PCR generating apparatus 92 is "400", the encoding delay is 0.3 seconds, and the PCR written in the image sync information has a value of "100", then the PCR value that is equal to the encoding

delay is calculated as " $0.3 \times 90,000 = 27,000$ ", and the replacement PCR is calculated as " $400 + 100 + 27,000 = 27,500$ ".

Supplements

5 The digital broadcast system of the present invention has been described through Embodiments 1 to 6. However, the present invention can be achieved in more various ways other than these embodiments. The following are such examples.

 (1) Embodiment 2 may be modified as: if the image sync
10 information replacing apparatus 33 fails to receive a PCR from the PCR generating apparatus 32 simultaneously with a standard PCR, it may calculate an approximate value of a PCR that should have been received from the PCR generating apparatus 32 using an approximate time when the standard PCR was received, and may
15 use the calculated PCR value to calculate an approximate value of the difference d1.

 (2) In Embodiment 3, the image sync information replacing apparatus 43 calculates a replacement PCR based on a program start trigger generated by the program start trigger generating
20 apparatus 45. However, the calculation of the replacement PCR may be based on the "net-Q" signal which is used to notify the timing for an image change.

 (3) In Embodiment 3, the image sync information replacing apparatus 43 obtains a program start trigger from the program
25 start trigger generating apparatus 45 included in the second broadcast apparatus 40. However, the image sync information replacing apparatus 43 may obtain a program start trigger from an external apparatus (for example, from the program start trigger generating apparatus included in the first broadcast

apparatus). The program start trigger may be transferred using an ancillary area of the image data, may be transferred via a dedicated line, or may be transferred via a public line using the Internet or the like.

5 (4) The above embodiments are described based on MPEG2-TS digital broadcasting. However, not limited to MPEG2-TS digital broadcasting, the present invention can be applied to any broadcasting system in which the image sync information is used to synchronize the image data with the attachment data.

10 (5) In each of the above embodiments, a broadcast program is composed of image data and attachment data. However, a broadcast program may be composed of audio data and attachment data, may be composed of image data, audio data, and attachment data

15 (6) Each of the image sync information replacement process procedures performed by the image sync information replacing apparatus in each embodiment (for example, the procedures shown in Figs. 9, 13, 16, 19, 21, and 22) may be recorded on a recording medium for distribution as a program for causing a machine to
20 perform the procedure. Alternatively, such programs may be distributed via a communication line or the like.

Such recording mediums include an IC card, optical disc, flexible disc, and ROM. A distributed program is installed into a machine having a program execution function, and the machine
25 operates as the image sync information replacing apparatus as described in one of the above embodiments by executing the installed program.

Industrial Applicability

The present invention can be applied to a broadcast system in which a broadcast program composed of contents data and attachment data is provided from a first broadcast apparatus to a second broadcast apparatus. The image sync information
5 replacing apparatus of the present invention enables a receiver, which receives a broadcast program broadcast by the second broadcast apparatus that receives the program from the first broadcast apparatus, to reproduce the image data in synchronization with the attachment data correctly.

CLAIMS

1. A broadcast system comprising a first broadcast apparatus and a second broadcast apparatus, the first broadcast apparatus
5 broadcasting a broadcast program including contents stream data and attachment data and providing the second broadcast apparatus with the broadcast program, the attachment data containing information that indicates timing with which the attachment data is to be reproduced in synchronization with the contents stream
10 data,

the first broadcast apparatus including:

a first time value generating means for sequentially generating first time values that indicate current times relative to a first standard time;

15 a first time value attaching means for sequentially attaching the generated first time values to a first encoded contents stream data generated by the first broadcast apparatus by encoding the contents stream data;

a first sync information generating means for generating
20 first sync information to be contained in the attachment data, the first sync information indicating, relative to one of the first time values, timing with which the attachment data is to be reproduced in synchronization with the first encoded contents stream data having the first time values attached thereto; and

25 a first broadcast means for digitally broadcasting the attachment data and the first encoded contents stream data with the first time values attached thereto,

the second broadcast apparatus including:

a second time value generating means for sequentially

generating second time values that indicate current times relative to a second standard time;

a second time value attaching means for sequentially attaching the generated second time values to a second encoded contents stream data generated by the second broadcast apparatus by encoding the contents stream data provided from the first broadcast apparatus;

a second sync information generating means for generating second sync information indicating timing which corresponds to the timing indicated by the first sync information and with which the attachment data is to be reproduced in synchronization with the second encoded contents stream data having the second time values; and

a second broadcast means for digitally broadcasting (a) the attachment data containing the second sync information instead of the first sync information and (b) the second encoded contents stream data with the second time values attached thereto.

2. The broadcast system of Claim 1, wherein

each piece of first sync information further contains one of the first time values,

the second broadcast apparatus further including

a difference value storing means for storing in advance a difference value between the first standard time and the second standard time, and

the second sync information generating means generates the second sync information based on the difference value and each first time value contained in the first sync information

in the attachment data provided from the first broadcast apparatus.

3. The broadcast system of Claim 1, wherein

5 the attachment data is formed as a stream, and
 the first time value attaching means further sequentially
attaches the generated first time values to the attachment data
stream,

 the second broadcast apparatus further including:

10 a first time value detecting means for sequentially
detecting the first time values from the attachment data stream
provided from the first broadcast apparatus; and

 a difference value storing means for, for each of the
detected first time values, calculating a difference between
15 a detected first time value and a second time value that is
generated by the second sync information generating means when
the first time value is detected, and storing the calculation
result as a difference value, and

 the second sync information generating means generates
20 the second sync information based on the difference values and
the first time values attached to the attachment data stream
provided from the first broadcast apparatus.

4. The broadcast system of Claim 1, wherein

25 each piece of first sync information further contains one
of the first time values,

 the first broadcast apparatus further includes

 a first time value transferring means for transferring
the first time values generated by the first time value generating

means to the second broadcast apparatus via a route different from a route for the attachment data, and

the second broadcast apparatus further includes

a difference value storing means for, for each of the first
5 time values transferred by the first time value transferring means, calculating a difference between a first time value and a second time value that is generated by the second sync information generating means when the first time value is received, and storing the calculation result as a difference
10 value,

the second sync information generating means generates the second sync information based on each difference value and each first time value contained in the first sync information in the attachment data provided from the first broadcast
15 apparatus.

5. The broadcast system of Claim 1, wherein

the first sync information contains program start information that indicates a program start time based on the
20 first standard time,

the broadcast system further comprises

a program start trigger sending means for sending a program start trigger so that the second broadcast apparatus receives, a predetermined time period earlier than a scheduled program
25 start time, a program start trigger indicating that a broadcast program starts a predetermined time period later, and

the second broadcast apparatus further includes

a program start time value storing means for obtaining a second time value that is generated by the second time value

generating means when the second broadcast apparatus receives the program start trigger, calculating the scheduled program start time from the obtained second time value, and storing the calculation result as a program start time value,

5 the second sync information generating means generates the second sync information based on the program start time value if the first sync information containing the program start information is detected from the attachment data provided from the first broadcast apparatus, and

10 the second broadcast means for digitally broadcasting (a) the attachment data containing the second sync information instead of the first sync information containing the program start information and (b) the second encoded contents stream data with the second time values attached thereto.

15

6. The broadcast system of Claim 1, wherein

the contents stream data and the attachment data are transferred from the first broadcast apparatus to the second broadcast apparatus via different lines,

20 the first sync information contains one of the first time values generated by the first time value attaching means,

the first broadcast apparatus further includes

a first time value transferring means for transferring the first time values generated by the first time value generating

25 means to the second broadcast apparatus, and

the second broadcast apparatus further includes

a transfer delay value storing means for storing in advance a transfer delay value that indicates a time period, recognized as a transfer delay, required for transferring the contents

stream data from the first broadcast apparatus to the second broadcast apparatus, and

the second sync information generating means generates the second sync information based on the transfer delay value and the first time value contained in the first sync information
5 in the attachment data provided from the first broadcast apparatus.

7. The broadcast system of Claim 1, wherein

10 the contents stream data and the attachment data are transferred from the first broadcast apparatus to the second broadcast apparatus via different lines,

the first sync information contains one of the first time values generated by the first time value attaching means,

15 the first broadcast apparatus further includes

a first time value transferring means for transferring the first time values generated by the first time value generating means to the second broadcast apparatus, and

the second broadcast apparatus further includes:

20 a first transfer delay value storing means for storing in advance a transfer delay value that indicates a time period, recognized as a first transfer delay, required for transferring the first time value from the first broadcast apparatus to the second broadcast apparatus; and

25 a second transfer delay value storing means for storing in advance a transfer delay value that indicates a time period, recognized as a second transfer delay, required for transferring the contents stream data from the first broadcast apparatus to the second broadcast apparatus, and

the second sync information generating means generates the second sync information based on the first and second transfer delay values and the first time value contained in the first sync information in the attachment data provided from the first broadcast apparatus.

8. The broadcast system of Claim 1, wherein

the first sync information contains (i) one of the first time values generated by the first time value generating means, (ii) a relative time value to the first time value, and (iii) a value indicating an increasing rate of the relative time value to the first time value, and both the first and second time values are repeatedly counted and generated in sequence in a range from a value "0" to an upper limit value, returning to 0 from the upper limit value,

the first broadcast apparatus further includes

a first time value transferring means for transferring the first time values to the second broadcast apparatus;

the second broadcast apparatus further includes:

a time values comparing means for comparing the first time value received from the first broadcast apparatus with a second time value generated by the second time value generating means when the first time value is detected; and

a time period calculating means for, when the time values comparing means recognizes as a result of the comparison that the second time value is larger than the first time value, calculating a time period between the second time value and the upper limit value;

a timer means for measuring time during the time period

calculated by the time period calculating means;

a third sync information generating means for, when the timer means measures time and reaches the upper limit value, generating third sync information indicating timing which
5 corresponds to the timing indicated by the first sync information and with which the attachment data is to be reproduced in synchronization with the second encoded contents stream data having the second time values, and

the second broadcast means digitally broadcasts (a) the
10 attachment data additionally containing the third sync information and (b) the second encoded contents stream data with the second time values attached thereto.

9. The broadcast system of Claim 1, wherein

15 each of the first and second broadcast apparatuses has an encoder for encoding the contents stream data,

the first sync information contains one of the first time values generated by the first time value attaching means,

the first broadcast apparatus further includes:

20 a first encode-delay value storing means for storing in advance a first encode-delay value that indicates a time period, recognized as a first encode-delay, required by the encoder of the first broadcast apparatus for encoding the contents stream data; and

25 a third sync information generating means for generating third sync information based on a result of adding the first time value contained in the first sync information to the first encode-delay value, and

the first broadcast means digitally broadcasts (a) the

attachment data containing the third sync information and (b) the first encoded contents stream data with the first time values attached thereto,

the second broadcast apparatus further includes:

5 a second encode-delay value storing means for storing in advance a second encode-delay value that indicates a time period, recognized as a second encode-delay, required by the encoder of the second broadcast apparatus for encoding the contents stream data; and

10 a difference value storing means for storing in advance a difference value between the first standard time and the second standard time, and

 the second sync information generating means generates the second sync information based on the difference value, the
15 second encode-delay value, and the first time value contained in the first sync information in the attachment data provided from the first broadcast apparatus.

10. A broadcast apparatus for digitally broadcasting a
20 broadcast program that is provided from an external apparatus and includes encoded contents stream data and attachment data, the attachment data containing information that indicates timing with which the attachment data is to be reproduced in synchronization with the contents stream data, the broadcast
25 apparatus comprising:

 a detecting means for detecting first sync information from the provided attachment data, the first sync information indicating, relative to one of first time values, timing with which the attachment data is to be reproduced in synchronization

with a first encoded contents stream data having the first time values, the first time values indicating current times relative to a first standard time and having been sequentially attached to the first encoded contents stream data by the external
5 apparatus;

a time value generating means for sequentially generating second time values that indicate current times relative to a second standard time;

a time value attaching means for sequentially attaching
10 the generated second time values to a second encoded contents stream data generated by the broadcast apparatus by encoding the contents stream data;

a sync information generating means for generating second sync information indicating timing which corresponds to the
15 timing indicated by the first sync information and with which the attachment data is to be reproduced in synchronization with the second encoded contents stream data having the second time values; and

a broadcast means for digitally broadcasting (a) the
20 attachment data containing the second sync information instead of the first sync information and (b) the second encoded contents stream data with the second time values attached thereto.

11. A sync information replacing apparatus, comprising:

25 a receiving means for receiving attachment data that contains first sync information indicating timing with which the attachment data is to be reproduced in synchronization with a first encoded contents stream data having first time values, the first time values indicating current times relative to a

first standard time and having been sequentially attached to the first encoded contents stream data by an external apparatus;

a detecting means for detecting the first sync information from the received attachment data;

5 a sync information generating means for generating second sync information indicating timing which corresponds to the timing indicated by the first sync information and with which the attachment data is to be reproduced in synchronization with a second encoded contents stream data having second time values;

10 and

an outputting means for outputting the attachment data containing the second sync information instead of the first sync information.

15 12. A sync information replacing method, comprising:

a receiving step for receiving attachment data that contains first sync information indicating timing with which the attachment data is to be reproduced in synchronization with a first encoded contents stream data having first time values,
20 the first time values indicating current times relative to a first standard time and having been sequentially attached to the first encoded contents stream data by an external apparatus;

a detecting step for detecting the first sync information from the received attachment data;

25 a sync information generating step for generating second sync information indicating timing which corresponds to the timing indicated by the first sync information and with which the attachment data is to be reproduced in synchronization with a second encoded contents stream data having second time values;

and

an outputting step for outputting the attachment data containing the second sync information instead of the first sync information.

5

13. A program for causing a computer to execute a sync information replacing process, the sync information replacing process including:

a receiving step for receiving attachment data that
10 contains first sync information indicating timing with which the attachment data is to be reproduced in synchronization with a first encoded contents stream data having first time values, the first time values indicating current times relative to a first standard time and having been sequentially attached to
15 the first encoded contents stream data by an external apparatus;

an extracting step for extracting the first sync information from the received attachment data;

a sync information generating step for generating second sync information indicating timing which corresponds to the
20 timing indicated by the first sync information and with which the attachment data is to be reproduced in synchronization with a second encoded contents stream data having second time values;
and

an outputting step for outputting the attachment data
25 containing the second sync information instead of the first sync information.

14. A recording medium in which a program for causing a computer to execute a sync information replacing process is recorded,

the sync information replacing process including:

a receiving step for receiving attachment data that contains first sync information indicating timing with which the attachment data is to be reproduced in synchronization with

5 a first encoded contents stream data having first time values, the first time values indicating current times relative to a first standard time and having been sequentially attached to the first encoded contents stream data by an external apparatus;

10 an extracting step for extracting the first sync information from the received attachment data;

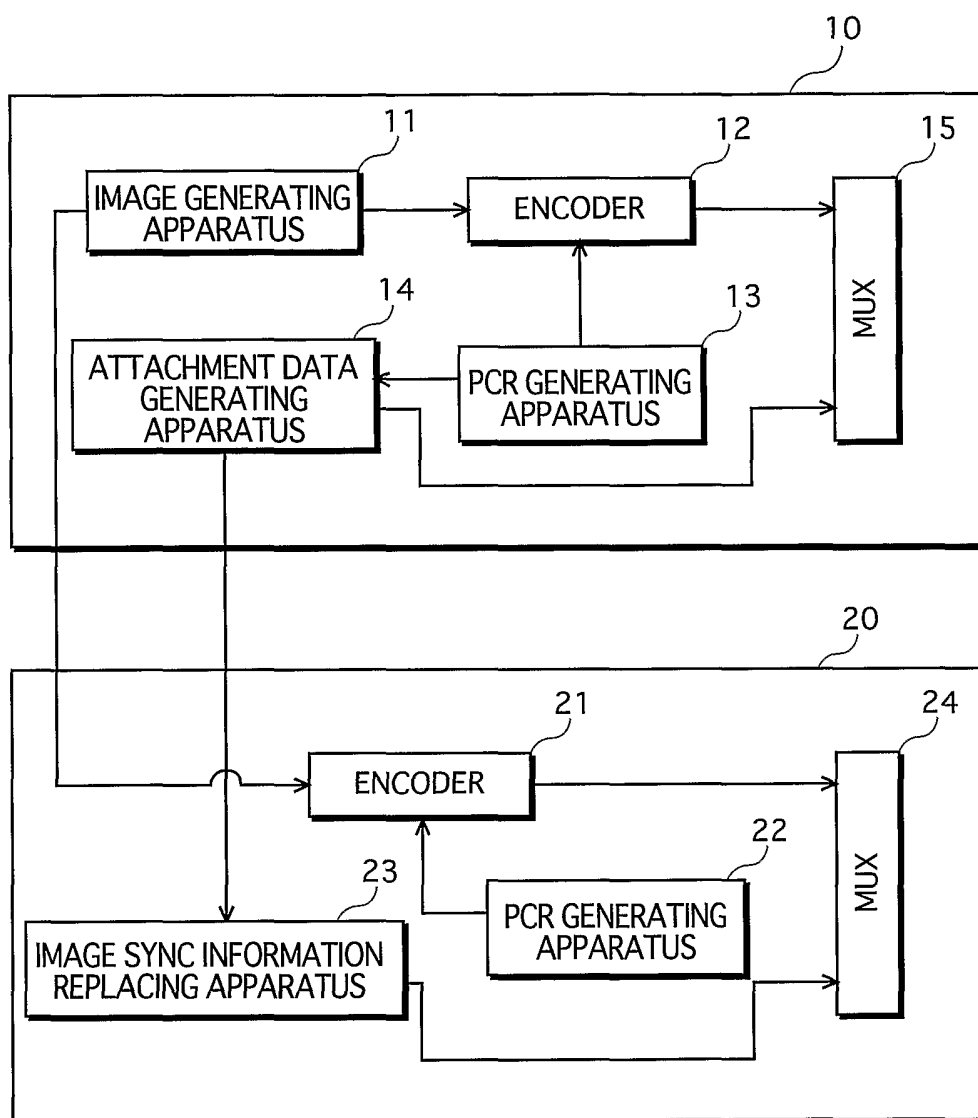
a sync information generating step for generating second sync information indicating timing which corresponds to the timing indicated by the first sync information and with which the attachment data is to be reproduced in synchronization with

15 a second encoded contents stream data having second time values; and

an outputting step for outputting the attachment data containing the second sync information instead of the first sync information.

20

FIG.1



1

FIG.2

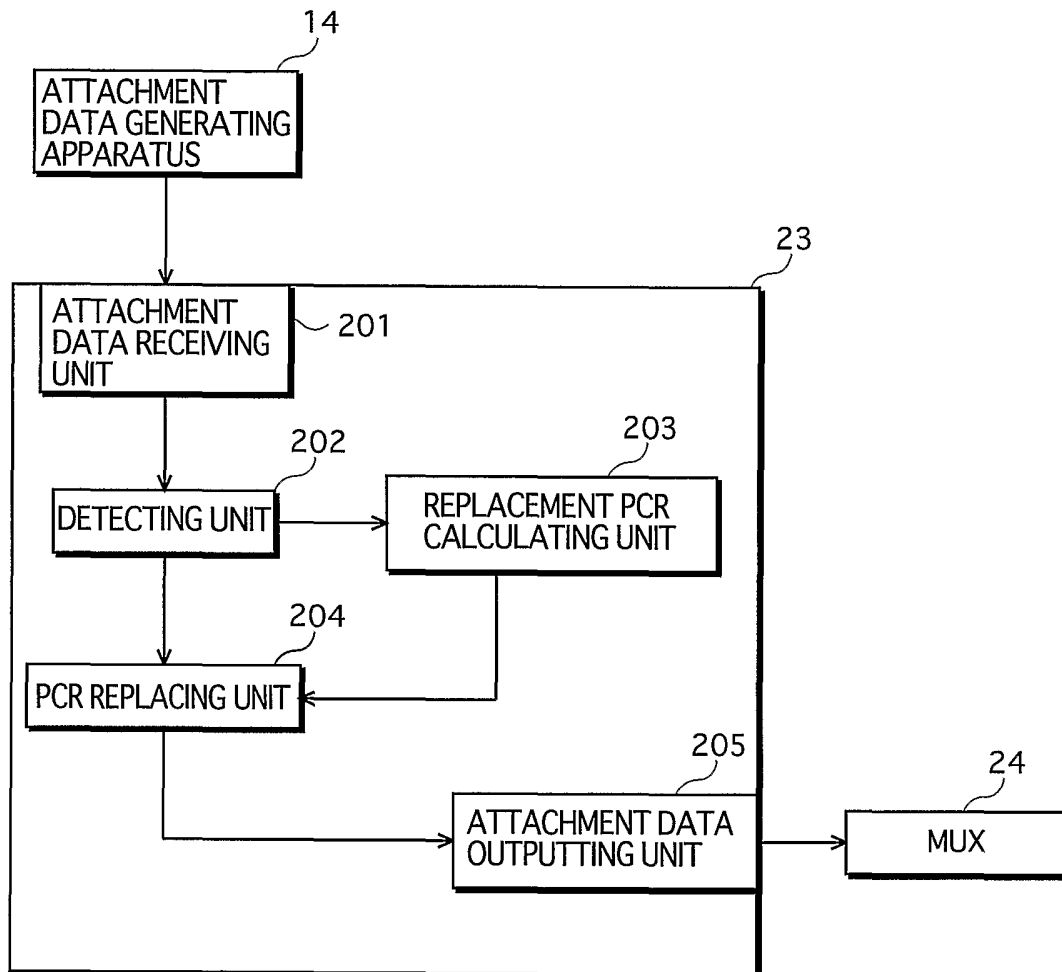


FIG.3

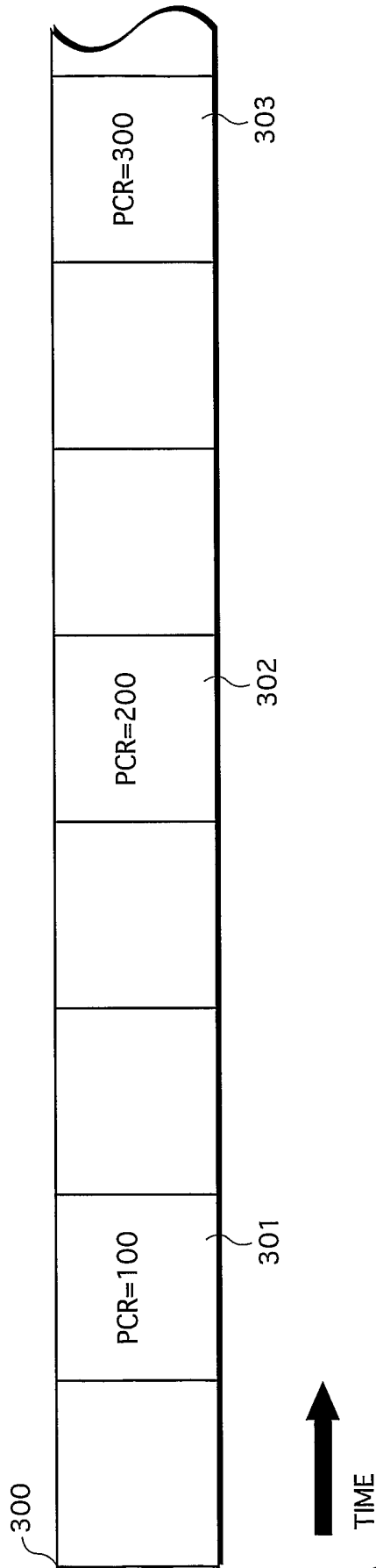


FIG. 4

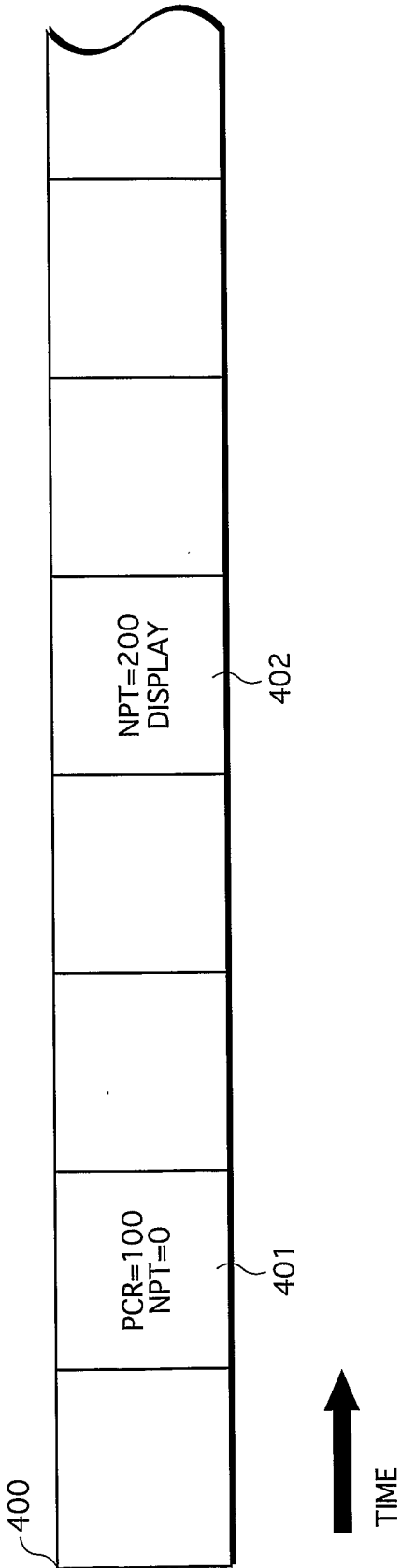


FIG.5

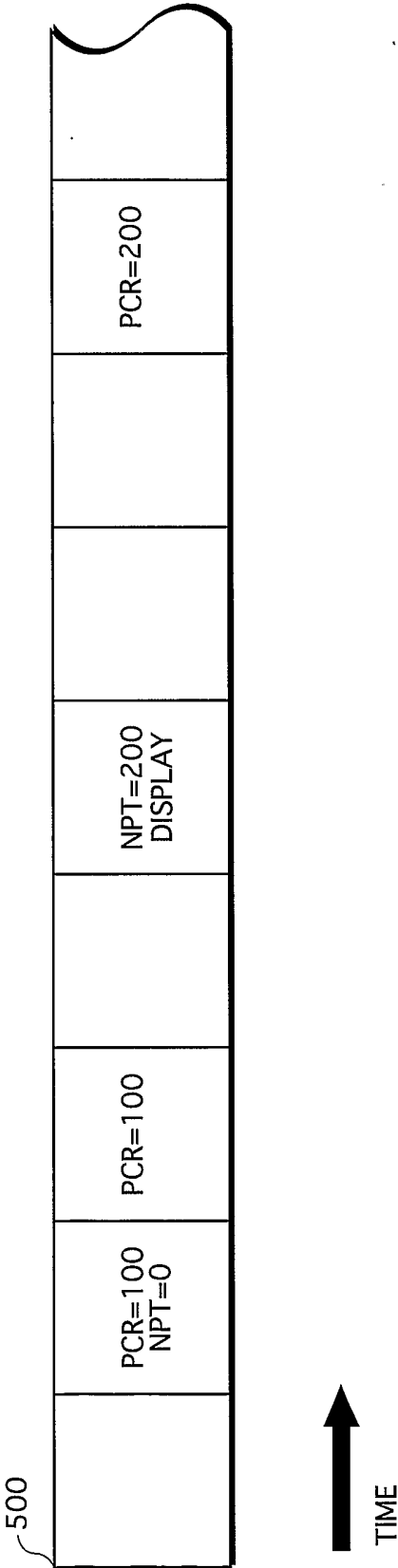


FIG.6

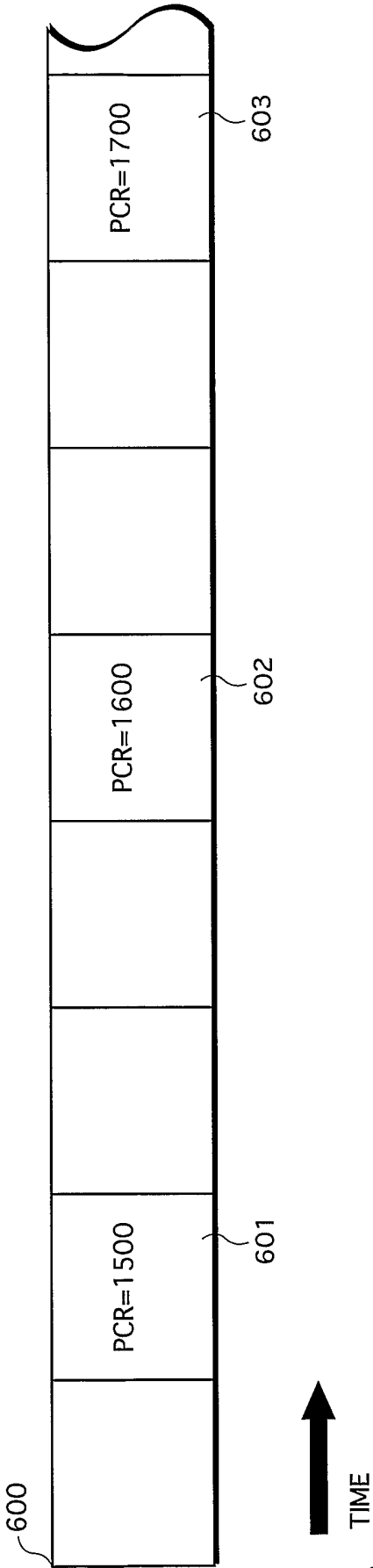


FIG.7

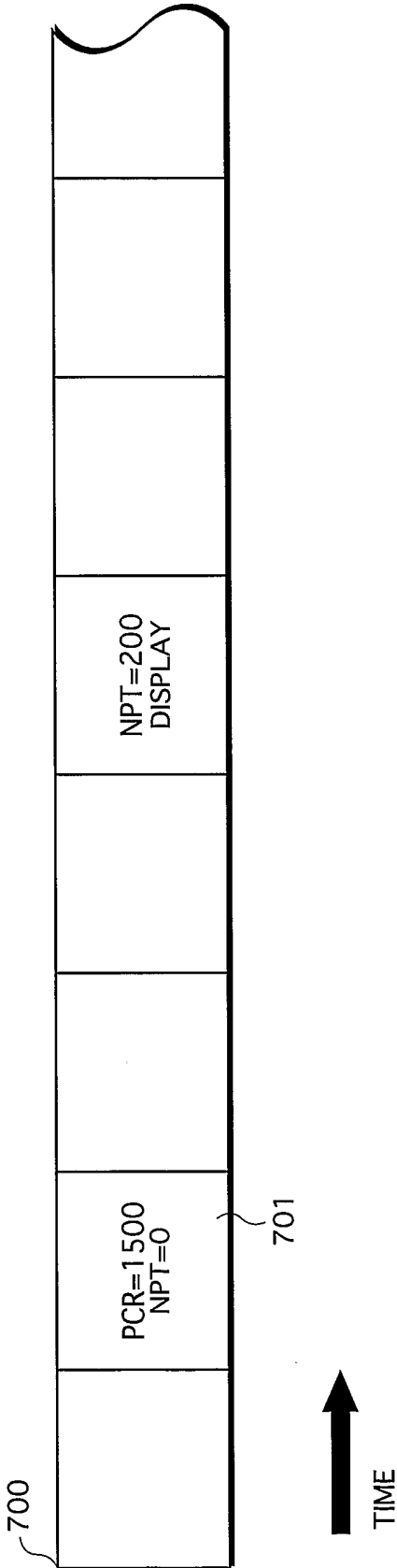


FIG.8

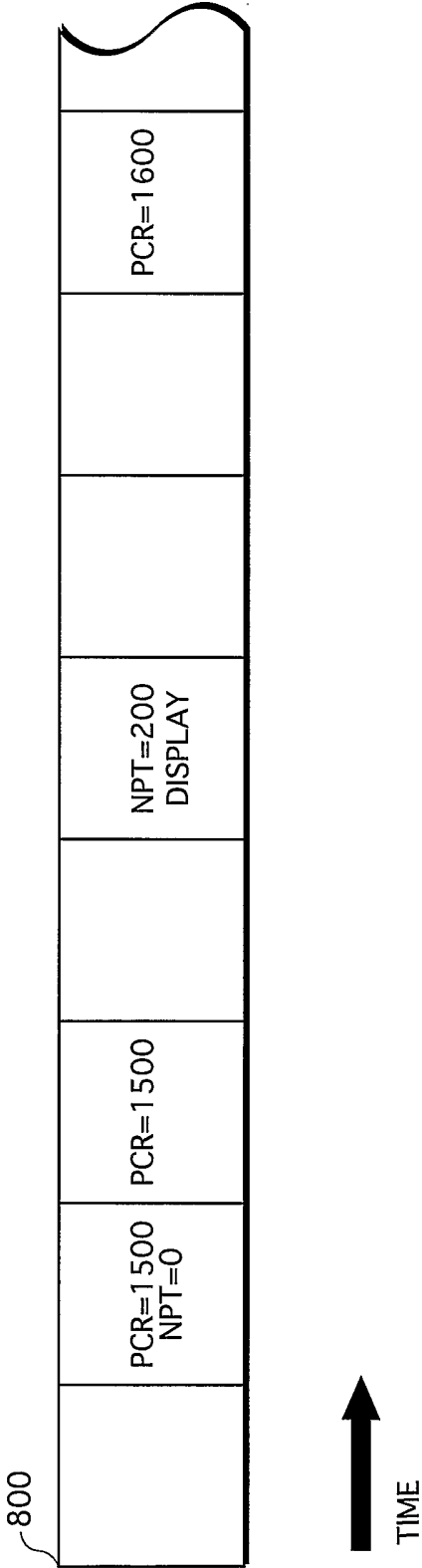


FIG.9

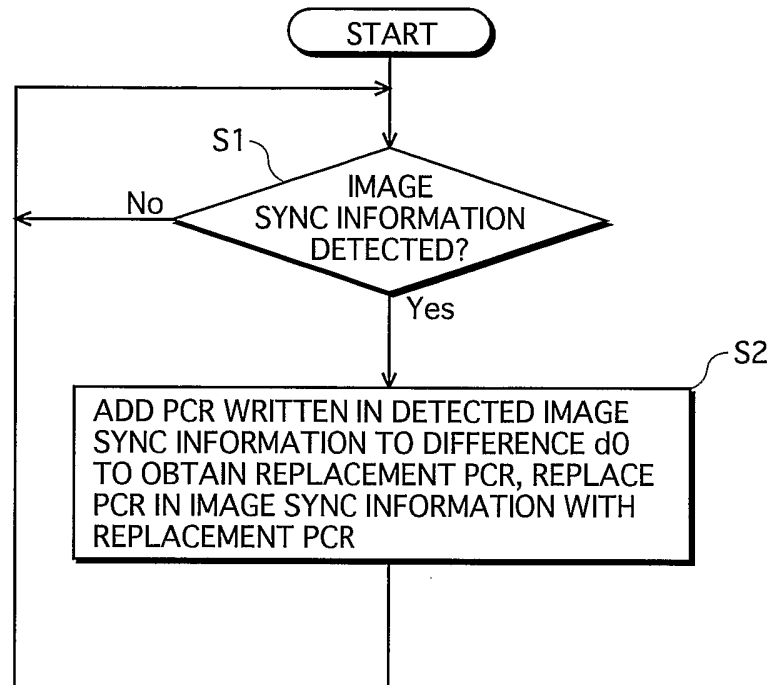
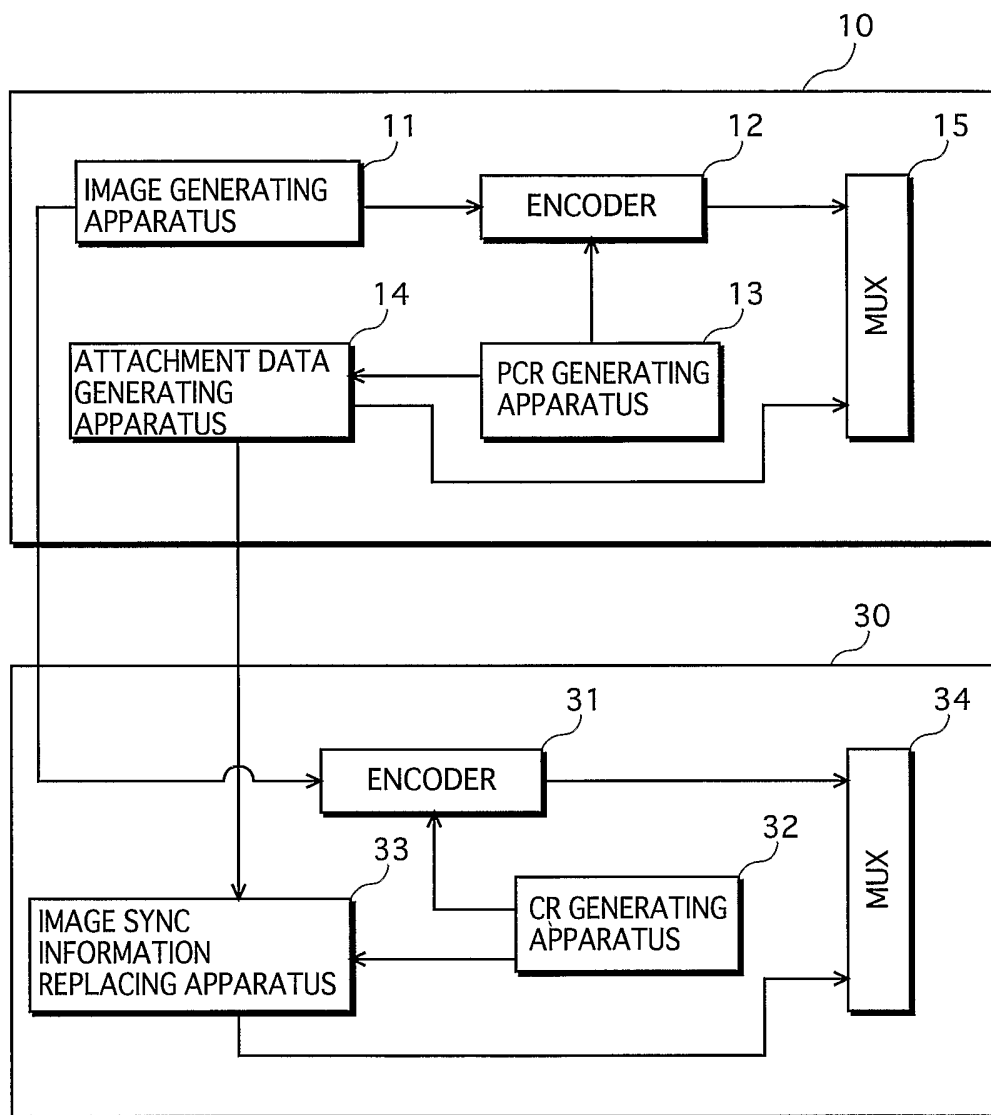


FIG.10



2

FIG.11

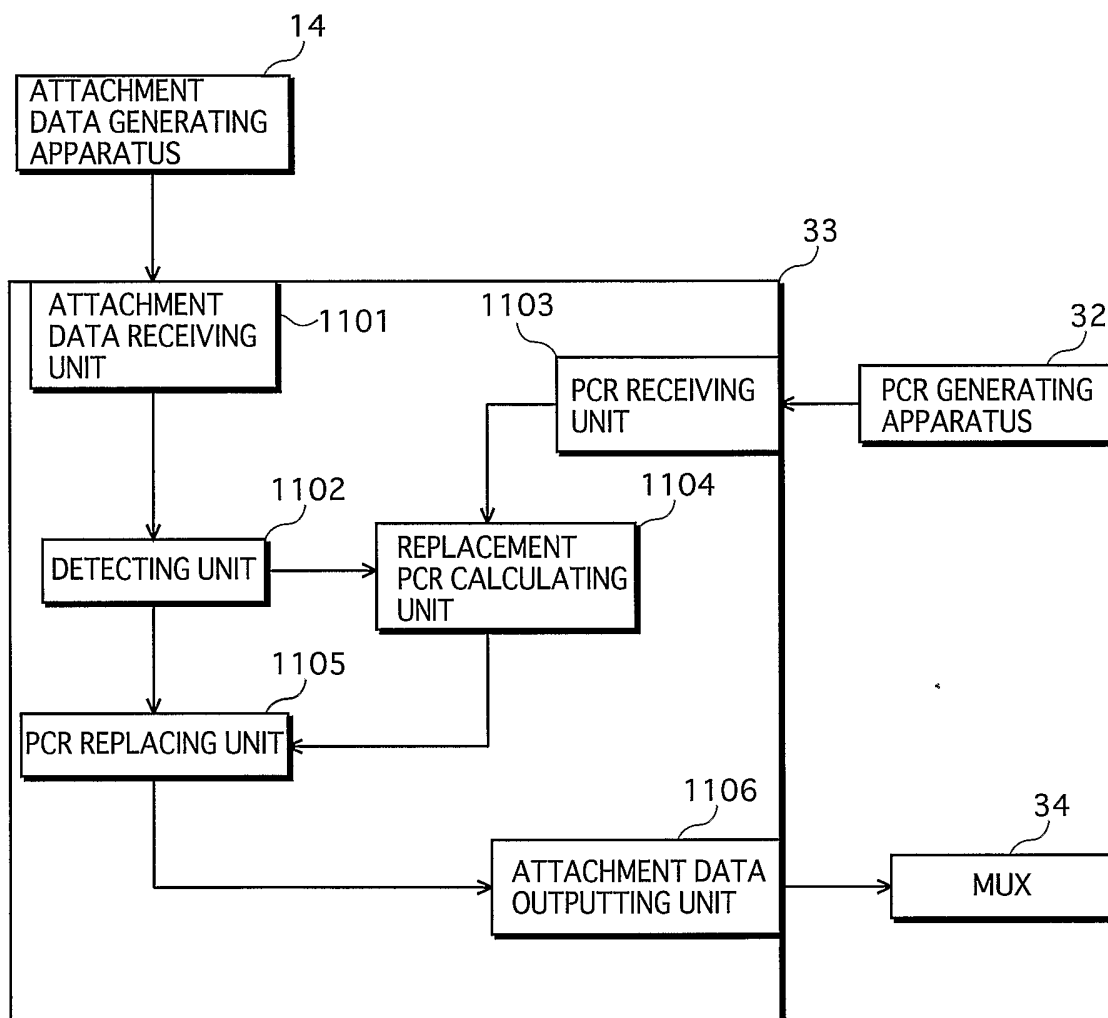


FIG.12

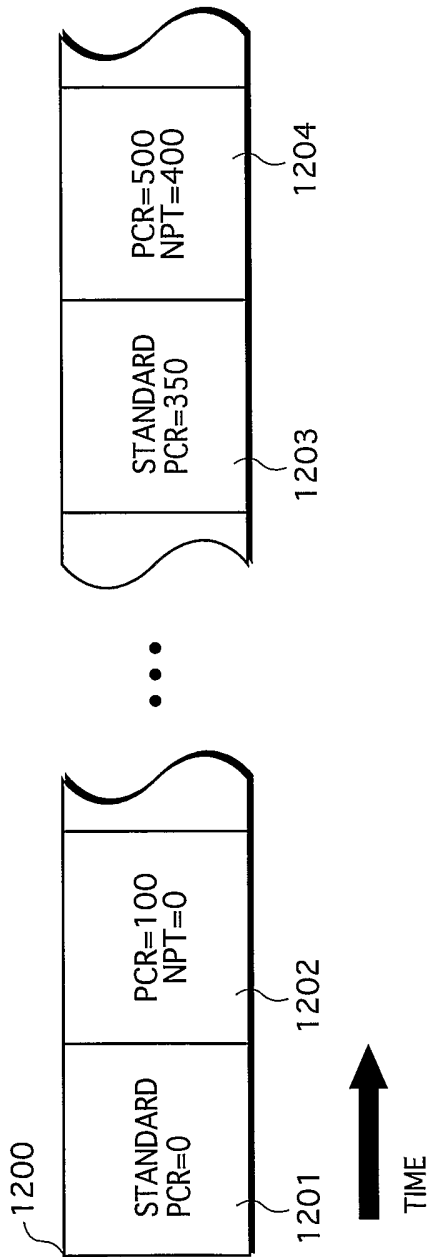


FIG.13

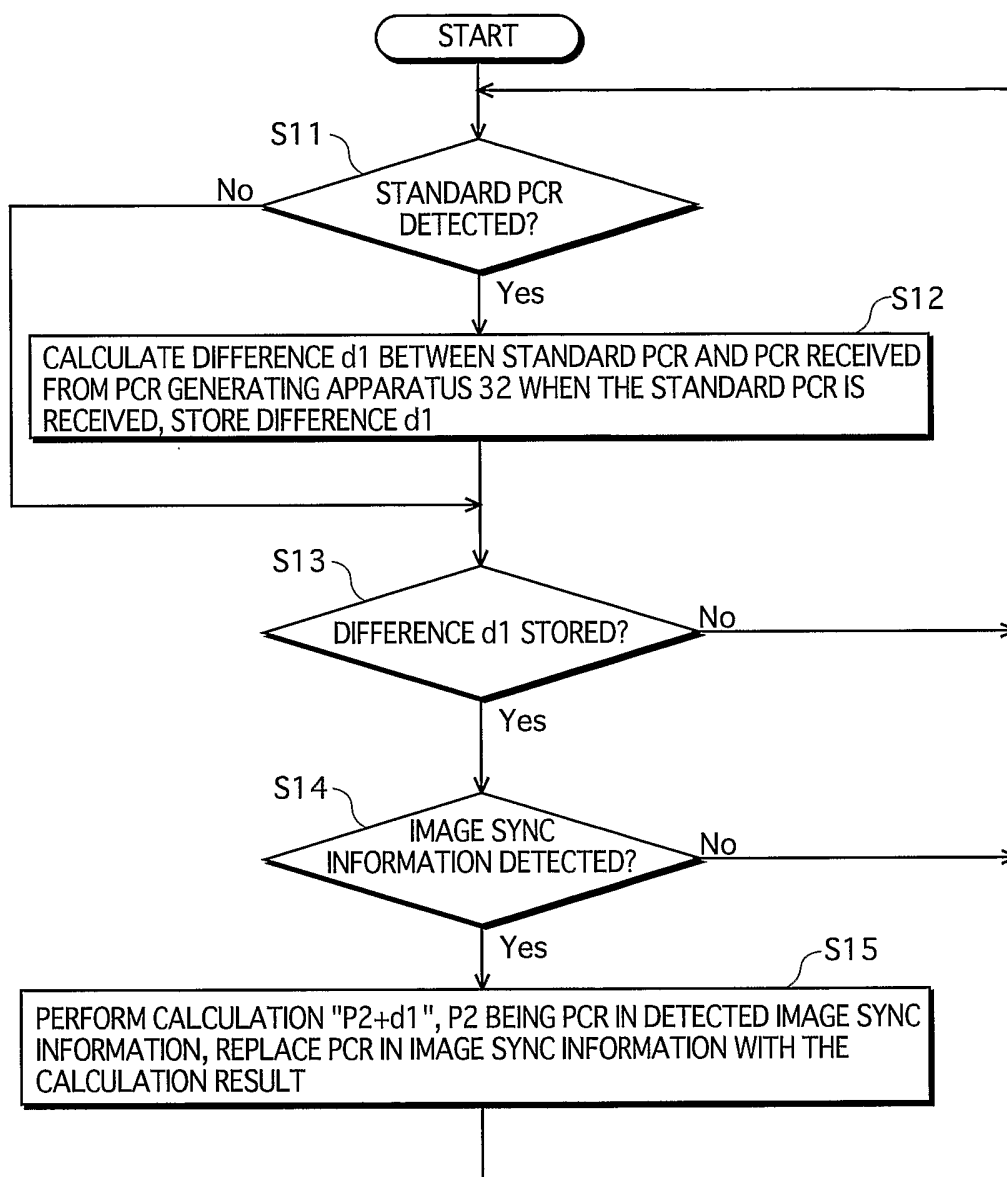


FIG.14

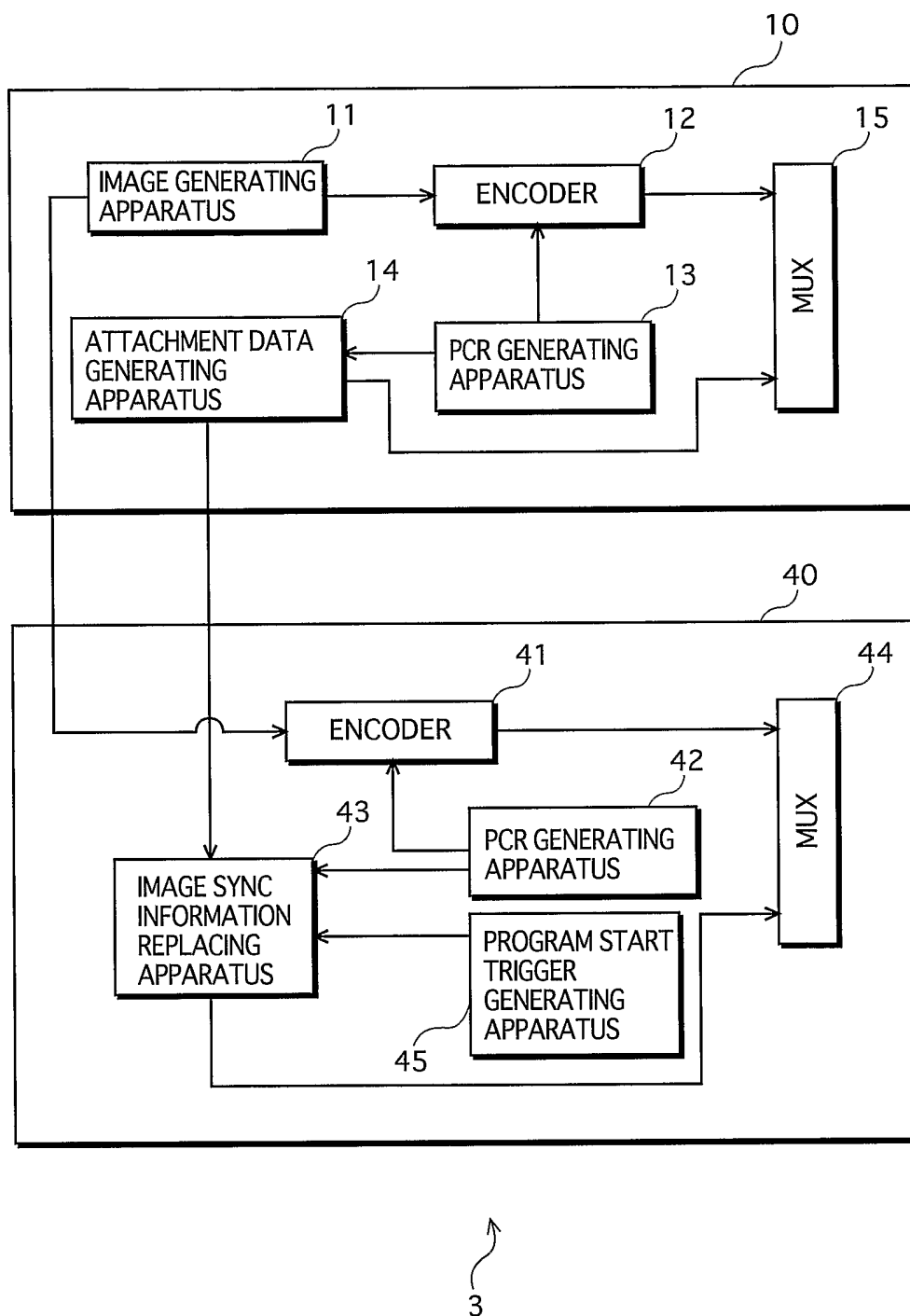


FIG.15

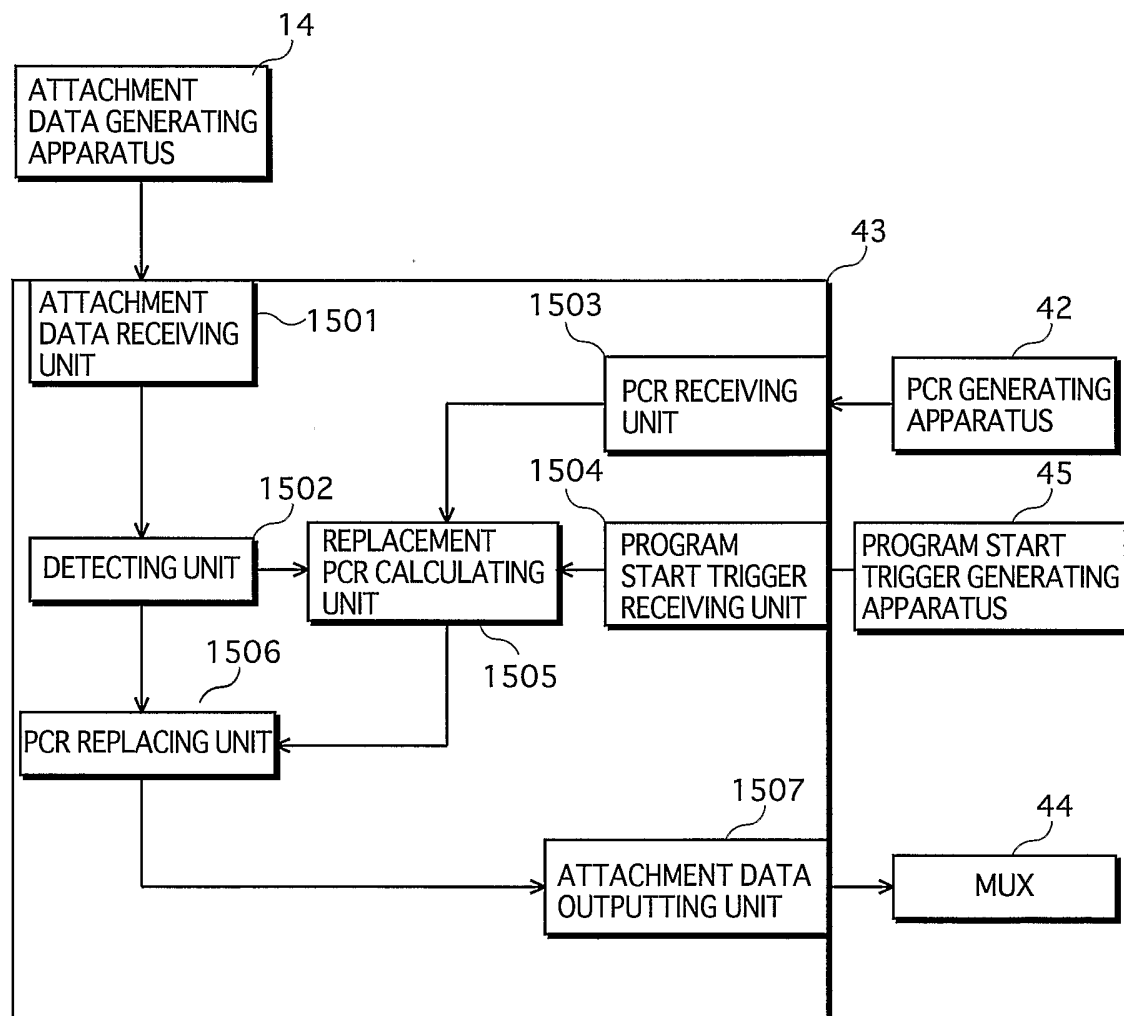


FIG.16

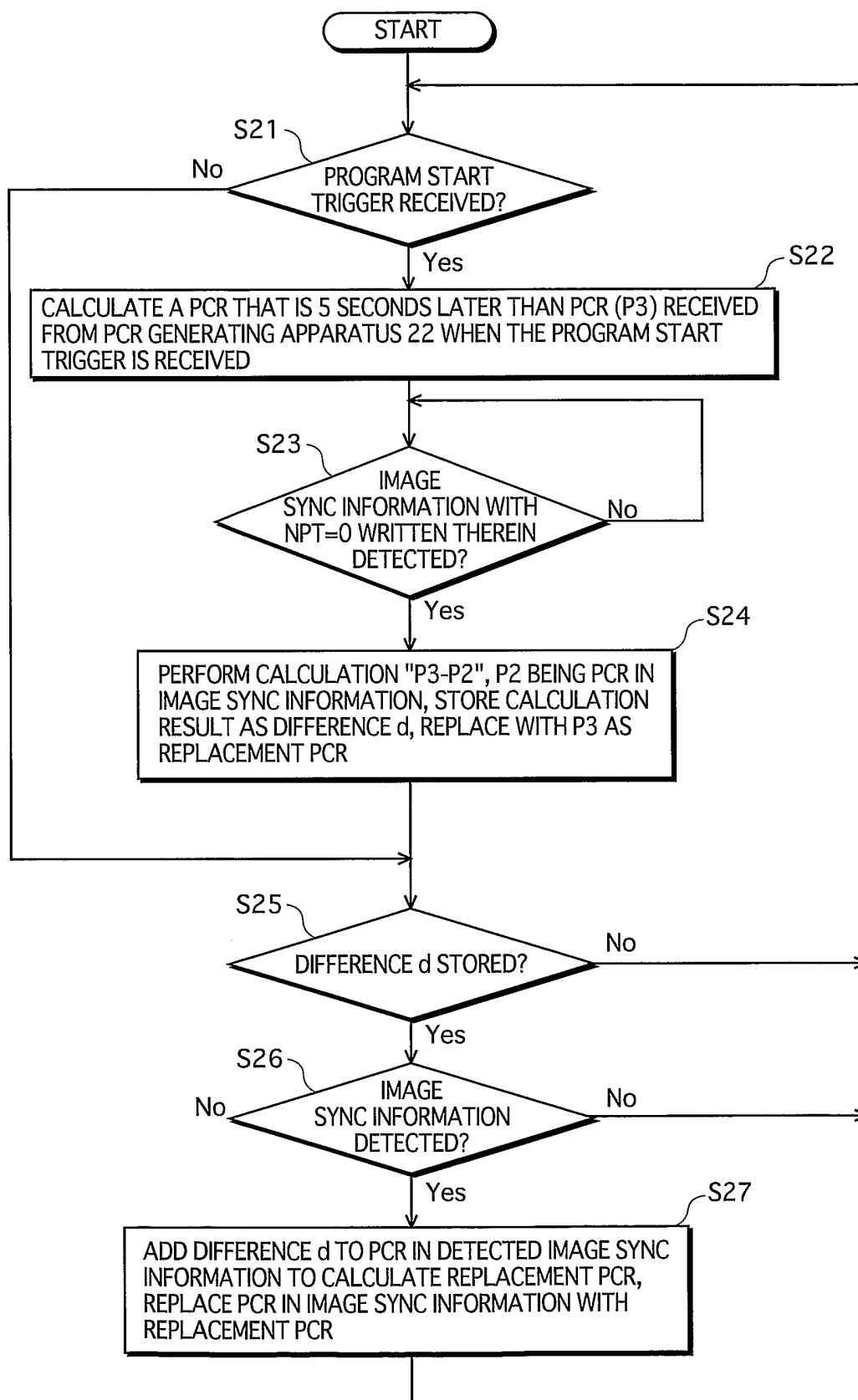


FIG.17

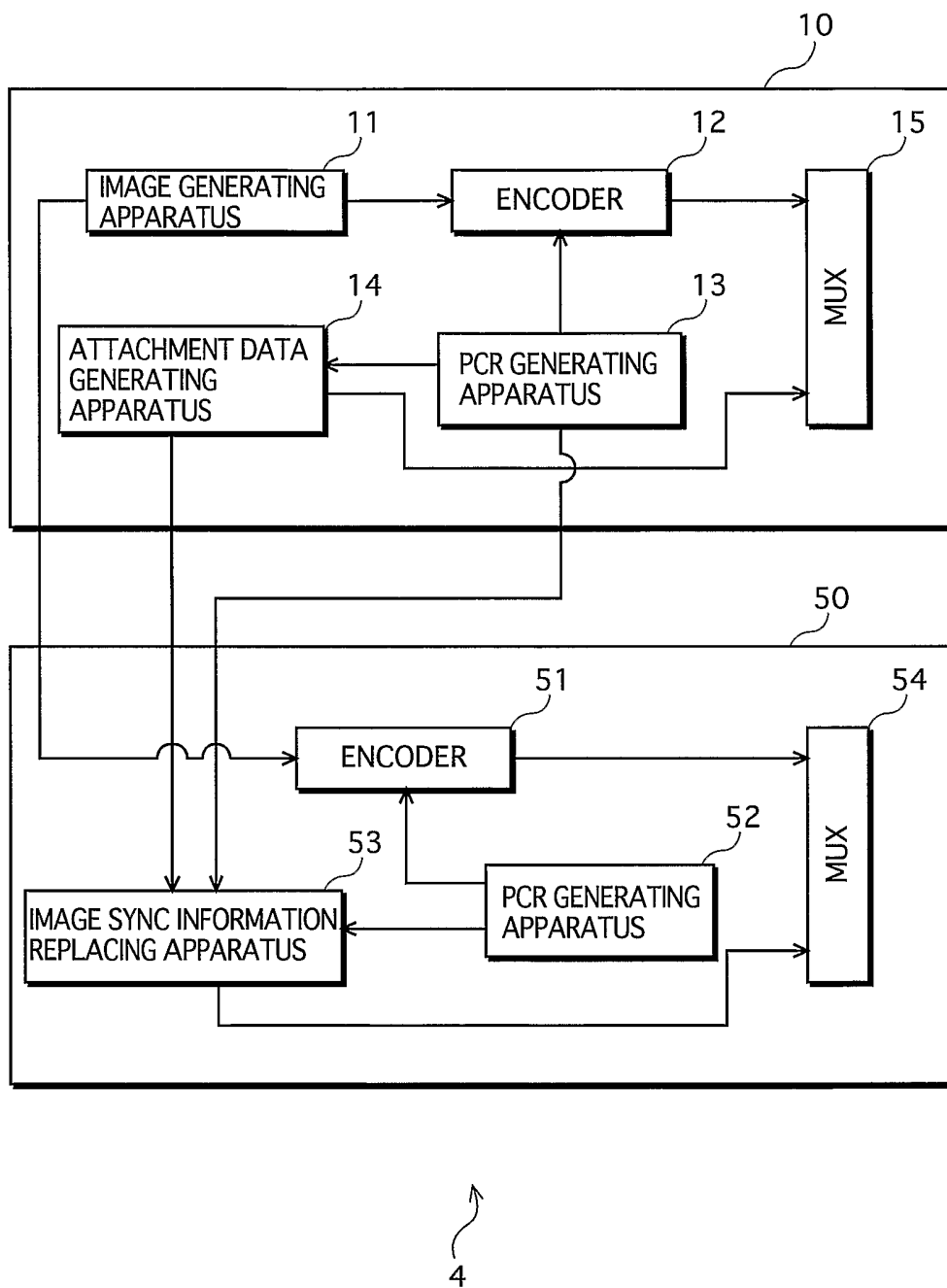


FIG.18

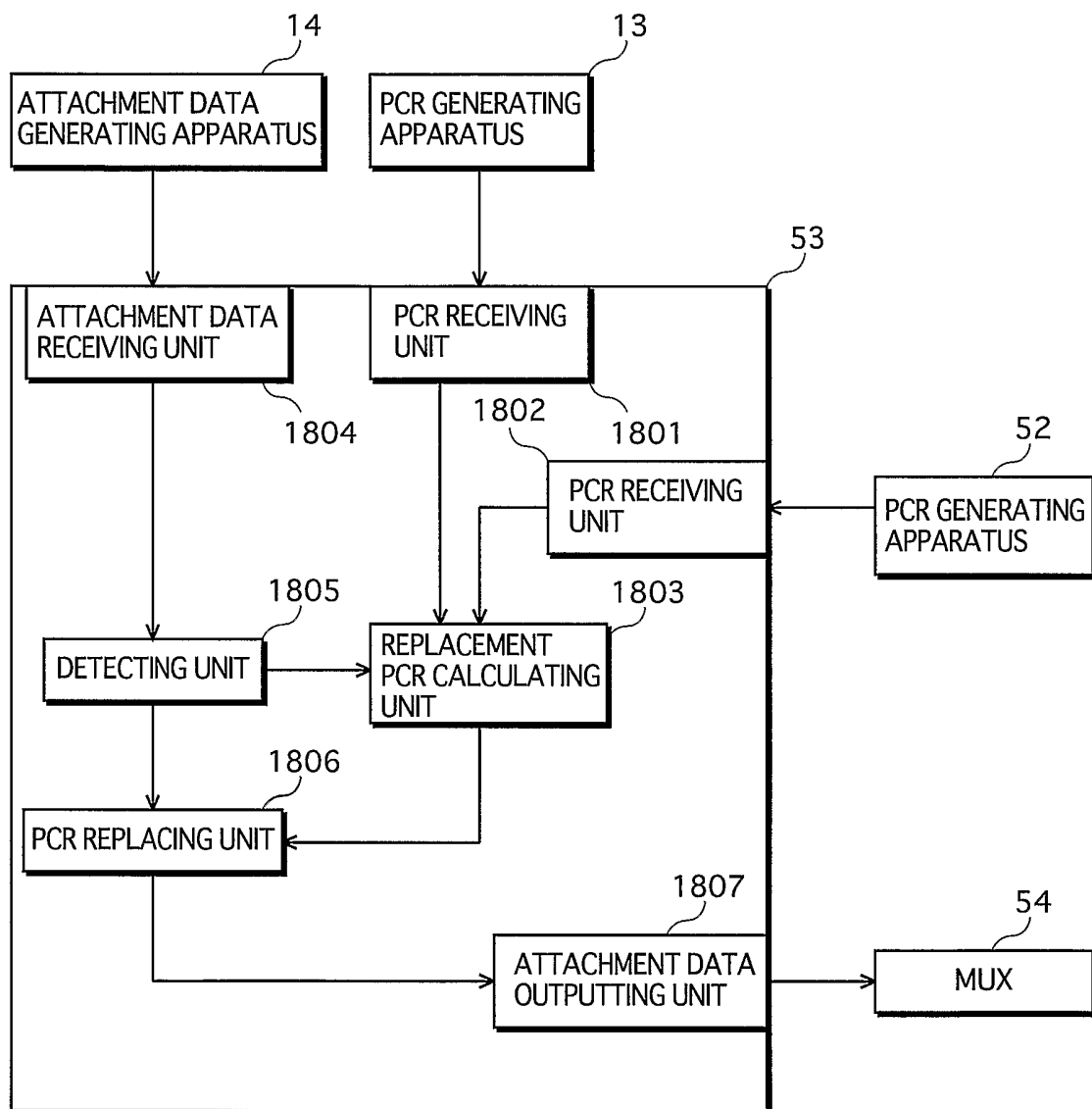


FIG.19

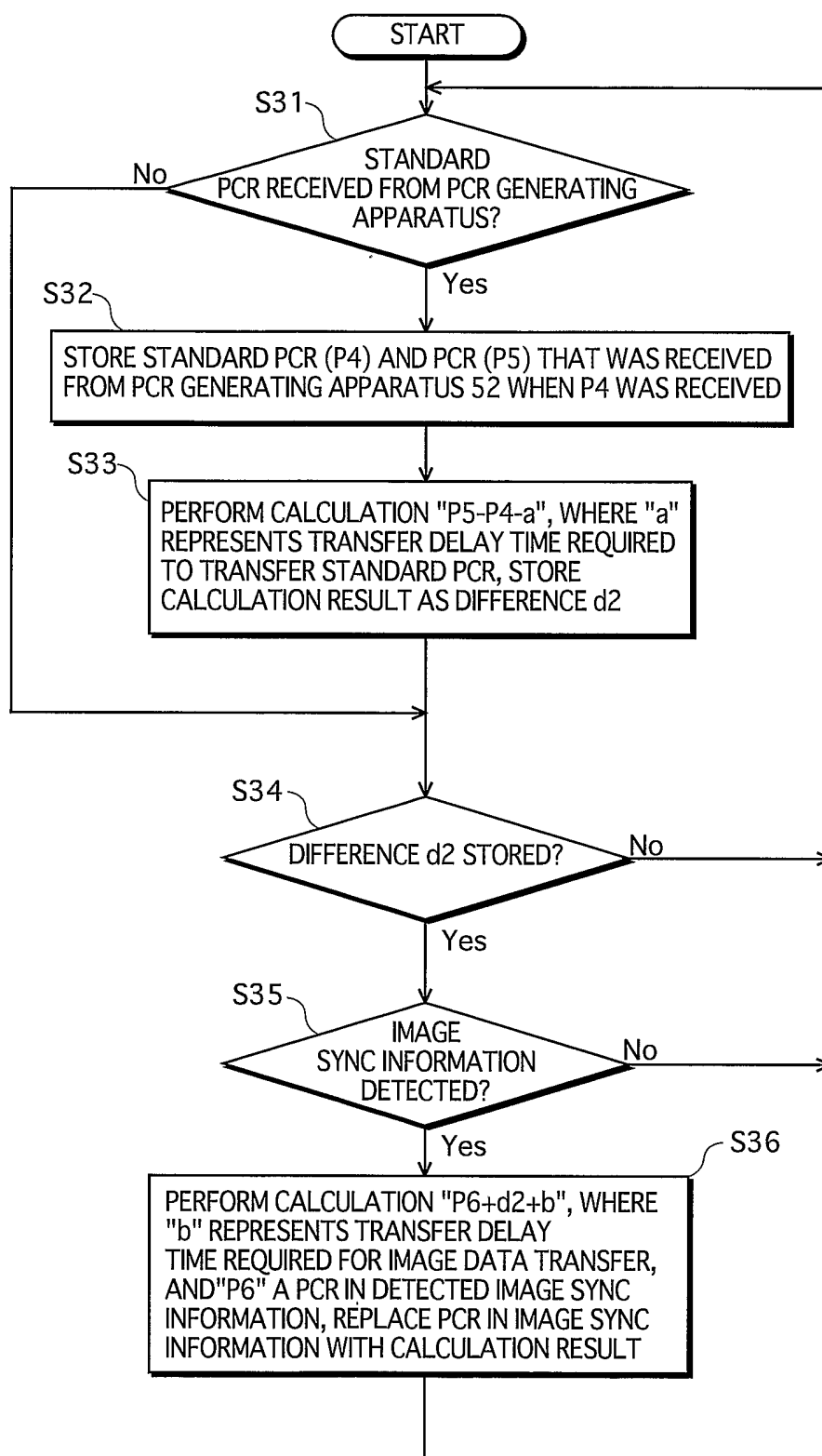


FIG.20

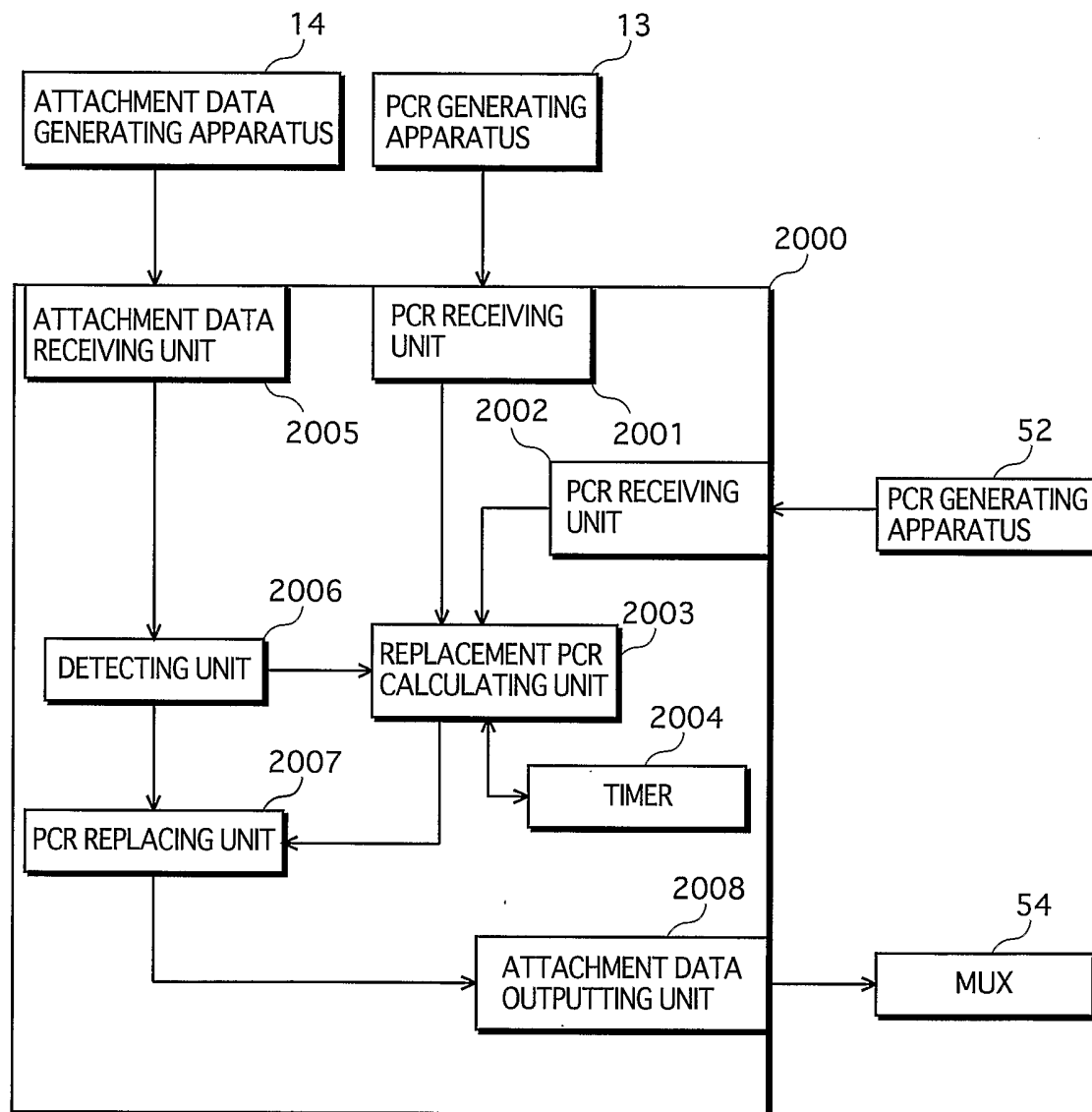


FIG.21

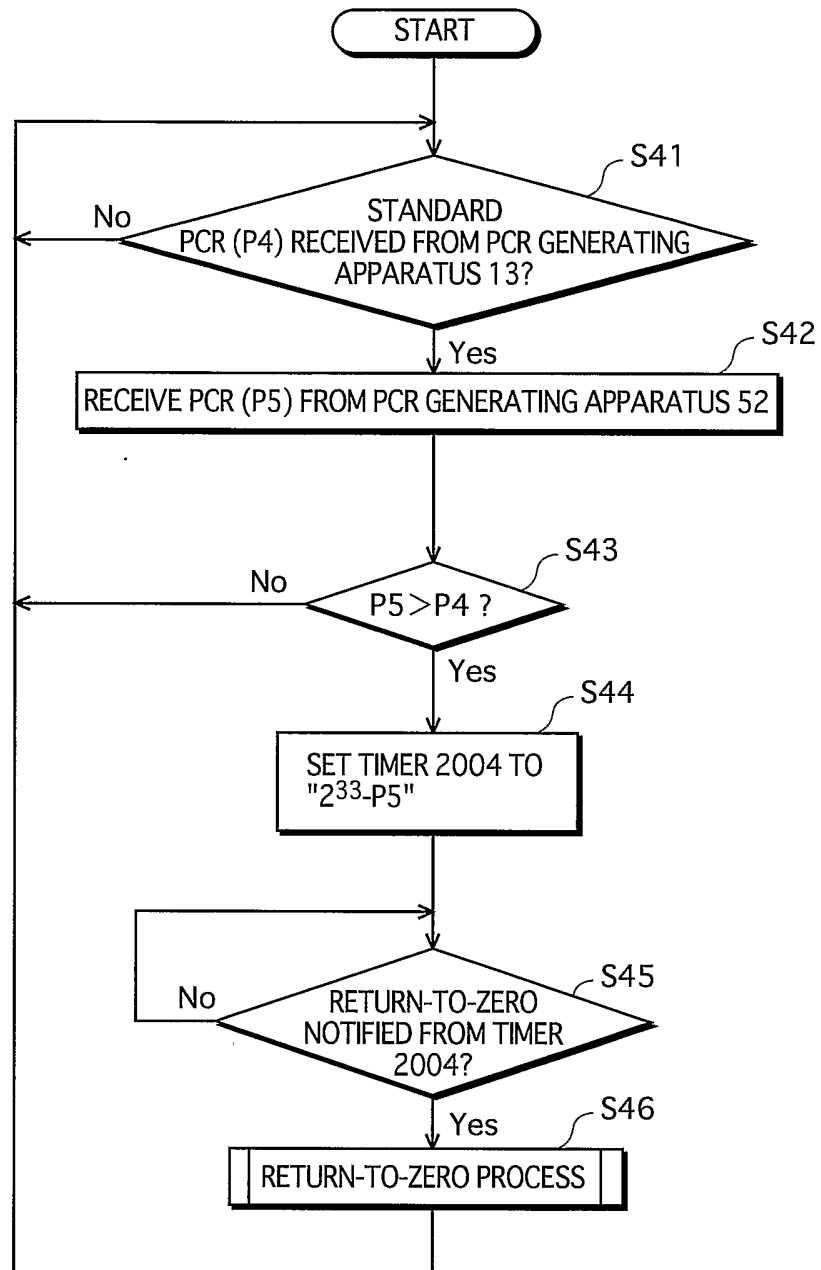


FIG.22

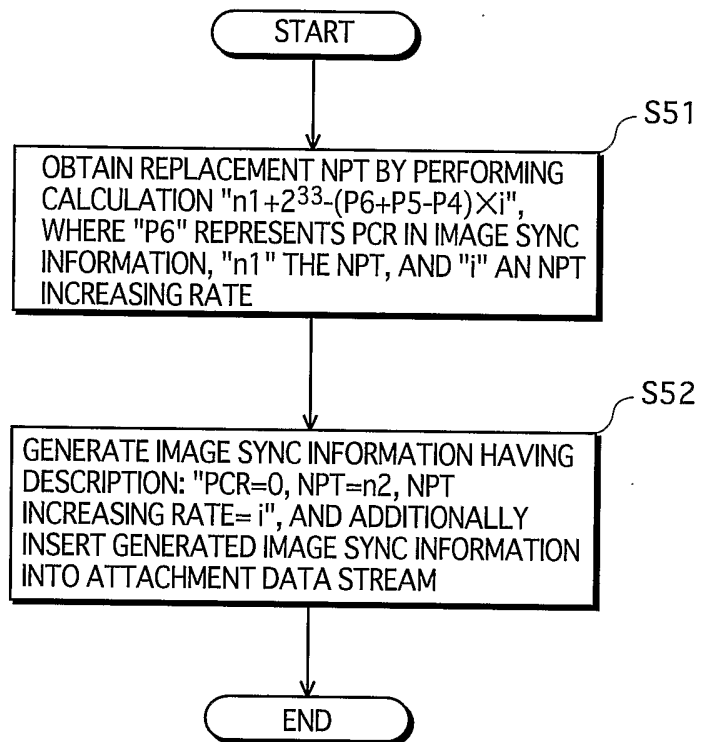


FIG.23

