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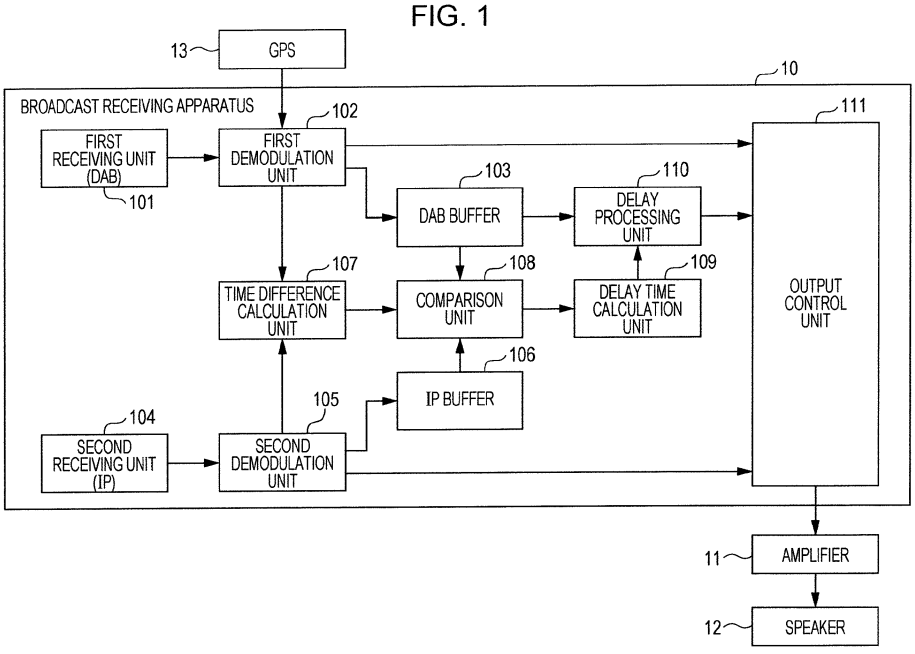
(54) BROADCAST RECEIVING APPARATUS AND OUTPUT CONTROL METHOD

(57) A broadcast receiving apparatus includes a time difference calculation unit (107) that calculates a time difference between time information added to audio data about a DAB broadcast and time information added to audio data about an IP broadcast. A comparison unit (108) compares the audio data about the DAB broadcast stored in a DAB buffer (103) with the audio data about the IP broadcast stored in an IP buffer (106). In identification of the same data as the audio data about the IP broadcast from the audio data about the DAB broadcast, the comparison unit (108) determines the audio data stored in a partial range of the DAB buffer (103) to be comparison target data on the basis of the calculated time difference and identifies the same data from the comparison target data to advance termination of the identification of the same data.

FIG. 1



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Description

[0001] The present invention relates to a broadcast receiving apparatus and an output control method. In particular, the present invention is preferably used for a broadcast receiving apparatus and an output control method capable of switching between a first standard broadcast and a second standard broadcast delayed from the first specification broadcast and selectively outputting the first standard broadcast or the second standard broadcast.

[0002] Broadcast receiving apparatuses have heretofore been proposed, which receive two broadcasts (for example, a digital audio broadcasting (DAB) broadcast and an Internet protocol (IP) broadcast) conforming to different standards but having the same content and switch between the two broadcasts to selectively output either of the broadcasts. With such an apparatus, for example, when the reception environment of one broadcast is degraded, switching to the other broadcast and outputting the other broadcast allows a user to continuously listen to the broadcast of the same content.

[0003] However, there are cases in which a time difference occurs between two broadcasts received by such a broadcast receiving apparatus. For example, in a broadcast receiving apparatus capable of switching between the DAB broadcast and the IP broadcast and selectively outputting the DAB broadcast or the IP broadcast, the IP broadcast is transmitted from a broadcasting station to the broadcast receiving apparatus via a provider, an Internet server, and so on. Accordingly, it is known that the time difference occurs between the DAB broadcast and the IP broadcast received by the broadcast receiving apparatus, that is, the reception of the IP broadcast is delayed from the reception of the DAB broadcast.

[0004] In order to resolve the above problem, technologies are proposed, which clear the time difference between the two broadcasts and synchronize the output timing of one broadcast with the output timing of the other broadcast to enable seamless switching between the two broadcasts.

[0005] For example, JP 2008-227599 A discloses a technology in which, in a dual-configuration IP broadcast transmission system including a 1-system IP transmission server and a 2-system IP transmission server, a time stamp is periodically added to a transport stream (TS) in each of the 1-system and the 2-system, a difference value between a program clock reference (PCR) code included in the TS and the time stamp is detected, and a synchronization process is performed to a TS signal on the basis of the difference value detected in each of the 1-system and the 2-system. With this technology, since IP packets from the 1-system IP transmission server and the 2-system IP transmission server are synchronously input into a switch, seamless switching between videos is achieved.

[0006] In order to calculate the time difference between two broadcasts for the synchronization between the output timing of one broadcast and the output timing of the other broadcast, a method of storing the respective pieces of broadcast data about the two broadcasts in buffers, identifying the same data as the other piece of broadcast data from one piece of broadcast data, and calculating the time difference between the reception timing of the same data identified from the one piece of broadcast data and the reception timing of the other piece of broadcast data has heretofore been used. However, this method has a problem in that it takes a long time to calculate the time difference.

[0007] Fig. 11 illustrates exemplary processing timing by a broadcast receiving apparatus in the related art. The broadcast receiving apparatus in the related art is exemplified here, which is capable of switching of output audio between the DAB broadcast and the IP broadcast. In this example, pieces of audio data having the same content "1" "2", "3" "4" ... are broadcasted in both the DAB broadcast and the IP broadcast. It is assumed here that one frame of the audio data is the broadcast data during a predetermined time (for example, one second) for schematic illustration.

[0008] As illustrated in Fig. 11, although the audio data about the DAB broadcast has the same content as that of the audio data about the IP broadcast, the IP broadcast is received with being delayed from the DAB broadcast because the IP broadcast is transmitted from a broadcasting station to the broadcast receiving apparatus via a provider, an Internet server, and so on. In the example illustrated in Fig. 11, the IP broadcast is delayed from the DAB broadcast by two frames of the audio data.

[0009] Accordingly, in the example illustrated in Fig. 11, a delay process for the audio data about the DAB broadcast is performed to synchronize the output timing of the audio data about the DAB broadcast with the output timing of the audio data about the IP broadcast so that the switching from the audio output of the DAB broadcast to the audio output of the IP broadcast is seamlessly performed.

[0010] Specifically, the broadcast receiving apparatus first detects the same data (link point) as the audio data about the IP broadcast stored in an IP buffer from the audio data about the DAB broadcast stored in a DAB buffer. Here, the broadcast receiving apparatus sequentially searches the pieces of audio data about the DAB broadcast stored in the DAB buffer from the beginning for the same data as the audio data about the IP broadcast.

[0011] For example, in the example illustrated in Fig. 11, upon turning on of a power supply of the broadcast receiving apparatus (timing t1 in Fig. 11) and reception of the audio data about the DAB broadcast and the audio data about the IP broadcast, the audio data about the DAB broadcast and the audio data about the IP broadcast, which are received, are sequentially stored in the respective buffers. In the example illustrated in Fig. 11, the DAB buffer has a capacity corresponding to six

frames of the audio data and the IP buffer has a capacity corresponding to one frame of the audio data. Upon reception of next new data when the maximum amount of audio data is stored in each buffer, the oldest data is deleted from the buffer and the next new data is stored in the buffer.

[0012] The example in Fig. 11 illustrates the states of the DAB buffer and the IP buffer at timing t2 in Fig. 11 when the audio data of six frames is first stored in the DAB buffer after the power supply of the broadcast receiving apparatus is switched to ON. At this time, the pieces of audio data [1] to [6] are stored in the DAB buffer and the piece of audio data [4] is stored in the IP buffer.

[0013] Upon storage of the maximum amount of audio data in each buffer, first, the broadcast receiving apparatus in the related art sequentially compares the pieces of audio data [1], [2], [3], and [4] stored in the DAB buffer with the piece of audio data [4] stored in the IP buffer to detect the same data as the piece of audio data [4] stored in the IP buffer from the DAB buffer. In other words, in the example in Fig. 11, the piece of audio data [4] about the DAB broadcast, which is the same as the piece of audio data [4] about the IP broadcast, is detected through the fourth comparison.

[0014] Then, the broadcast receiving apparatus in the related art calculates the time difference between the reception timing of the piece of audio data [4] about the IP broadcast and the reception timing of the piece of audio data [4] about the DAB broadcast as a delay time of the IP broadcast. The reception of the piece of audio data [4] about the IP broadcast when the piece of audio data [6] about the DAB broadcast is received indicates that the IP broadcast is delayed from the DAB broadcast by two frames of the audio data. In the example illustrated in Fig. 11, since the comparison process has been performed four times, it takes a processing time (a time period from the timing t2 to timing t3 in Fig. 11) corresponding to four frames of the audio data before the delay time of the IP broadcast is calculated.

[0015] Then, the broadcast receiving apparatus time-stretches the audio data about the DAB broadcast by a required number of frames (a time period from the timing t3 to timing t4 in Fig. 11) so that the calculated delay time of the IP broadcast is cleared. The time-stretch means that the frequency of a playback process is reduced to lengthen a playback time. This allows the broadcast receiving apparatus in the related art to clear the delay time of the IP broadcast. As a result, the broadcast receiving apparatus in the related art is capable of switching from the output of the DAB broadcast to the output of the IP broadcast in a state in which the output timing of the DAB broadcast is synchronized with the output timing of the IP broadcast (a state subsequent to the timing t4 in Fig. 11).

[0016] As described above, the broadcast receiving apparatus in the related art has a problem in that, since it takes a long time to calculate the delay time for the seamless switching of the output audio, the synchronization timing of the two broadcasts for seamless switching of the output audio is not moved up. Accordingly, when the switching to the IP broadcast is required because, for example, the reception environment of the DAB broadcast is degraded immediately after the power supply of the broadcast receiving apparatus is switched to ON, it takes a time to switch to the IP broadcast and the user is forced to listen to the output audio of the DAB broadcast.

[0017] Although the amount of data to be stored in the DAB buffer is set to the audio data of six frames (when one frame corresponds to one second, the amount of data corresponds to six seconds) in the example illustrated in Fig. 11, it may be necessary to store a larger amount of data in the DAB buffer. For example, when it is necessary to store the audio data corresponding to 60 seconds in the DAB buffer, the comparison process is started only after at least 60 seconds and the number of times of the comparison process is greatly increased.

It is an object of the present invention to move up the synchronization timing of two broadcasts for seamless switching of output audio.

[0018] The present invention relates to a broadcast receiving apparatus and a method according to the independent claims. Embodiments are disclosed in the dependent claims. The present invention according to an aspect provides a broadcast receiving apparatus that compares first standard broadcast data stored in a first storage unit with second standard broadcast data stored in a second storage unit to identify the same data as the second standard broadcast data stored in the second storage unit from the first standard broadcast data stored in the first storage unit; calculates a delay time of a second standard broadcast from a first standard broadcast on the basis of reception timing of the same data identified from the first standard broadcast data stored in the first storage unit and reception timing of the second standard broadcast data stored in the second storage unit; and performs a delay process to the first standard broadcast data in accordance with the calculated delay time to synchronize output timing of the first standard broadcast data with output timing of the second standard broadcast data. The broadcast receiving apparatus calculates a time difference between time information added to the first standard broadcast data and time information added to the second standard broadcast data, determines the broadcast data stored in a partial range of the first storage unit to be comparison target data on the basis of the calculated time difference, and performs the comparison to the comparison target data to identify the same data as the second standard broadcast data stored in the second storage unit from the comparison target data.

[0019] According to an embodiment of the present invention, the range of data to be compared is narrowed down through the calculation of the time difference in the first standard broadcast data stored in the first storage unit. Accordingly, it is possible to advance termination of the process of identifying the same data from the first

standard broadcast data. Consequently, it is possible to move up the synchronization timing of the two broadcasts for seamless switching of output audio.

BRIEF DESCRIPTION OF THE DRAWINGS

[0020]

Fig. 1 is a block diagram illustrating an exemplary functional configuration of a broadcast receiving apparatus according to a first embodiment of the present invention;

Fig. 2 is a flowchart illustrating an exemplary process performed by the broadcast receiving apparatus according to the first embodiment of the present invention;

Fig. 3 illustrates exemplary processing timing by the broadcast receiving apparatus according to the first embodiment of the present invention;

Fig. 4 is a block diagram illustrating an exemplary functional configuration of a broadcast receiving apparatus according to a second embodiment of the present invention;

Fig. 5 is a flowchart illustrating an exemplary process performed by the broadcast receiving apparatus according to the second embodiment of the present invention;

Fig. 6 illustrates exemplary processing timing by the broadcast receiving apparatus according to the second embodiment of the present invention;

Fig. 7 is a block diagram illustrating an exemplary functional configuration of a broadcast receiving apparatus according to a third embodiment of the present invention;

Fig. 8 is a flowchart illustrating an exemplary process performed by the broadcast receiving apparatus according to the third embodiment of the present invention;

Fig. 9 illustrates exemplary processing timing by the broadcast receiving apparatus according to the third embodiment of the present invention;

Fig. 10 illustrates exemplary processing timing by a broadcast receiving apparatus according to a fourth embodiment of the present invention; and

Fig. 11 illustrates exemplary processing timing by a broadcast receiving apparatus in the related art.

[0021] Embodiments of the present invention will herein be described with reference to the attached drawings. Fig. 1 is a block diagram illustrating an exemplary functional configuration of a broadcast receiving apparatus 10 according to a first embodiment of the present invention. The broadcast receiving apparatus 10 illustrated in Fig. 1 is capable of receiving the DAB broadcast (an example of a first standard broadcast) and the IP broadcast (an example of a second standard broadcast) and switching between the audio of the received DAB broadcast and the audio of the received IP broadcast to selectively output the audio of the DAB broadcast or the audio of the IP broadcast to a speaker 12.

[0022] Referring to Fig. 1, the broadcast receiving apparatus 10 includes a first receiving unit 101, a first demodulation unit 102, a DAB buffer 103, a second receiving unit 104, a second demodulation unit 105, an IP buffer 106, a time difference calculation unit 107, a comparison unit 108, a delay time calculation unit 109, a delay processing unit 110, and an output control unit 111.

[0023] Each of the above functional blocks 101 to 111 may be configured by any of hardware, a digital signal processor (DSP), and software. For example, when the above functional blocks 101 to 111 are configured by software, the functional blocks 101 to 111 practically include a central processing unit (CPU), a random access memory (RAM), a read only memory (ROM), and so on in a computer and are realized by running programs. The programs are stored in a storage medium, such as the RAM, the ROM, a hard disk, or a semiconductor memory.

[0024] The first receiving unit 101 receives broadcast waves of the DAB broadcast. The first demodulation unit 102 demodulates a digital audio signal included in the broadcast waves of the DAB broadcast received by the first receiving unit 101. The DAB buffer 103 (first storage unit) stores audio data included in the DAB broadcast (the DAB broadcast subjected to the demodulation by the first demodulation unit 102) received by the first receiving unit 101. The maximum amount of audio data about the DAB broadcast capable of being stored in the DAB buffer 103 is set in advance.

[0025] The second receiving unit 104 receives communication data about the IP broadcast. The second demodulation unit 105 demodulates a digital audio signal included in the communication data about the IP broadcast received by the second receiving unit 104. The IP buffer 106 (second storage unit) stores audio data included in the IP broadcast (the IP broadcast subjected to the demodulation by the second demodulation unit 105) received by the second receiving unit 104. The maximum amount of audio data about the IP broadcast capable of being stored in the IP buffer 106 is set in advance.

[0026] The IP broadcast received by the second receiving unit 104 has the same content as that of the DAB broadcast received by the first receiving unit 101. However, the IP broadcast received by the second receiving unit 104 is received with being delayed from the DAB broadcast received by the first receiving unit 101. This is because the first receiving unit 101 directly receives the broadcast waves of the DAB broadcast while the second receiving unit 104 receives the communication data about the IP broadcast transmitted from a broadcasting station via a provider, an Internet server, and so on.

[0027] The output control unit 111 switches between the digital audio signal of the DAB broadcast (the DAB broadcast subjected to the demodulation by the first demodulation unit 102) received by the first receiving unit 101 and the digital audio signal of the IP broadcast (the IP broadcast subjected to the demodulation by the sec-

ond demodulation unit 105) received by the second receiving unit 104 and selectively outputs the digital audio signal of the DAB broadcast or the digital audio signal of the IP broadcast. For example, the output control unit 111 switches to and outputs the DAB broadcast when the reception signal strength of the DAB broadcast is higher than a predetermined threshold value. In contrast, the output control unit 111 switches to and outputs the IP broadcast when the reception signal strength of the DAB broadcast is lower than the predetermined threshold value. In other words, the output control unit 111 preferentially outputs the DAB broadcast having a quality higher than that of the IP broadcast. The audio signal output from the output control unit 111 is amplified by an amplifier 11 and the audio is output from the speaker 12.

[0028] The time difference calculation unit 107 calculates a time difference between time information added to the audio data about the DAB broadcast and time information added to the audio data about the IP broadcast. The time information has already been added to the audio data about the IP broadcast when the audio data about the IP broadcast is received by the second receiving unit 104. In contrast, the time information supplied from a Global Positioning System (GPS) 13 is added to the audio data about the DAB broadcast when the audio data about the DAB broadcast is received by the first receiving unit 101.

[0029] The comparison unit 108 compares the audio data about the DAB broadcast stored in the DAB buffer 103 with the audio data about the IP broadcast stored in the IP buffer 106 to identify the same data as the audio data about the IP broadcast stored in the IP buffer 106 from the audio data about the DAB broadcast stored in the DAB buffer 103.

[0030] In the first embodiment, the comparison unit 108 determines the audio data stored in a partial range of the DAB buffer 103 to be comparison target data on the basis of the time difference calculated by the time difference calculation unit 107. Then, the comparison unit 108 compares the comparison target data with the audio data about the IP broadcast stored in the IP buffer 106 to identify the same data as the audio data about the IP broadcast stored in the IP buffer 106 from the comparison target data.

[0031] Specifically, in the first embodiment, the comparison unit 108 sets a comparison start position at a positon after the beginning in the audio data about the DAB broadcast stored in the DAB buffer 103 on the basis of the time difference calculated by the time difference calculation unit 107 and determines the data after the comparison start position to be the comparison target data. Then, the comparison unit 108 compares the comparison target data with the audio data about the IP broadcast stored in the IP buffer 106 to identify the same data as the audio data about the IP broadcast stored in the IP buffer 106 from the comparison target data.

[0032] The delay time calculation unit 109 calculates a delay time of the IP broadcast from the DAB broadcast on the basis of the reception timing of the same data identified by the comparison unit 108 from the audio data about the DAB broadcast stored in the DAB buffer 103 and the reception timing of the audio data about the IP broadcast stored in the IP buffer 106. For example, when the reception timing of the same data identified from the audio data about the DAB broadcast stored in the DAB buffer 103 is two seconds before the reception timing of the audio data about the IP broadcast stored in the IP buffer 106, the delay time calculation unit 109 calculates the delay time of the IP broadcast from the DAB broadcast as "two seconds."

[0033] The delay processing unit 110 performs a delay process (time-stretching) to the audio data about the DAB broadcast in accordance with the delay time calculated by the delay time calculation unit 109. The delay processing unit 110 synchronizes the output timing of the audio data about the DAB broadcast output from the output control unit 111 with the output timing of the audio data about the IP broadcast output from the output control unit 111 through the delay process (time-stretching).

Exemplary process by broadcast receiving apparatus 10

[0034] Fig. 2 is a flowchart illustrating an exemplary process performed by the broadcast receiving apparatus 10 according to the first embodiment of the present invention. The process illustrated in Fig. 2 is performed, for example, upon switching of a power supply of the broadcast receiving apparatus 10 to ON.

[0035] Referring to Fig. 2, in Step S202, the first receiving unit 101 starts reception of the DAB broadcast. In Step S204, the first demodulation unit 102 demodulates the digital audio signal included in the broadcast waves of the DAB broadcast received by the first receiving unit 101. In Step S206, the DAB buffer 103 stores the audio data included in the digital audio signal subjected to the demodulation by the first demodulation unit 102.

[0036] In Step S208, the second receiving unit 104 starts reception of the IP broadcast. In Step S210, the second demodulation unit 105 demodulates the digital audio signal included in the communication data about the IP broadcast received by the second receiving unit 104. In Step S212, the IP buffer 106 stores the audio data included in the digital audio signal subjected to the demodulation by the second demodulation unit 105. Practically, the processing until the audio data about the DAB broadcast is stored in the DAB buffer 103 (Steps S202 to S206) is performed in parallel with the processing until the audio data about the IP broadcast is stored in the IP buffer 106 (Steps S208 to S212).

[0037] In Step S214, the time difference calculation unit 107 determines whether the maximum amount of data is stored in the DAB buffer 103. If the time difference calculation unit 107 determines that the maximum amount of data is not stored in the DAB buffer 103 (NO in Step S214), the process goes back to Step S202 to perform the processing in Step S202 and the subsequent

steps again.

[0038] If the time difference calculation unit 107 determines that the maximum amount of data is stored in the DAB buffer 103 (YES in Step S214), in Step S216, the time difference calculation unit 107 acquires the time information added to the audio data about the DAB broadcast. In Step S218, the time difference calculation unit 107 acquires the time information added to the audio data about the IP broadcast. In Step S220, the time difference calculation unit 107 calculates the time difference between the time information added to the audio data about the DAB broadcast and the time information added to the audio data about the IP broadcast.

[0039] In Step S222, the comparison unit 108 sets the comparison start position at a positon after the beginning in the audio data about the DAB broadcast stored in the DAB buffer 103 on the basis of the time difference calculated in Step S220. In Step S224, the comparison unit 108 compares the comparison target data after the comparison start position set in Step S222 with the audio data about the IP broadcast stored in the IP buffer 106 to identify the same data (link point) as the audio data about the IP broadcast stored in the IP buffer 106 from the comparison target data.

[0040] In Step S226, the delay time calculation unit 109 calculates the delay time of the IP broadcast from the DAB broadcast on the basis of the reception timing of the audio data about the IP broadcast stored in the IP buffer 106 and the reception timing of the same data identified from the comparison target data stored in the DAB buffer 103 in Step S224. In Step S228, the delay processing unit 110 starts the delay process for the audio data about the DAB broadcast output from the output control unit 111.

[0041] In Step S230, the delay processing unit 110 determines whether the delay time of the IP broadcast calculated in Step S226 is cleared. If the delay processing unit 110 determines that the delay time of the IP broadcast is not cleared (NO in Step S230), the process performs the determination in Step S230 again.

[0042] If the delay processing unit 110 determines that the delay time of the IP broadcast is cleared (YES in Step S230), in Step S232, the delay processing unit 110 terminates the delay process for the audio data about the DAB broadcast output from the output control unit 111. Then, the process illustrated in Fig. 2 is terminated.

Exemplary processing timing

[0043] Fig. 3 illustrates exemplary processing timing by the broadcast receiving apparatus 10 according to the first embodiment of the present invention. In the example illustrated in Fig. 3, the pieces of audio data having the same content [1], [2], [3], [4], ... are broadcasted in both the DAB broadcast and the IP broadcast. It is assumed here that one frame of the audio data is the audio data during a predetermined time (for example, one second) for schematic illustration.

[0044] As illustrated in Fig. 3, although the audio data about the DAB broadcast has the same content as that of the audio data about the IP broadcast, the IP broadcast is received with being delayed from the DAB broadcast because the IP broadcast is transmitted from a broadcasting station to the broadcast receiving apparatus via a provider, an Internet server, and so on. In the example illustrated in Fig. 3, the IP broadcast is delayed from the DAB broadcast by two frames of the audio data.

[0045] Accordingly, in the example illustrated in Fig. 3, the delay process for the audio data about the DAB broadcast is performed to synchronize the output timing of the audio data about the DAB broadcast with the output timing of the audio data about the IP broadcast so that the switching from the audio output of the DAB broadcast to the audio output of the IP broadcast is seamlessly performed.

[0046] Specifically, upon turning on of the power supply of the broadcast receiving apparatus 10 (timing t1 in Fig. 3) and reception of the audio data about the DAB broadcast and the audio data about the IP broadcast, the broadcast receiving apparatus 10 of the first embodiment sequentially stores the audio data about the DAB broadcast and the audio data about the IP broadcast, which are received, in the DAB buffer 103 and the IP buffer 106, respectively.

[0047] In the example illustrated in Fig. 3, the DAB buffer 103 has a capacity corresponding to six frames of the audio data and the IP buffer 106 has a capacity corresponding to one frame of the audio data. The example in Fig. 3 illustrates the states of the DAB buffer 103 and the IP buffer 106 at timing t2 in Fig. 3 when the audio data of six frames (the pieces of audio data [1] to [6]) is first stored in the DAB buffer 103 after the power supply of the broadcast receiving apparatus 10 is switched to ON. At this time, the piece of audio data [4] is stored in the IP buffer 106.

[0048] After the maximum amount (six frames) of audio data is stored in the DAB buffer 103, first, the time difference calculation unit 107 calculates the time difference between the time information about the audio data about the DAB broadcast and the time information about the audio data about the IP broadcast. Then, the comparison unit 108 sets the comparison start position in the audio data stored in the DAB buffer 103 on the basis of the calculated time difference. In the example illustrated in Fig. 3, since the time difference is about two frames of the audio data, the comparison unit 108 has enough time to set the piece of audio data [3] three frames before the pieces of audio data [6] as the comparison start position.

[0049] Then, the comparison unit 108 sequentially compares the pieces of audio data [3] and [4] stored in the DAB buffer 103 with the piece of audio data [4] stored in the IP buffer 106 to detect the same data as the piece of audio data [4] stored in the IP buffer 106 from the DAB buffer 103. In other words, in the example in Fig. 3, the piece of audio data [4] about the DAB broadcast, which is the same as the piece of audio data [4] about the IP

broadcast, is detected through the second comparison.

[0050] Then, the delay time calculation unit 109 calculates the time difference between the reception timing of the piece of audio data [4] about the IP broadcast and the reception timing of the piece of audio data [4] about the DAB broadcast as the delay time of the IP broadcast. The reception of the piece of audio data [4] about the IP broadcast when the piece of audio data [6] about the DAB broadcast is received indicates that the IP broadcast is delayed from the DAB broadcast by two frames of the audio data.

[0051] Then, the delay processing unit 110 time-stretches the audio data about the DAB broadcast by a required number of frames (a time period from timing t3 to timing t4 in Fig. 3) so that the calculated delay time of the IP broadcast is cleared. This allows the broadcast receiving apparatus 10 to clear the delay time of the IP broadcast. As a result, the broadcast receiving apparatus 10 is capable of switching from the output of the DAB broadcast to the output of the IP broadcast in a state in which the output timing of the DAB broadcast is synchronized with the output timing of the IP broadcast (a state subsequent to the timing t4 in Fig. 3).

[0052] In the example illustrated in Fig. 3, since the comparison between the audio data stored in the IP buffer 106 and the audio data stored in the DAB buffer 103 is performed two times, it takes a processing time (a time period from the timing t2 to the timing t3 in Fig. 3) corresponding to two frames of the audio data to calculate the delay time of the IP broadcast. In other words, the processing time to calculate the delay time of the IP broadcast is reduced by two frames of the audio data, compared with the example in the related art (refer to Fig. 11). Accordingly, in the example illustrated in Fig. 3, the timing (the timing t4) when the output timing of the audio data about the DAB broadcast is synchronized with the output timing of the audio data about the IP broadcast is moved up by two frames of the audio data, compared with the example in the related art.

[0053] As described above, with the broadcast receiving apparatus 10 of the first embodiment, the comparison process to identify the same data is started from a position closer to the same data as the audio data about the IP broadcast stored in the IP buffer 106, in the audio data about the DAB broadcast stored in the DAB buffer 103. Accordingly, the time required to perform the comparison process to identify the same data is reduced to advance the termination of the comparison process. As a result, with the broadcast receiving apparatus 10 of the first embodiment, the synchronization timing of the two broadcasts for seamless switching of the output audio is moved up.

[0054] A second embodiment of the present invention will now be described with reference to Figs. 4 to 6. Fig. 4 is a block diagram illustrating an exemplary functional configuration of a broadcast receiving apparatus 10' according to the second embodiment of the present invention. The broadcast receiving apparatus 10' illustrated in Fig. 4 differs from the broadcast receiving apparatus 10 (refer to Fig. 1) of the first embodiment in that the broadcast receiving apparatus 10' includes a time difference calculation unit 107' and a comparison unit 108', instead of the time difference calculation unit 107 and the comparison unit 108.

[0055] The time difference calculation unit 107' calculates the time difference between the time information added to the audio data about the DAB broadcast and the time information added to the audio data about the IP broadcast. The time difference calculation unit 107' of the second embodiment differs from the time difference calculation unit 107 of the first embodiment in that the time difference calculation unit 107' calculates the time difference without waiting for the storage of the maximum amount of audio data in the DAB buffer 103. The time information is added to the audio data about the DAB broadcast by the GPS 13 at constant, relatively short intervals (for example, one second). The time information is added to the audio data about the IP broadcast by the GPS 13 at constant, relatively long intervals (for example, two seconds). Accordingly, the time difference calculation unit 107' calculates the time difference between the two pieces of time information when the time information is added to both the audio data about the DAB broadcast and the audio data about the IP broadcast.

[0056] When the time difference is calculated by the time difference calculation unit 107' before the maximum amount of audio data is stored in the DAB buffer 103, the comparison unit 108' determines the audio data stored in the DAB buffer 103 at this time to be the comparison target data and compares the comparison target data with the audio data about the IP broadcast stored in the IP buffer 106 to identify the same data as the audio data about the IP broadcast stored in the IP buffer 106 from the comparison target data.

Exemplary process by broadcast receiving apparatus 10'

[0057] Fig. 5 is a flowchart illustrating an exemplary process performed by the broadcast receiving apparatus 10' according to the second embodiment of the present invention. The process illustrated in Fig. 5 is performed, for example, upon switching of a power supply of the broadcast receiving apparatus 10' to ON.

[0058] Referring to Fig. 5, in Step S502, the first receiving unit 101 starts reception of the DAB broadcast. In Step S504, the first demodulation unit 102 demodulates the digital audio signal included in the broadcast waves of the DAB broadcast received by the first receiving unit 101. In Step S506, the DAB buffer 103 stores the audio data included in the digital audio signal subjected to the demodulation by the first demodulation unit 102.

[0059] In Step S508, the second receiving unit 104 starts reception of the IP broadcast. In Step S510, the second demodulation unit 105 demodulates the digital audio signal included in the communication data about the IP broadcast received by the second receiving unit

104. In Step S512, the IP buffer 106 stores the audio data included in the digital audio signal subjected to the demodulation by the second demodulation unit 105.

[0060] In Step S514, the time difference calculation unit 107' determines whether both the time information added to the audio data about the DAB broadcast and the time information added to the audio data about the IP broadcast are acquired. If the time difference calculation unit 107' determines that both the time information about the DAB broadcast and the time information about the IP broadcast are not acquired (NO in Step S514), the process goes back to Step S502 to perform the processing in Step S502 and the subsequent steps again.

[0061] If the time difference calculation unit 107' determines that both the time information about the DAB broadcast and the time information about the IP broadcast are acquired (YES in Step S514), in Step S516, the time difference calculation unit 107' calculates the time difference between the time information about the DAB broadcast and the time information about the IP broadcast, which are acquired. In Step S518, the comparison unit 108' uses the audio data stored in the DAB buffer 103 at the time when the time difference is calculated as the comparison target data and compares the comparison target data with the audio data about the IP broadcast stored in the IP buffer 106 to identify the same data (link point) as the audio data about the IP broadcast stored in the IP buffer 106 from the comparison target data.

[0062] In Step S520, the delay time calculation unit 109 calculates the delay time of the IP broadcast from the DAB broadcast on the basis of the reception timing of the audio data about the IP broadcast stored in the IP buffer 106 and the reception timing of the same data identified from the comparison target data stored in the DAB buffer 103 in Step S518. In Step S522, the delay processing unit 110 starts the delay process for the audio data about the DAB broadcast output from the output control unit 111.

[0063] In Step S524, the delay processing unit 110 determines whether the delay time of the IP broadcast calculated in Step S520 is cleared. If the delay processing unit 110 determines that the delay time of the IP broadcast is not cleared (NO in Step S524), the process performs the determination in Step S524 again.

[0064] If the delay processing unit 110 determines that the delay time of the IP broadcast is cleared (YES in Step S524), in Step S526, the delay processing unit 110 terminates the delay process for the audio data about the DAB broadcast output from the output control unit 111. Then, the process illustrated in Fig. 5 is terminated.

Exemplary processing timing

[0065] Fig. 6 illustrates exemplary processing timing by the broadcast receiving apparatus 10' according to the second embodiment of the present invention. Since the content and the reception timing of the audio data about the DAB broadcast and the content and the reception timing of the audio data about the IP broadcast in Fig. 6 are the same as those in the first embodiment (refer to Fig. 3), a description of them is omitted herein.

[0066] Upon turning on of the power supply of the broadcast receiving apparatus 10' (timing t1 in Fig. 6) and reception of the audio data about the DAB broadcast and the audio data about the IP broadcast, the broadcast receiving apparatus 10' of the second embodiment sequentially stores the audio data about the DAB broadcast and the audio data about the IP broadcast, which are received, in the DAB buffer 103 and the IP buffer 106, respectively.

[0067] In the example illustrated in Fig. 6, the DAB buffer 103 has a capacity corresponding to six frames of the audio data and the IP buffer 106 has a capacity corresponding to one frame of the audio data. The example in Fig. 6 illustrates the states of the DAB buffer 103 and the IP buffer 106 at timing t2 in Fig. 6 when the audio data of four frames (the pieces of audio data [1] to [4]) is first stored in the DAB buffer 103 after the power supply of the broadcast receiving apparatus 10' is switched to ON. At this time, the piece of audio data [2] is stored in the IP buffer 106.

[0068] At this time, the time information is added to the audio data about the DAB broadcast and the time information is added also to the audio data about the IP broadcast. Accordingly, the time difference calculation unit 107' calculates here the time difference between the time information added to the audio data about the DAB broadcast and the time information added to the audio data about the IP broadcast. As illustrated in Fig. 6, the time information is added to the audio data about the DAB broadcast at constant, relatively short intervals (for every one frame) while the time information is added to the audio data about the IP broadcast at constant, relatively long intervals (for example, for every two frames). Accordingly, the time difference calculation unit 107' calculates the time difference between the two pieces of time information at the timing when the time information is added to both the audio data about the DAB broadcast and the audio data about the IP broadcast.

[0069] Upon calculation of the time difference in the above manner, the comparison unit 108' uses the pieces of audio data [1] to [4] stored in the DAB buffer 103 as the comparison target data and starts the process of identifying the same data as the piece of audio data [2] stored in the IP buffer 106 from the comparison target data. Specifically, the comparison unit 108' sequentially compares the pieces of audio data [1] and [2] stored in the DAB buffer 103 with the piece of audio data [2] stored in the IP buffer 106 to detect the same data as the piece of audio data [2] stored in the IP buffer 106 from the DAB buffer 103. In other words, in the example in Fig. 6, the piece of audio data [2] about the DAB broadcast, which is the same as the piece of audio data [2] about the IP broadcast, is detected through the second comparison.

[0070] Then, the delay time calculation unit 109 calculates the time difference between the reception timing of

the piece of audio data [2] about the IP broadcast and the reception timing of the piece of audio data [2] about the DAB broadcast as the delay time of the IP broadcast. The reception of the piece of audio data [2] about the IP broadcast when the piece of audio data [4] about the DAB broadcast is received indicates that the IP broadcast is delayed from the DAB broadcast by two frames of the audio data.

[0071] Then, the delay processing unit 110 time-stretches the audio data about the DAB broadcast by a required number of frames (a time period from timing t3 to timing t4 in Fig. 6) so that the calculated delay time of the IP broadcast is cleared. This allows the broadcast receiving apparatus 10' to clear the delay time of the IP broadcast. As a result, the broadcast receiving apparatus 10' is capable of switching from the output of the DAB broadcast to the output of the IP broadcast in a state in which the output timing of the DAB broadcast is synchronized with the output timing of the IP broadcast (a state subsequent to the timing t4 in Fig. 6).

[0072] In the example illustrated in Fig. 6, since the comparison between the audio data stored in the IP buffer 106 and the audio data stored in the DAB buffer 103 is performed two times, it takes a processing time (a time period from the timing t2 to the timing t3 in Fig. 6) corresponding to two frames of the audio data to calculate the delay time of the IP broadcast. In other words, the processing time to calculate the delay time of the IP broadcast is reduced by two frames of the audio data, compared with the example in the related art (refer to Fig. 11). In addition, in the example illustrated in Fig. 6, the timing when the calculation of the delay time of the IP broadcast is started is moved up by two frames of the audio data, compared with the example in the related art. Accordingly, in the example illustrated in Fig. 6, the timing (the timing t4 in Fig. 6) when the output timing of the audio data about the DAB broadcast is synchronized with the output timing of the audio data about the IP broadcast is moved up by four frames of the audio data, compared with the example in the related art.

[0073] As described above, with the broadcast receiving apparatus 10' of the second embodiment, the comparison process for identifying the same data as the audio data about the IP broadcast stored in the IP buffer 106 from the audio data about the DAB broadcast stored in the DAB buffer 103 is started without waiting for the storage of the maximum amount of audio data in the DAB buffer 103. In addition, since the timing when the comparison process is started is moved up, the same data to be identified from the DAB buffer 103 is made closer to the beginning of the DAB buffer 103 (that is, the position where the comparison process is started). Accordingly, the timing when the comparison process for identifying the same data is started is moved up and the time required for the comparison process is reduced, thereby advancing the termination of the comparison process. As a result, with the broadcast receiving apparatus 10' of the second embodiment, the synchronization timing of the two broadcasts for seamless switching of the output audio is moved up.

[0074] A third embodiment of the present invention will now be described with reference to Figs. 7 to 9. Fig. 7 is a block diagram illustrating an exemplary functional configuration of a broadcast receiving apparatus 10'' according to the third embodiment of the present invention. The broadcast receiving apparatus 10'' illustrated in Fig. 7 differs from the broadcast receiving apparatus 10 (refer to Fig. 1) of the first embodiment in that the broadcast receiving apparatus 10'' includes a time difference calculation unit 107' and a delay processing unit 110', instead of the time difference calculation unit 107 and the delay processing unit 110, and in that the broadcast receiving apparatus 10'' does not include the IP buffer 106, the comparison unit 108, and the delay time calculation unit 109.

[0075] The time difference calculation unit 107' of the third embodiment is equivalent to the time difference calculation unit 107' of the second embodiment and calculates the time difference without waiting for the storage of the maximum amount of audio data in the DAB buffer 103. The delay processing unit 110' performs the delay process for the audio data about the DAB broadcast in accordance with the time difference calculated by the time difference calculation unit 107'. Specifically, upon calculation of the time difference by the time difference calculation unit 107', the delay processing unit 110' immediately starts the delay process for the audio data about the DAB broadcast. This allows the delay processing unit 110' to synchronize the output timing of the audio data about the DAB broadcast output from the output control unit 111 with the output timing of the audio data about the IP broadcast output from the output control unit 111.

Exemplary process by broadcast receiving apparatus 10''

[0076] Fig. 8 is a flowchart illustrating an exemplary process performed by the broadcast receiving apparatus 10'' according to the third embodiment of the present invention. The process illustrated in Fig. 8 is performed, for example, upon switching of a power supply of the broadcast receiving apparatus 10'' to ON.

[0077] Referring to Fig. 8, in Step S802, the first receiving unit 101 starts reception of the DAB broadcast. In Step S804, the first demodulation unit 102 demodulates the digital audio signal included in the broadcast waves of the DAB broadcast received by the first receiving unit 101. In Step S806, the DAB buffer 103 stores the audio data included in the digital audio signal subjected to the demodulation by the first demodulation unit 102.

[0078] In Step S808, the second receiving unit 104 starts reception of the IP broadcast. In Step S810, the second demodulation unit 105 demodulates the digital audio signal included in the communication data about the IP broadcast received by the second receiving unit

104.

[0079] In Step S812, the time difference calculation unit 107' determines whether both the time information added to the audio data about the DAB broadcast and the time information added to the audio data about the IP broadcast are acquired. If the time difference calculation unit 107' determines that both the time information about the DAB broadcast and the time information about the IP broadcast are not acquired (NO in Step S812), the process goes back to Step S802 to perform the processing in Step S802 and the subsequent steps again.

[0080] If the time difference calculation unit 107' determines that both the time information about the DAB broadcast and the time information about the IP broadcast are acquired (YES in Step S812), in Step S814, the time difference calculation unit 107' calculates the time difference between the time information about the DAB broadcast and the time information about the IP broadcast, which are acquired. In Step S816, the delay processing unit 110' starts the delay process for the audio data about the DAB broadcast output from the output control unit 111.

[0081] In Step S818, the delay processing unit 110' determines whether the time difference calculated in Step S814 is cleared. If the delay processing unit 110' determines that the time difference calculated in Step S814 is not cleared (NO in Step S818), the process performs the determination in Step S818 again.

[0082] If the delay processing unit 110' determines that the time difference calculated in Step S814 is cleared (YES in Step S818), in Step S820, the delay processing unit 110' terminates the delay process for the audio data about the DAB broadcast output from the output control unit 111. Then, the process illustrated in Fig. 8 is terminated.

Exemplary processing timing

[0083] Fig. 9 illustrates exemplary processing timing by the broadcast receiving apparatus 10'' according to the third embodiment of the present invention. Since the content and the reception timing of the audio data about the DAB broadcast and the content and the reception timing of the audio data about the IP broadcast in Fig. 9 are the same as those in the first embodiment (refer to Fig. 3), a description of them is omitted herein.

[0084] In the broadcast receiving apparatus 10'' of the third embodiment, upon turning on of the power supply of the broadcast receiving apparatus 10'' (timing t1 in Fig. 9) and reception of the audio data about the DAB broadcast and the audio data about the IP broadcast, the time difference calculation unit 107' attempts to acquire the time information from each of the DAB broadcast and the IP broadcast. Upon acquisition of the time information from each of the DAB broadcast and the IP broadcast, the time difference calculation unit 107' calculates the time difference between the time information acquired from the DAB broadcast and the time information acquired from the IP broadcast.

[0085] In the example illustrated in Fig. 9, upon reception of the second frame of the audio data (the piece of audio data [2]) about the IP broadcast (timing t2 in Fig. 9) after the power supply of the broadcast receiving apparatus 10'' is switched to ON, the time information (denoted by "T" in Fig. 9) is acquired from each of the DAB broadcast and the IP broadcast and the time difference between the two pieces of time information is calculated (the timing t2 in Fig. 9). In the example illustrated in Fig. 9, about two frames of the audio data are calculated as the time difference between the two pieces of time information.

[0086] Upon calculation of the time difference in the above manner, the delay processing unit 110' immediately starts the delay process for the audio data about the DAB broadcast. Specifically, the delay processing unit 110' time-stretches the audio data about the DAB broadcast by a required number of frames (a time period from the timing t2 to timing t3 in Fig. 9) so that the calculated time difference is cleared. This allows the broadcast receiving apparatus 10'' to clear the delay time of the IP broadcast. As a result, the broadcast receiving apparatus 10'' is capable of switching from the output of the DAB broadcast to the output of the IP broadcast in a state in which the output timing of the DAB broadcast is synchronized with the output timing of the IP broadcast (a state subsequent to the timing t3 in Fig. 9).

[0087] In the example illustrated in Fig. 9, the delay process for the DAB broadcast is performed on the basis of the time difference between the time information about the DAB broadcast and the time information about the IP broadcast without performing the comparison process (the process of calculating the time difference) described above in the first and second embodiments. Accordingly, in the example illustrated in Fig. 9, the timing (the timing t3 in Fig. 9) when the output timing of the audio data about the DAB broadcast is synchronized with the output timing of the audio data about the IP broadcast is moved up by six frames of the audio data, compared with the example in the related art.

[0088] As described above, with the broadcast receiving apparatus 10'' of the third embodiment, upon calculation of the time difference between the time information about the audio data about the DAB broadcast and the time information about the audio data about the IP broadcast, the delay process for the audio data about the DAB broadcast is immediately started, regarding the time difference as the delay time of the IP broadcast. As a result, with the broadcast receiving apparatus 10'' of the third embodiment, the synchronization timing of the two broadcasts for seamless switching of the output audio is moved up.

[0089] A fourth embodiment of the present invention will now be described with reference to Fig. 10. The first embodiment and the second embodiment described above are combined with each other in the fourth embodiment. Specifically, the configuration in which the

comparison process is started at the time when the time difference between the time information about the DAB broadcast and the time information about the IP broadcast is calculated without waiting for the storage of the maximum amount of audio data in the DAB buffer 103 is combined with the configuration in which the comparison start position is set at a position after the beginning in the audio data stored in the DAB buffer 103 on the basis of the calculated time difference.

[0090] Exemplary processing timing by a broadcast receiving apparatus according to the fourth embodiment of the present invention will now be described with reference to Fig. 10. In the example illustrated in Fig. 10, the DAB buffer has a capacity corresponding to 15 frames of the audio data. In addition, in the example illustrated in Fig. 10, the IP broadcast is delayed from the DAB broadcast by four frames of the audio data. Furthermore, in the example illustrated in Fig. 10, the time information is added to the audio data about the DAB broadcast for every one frame of the audio data and the time information is added to the audio data about the IP broadcast for every four frames of the audio data.

[0091] The example in Fig. 10 illustrates the states of the DAB buffer and the IP buffer at timing t2 in Fig. 10 when the audio data of eight frames (the pieces of audio data [1] to [8]) is first stored in the DAB buffer after a power supply of the broadcast receiving apparatus is switched to ON. At this time, the piece of audio data [4] is stored in the IP buffer.

[0092] At this time, the time information is added to the piece of audio data [8] about the DAB broadcast and the time information is added also to the piece of audio data [4] about the IP broadcast. Accordingly, the broadcast receiving apparatus calculates the time difference between the time information acquired from the DAB broadcast and the time information acquired from the IP broadcast at this time.

[0093] Then, the broadcast receiving apparatus sets the comparison start position in the audio data stored in the DAB buffer on the basis of the calculated time difference. In the example illustrated in Fig. 10, since the calculated time difference is about four frames of the audio data, the broadcast receiving apparatus has enough time to set the piece of audio data [3] five frames before the piece of audio data [8] as the comparison start position.

[0094] Then, the broadcast receiving apparatus sequentially compares the pieces of audio data [3] and [4] stored in the DAB buffer with the piece of audio data [4] stored in the IP buffer to detect the same data as the piece of audio data [4] stored in the IP buffer from the DAB buffer. In other words, in the example in Fig. 10, the piece of audio data [4] about the DAB broadcast, which is the same as the piece of audio data [4] about the IP broadcast, is detected through the second comparison.

[0095] Then, the broadcast receiving apparatus calculates the time difference between the reception timing of the piece of audio data [4] about the IP broadcast and the reception timing of the piece of audio data [4] about the DAB broadcast as the delay time of the IP broadcast. The reception of the piece of audio data [4] about the IP broadcast when the piece of audio data [8] about the DAB broadcast is received indicates that the IP broadcast is delayed from the DAB broadcast by four frames of the audio data.

[0096] Then, the broadcast receiving apparatus time-stretches the audio data about the DAB broadcast by a required number of frames (a time period from timing t3 to timing t4 in Fig. 10) so that the calculated delay time of the IP broadcast is cleared. This allows the broadcast receiving apparatus to clear the delay time of the IP broadcast. As a result, the broadcast receiving apparatus is capable of switching from the output of the DAB broadcast to the output of the IP broadcast in a state in which the output timing of the DAB broadcast is synchronized with the output timing of the IP broadcast (a state subsequent to the timing t4 in Fig. 10).

[0097] In the example illustrated in Fig. 10, the comparison process is started at the time when eight frames of the audio data, which is less than the maximum amount of data (15 frames), are stored in the DAB buffer. Accordingly, the timing when the comparison process is started is moved up by seven frames of the audio data, compared with the method in the related art in which the comparison process is started at the time when the maximum amount of audio data is stored in the DAB buffer.

[0098] In addition, in the example illustrated in Fig. 10, the comparison process is started from the piece of audio data [3] stored in the DAB buffer on the basis of the calculated time difference. Accordingly, the processing time to calculate the delay time of the IP broadcast is reduced by two frames of the audio data, compared with the method in the related art in which the comparison process is started from the beginning (the piece of audio data [1]).

[0099] Consequently, with the broadcast receiving apparatus of the fourth embodiment, the synchronization timing of the two broadcasts for seamless switching of the output audio is greatly moved up, compared with the method in the related art.

[0100] Although the DAB broadcast is applied as the first standard broadcast and the IP broadcast is applied as the second standard broadcast in the first to fourth embodiments described above, the present invention is not limited to these. For example, a frequency modulation (FM) broadcast may be applied as the first standard broadcast and the IP broadcast may be applied as the second standard broadcast. Alternatively, the DAB broadcast may be applied as the first standard broadcast and the FM broadcast may be applied as the second standard broadcast.

[0101] While the present invention is described in terms of some specific examples and embodiments, the present invention is not limited to these specific examples and embodiments and the technical range of the present invention should not be interpreted in a limited way. It will be clear that any changes and modified embodiments will be obvious to those skilled in the art without departing

from the scope of the claims.

Claims

1. A broadcast receiving apparatus comprising:

a first receiving unit (101) configured to receive a first standard broadcast;
a second receiving unit (104) configured to receive a second standard broadcast delayed from the first standard broadcast;
an output control unit (111) configured to switch between first standard broadcast data received by the first receiving unit (101) and second standard broadcast data received by the second receiving unit (104) and to selectively output the first standard broadcast data or the second standard broadcast data;
a first storage unit (103) configured to temporarily store the first standard broadcast data received by the first receiving unit (101);
a second storage unit (106) configured to temporarily store the second standard broadcast data received by the second receiving unit (104);
a comparison unit (108) configured to compare the first standard broadcast data stored in the first storage unit (103) with the second standard broadcast data stored in the second storage unit (106) to identify the same data as the second standard broadcast data stored in the second storage unit (106) from the first standard broadcast data stored in the first storage unit (103);
a delay time calculation unit (109) configured to calculate a delay time of the second standard broadcast from the first standard broadcast on the basis of a reception timing of the same data identified from the first standard broadcast data by the comparison unit (108) and a reception timing of the second standard broadcast data stored in the second storage unit (106);
a delay processing unit (110) configured to perform a delay process to the first standard broadcast data in accordance with the delay time calculated by the delay time calculation unit (109) to synchronize output timing of the first standard broadcast data with output timing of the second standard broadcast data; and
a time difference calculation unit (107) configured to calculate a time difference between time information added to the first standard broadcast data and time information added to the second standard broadcast data,
wherein the comparison unit (108) is configured to determine the broadcast data stored in a partial range of the first storage unit (103) to be comparison target data on the basis of the time difference calculated by the time difference calculation unit (107) and to perform the comparison to the comparison target data to identify the same data from the comparison target data.

2. The broadcast receiving apparatus according to Claim 1,
wherein the comparison unit (108) is configured to set a comparison start position after the beginning in the first standard broadcast data stored in the first storage unit (103) on the basis of the time difference calculated by the time difference calculation unit (107), to determine data after the comparison start position to be the comparison target data, and to perform the comparison to the comparison target data to identify the same data from the comparison target data.

3. The broadcast receiving apparatus according to Claim 1 or 2,
wherein, when the time difference is calculated by the time difference calculation unit (107) before the first standard broadcast data of a predetermined maximum amount is stored in the first storage unit (103), the comparison unit (108) is configured to determine the first standard broadcast data stored in the first storage unit (103) at the time when the time difference is calculated to be the comparison target data and to perform the comparison to the comparison target data to identify the same data from the comparison target data.

4. The broadcast receiving apparatus according to one of claims 1-3,
wherein, when the time difference is calculated by the time difference calculation unit (107) before the first standard broadcast data of a predetermined maximum amount is stored in the first storage unit (103), the comparison unit (108) is configured to set a comparison start position after the beginning in the first standard broadcast data stored in the first storage unit (103) at the time when the time difference is calculated on the basis of the time difference calculated by the time difference calculation unit (107), to determine data after the comparison start position to be the comparison target data, and to perform the comparison to the comparison target data to identify the same data from the comparison target data.

5. The broadcast receiving apparatus according to any of Claims 1 to 4,
wherein the first standard broadcast is a frequency modulation (FM) broadcast and the second standard broadcast is an Internet protocol (IP) broadcast.

6. The broadcast receiving apparatus according to any of Claims 1 to 4,
wherein the first standard broadcast is a digital audio broadcasting (DAB) broadcast and the second

standard broadcast is an Internet protocol (IP) broadcast.

7. An output control method performed by a broadcast receiving apparatus including an output control unit (111) that switches between a first standard broadcast and a second standard broadcast delayed from the first standard broadcast and selectively outputs the first standard broadcast or the second standard broadcast, the output control method comprising:

temporarily storing first standard broadcast data by a first storage unit (103) in the broadcast receiving apparatus;
temporarily storing second standard broadcast data by a second storage unit (106) in the broadcast receiving apparatus;
calculating a time difference between time information added to the first standard broadcast data and time information added to the second standard broadcast data by a time difference calculation unit (107) in the broadcast receiving apparatus;
determining the broadcast data stored in a partial range of the first storage unit (103) to be comparison target data on the basis of the calculated time difference and comparing the comparison target data with the second standard broadcast data stored in the second storage unit (106) to identify the same data as the second standard broadcast data stored in the second storage unit (106) from the comparison target data by a comparison unit (108) in the broadcast receiving apparatus;
calculating a delay time of the second standard broadcast from the first standard broadcast on the basis of a reception timing of the same data identified from the comparison target data and a reception timing of the second standard broadcast data stored in the second storage unit (106) by a delay time calculation unit (109) in the broadcast receiving apparatus; and
performing a delay process to the first standard broadcast data in accordance with the calculated delay time to synchronize output timing of the first standard broadcast data with output timing of the second standard broadcast data by a delay processing unit (110) in the broadcast receiving apparatus.

FIG. 1

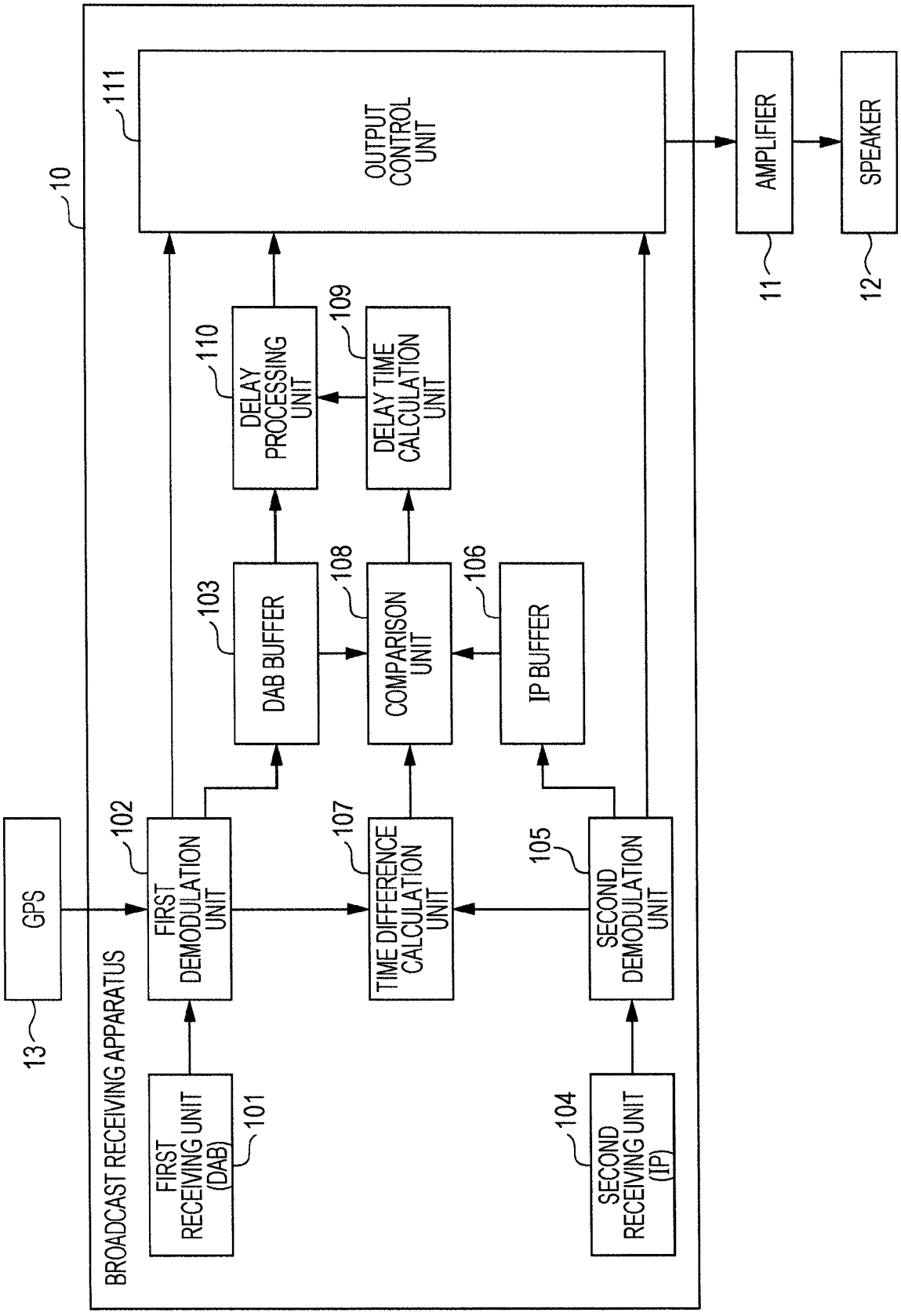

BROADCAST RECEIVING APPARATUS
10
GPS
13
FIRST RECEIVING UNIT (DAB)
101
FIRST DEMODULATION UNIT
102
DAB BUFFER
103
SECOND RECEIVING UNIT (IP)
104
SECOND DEMODULATION UNIT
105
IP BUFFER
106
TIME DIFFERENCE CALCULATION UNIT
107
COMPARISON UNIT
108
DELAY TIME CALCULATION UNIT
109
DELAY PROCESSING UNIT
110
OUTPUT CONTROL UNIT
111
AMPLIFIER
11
SPEAKER
12

FIG. 2

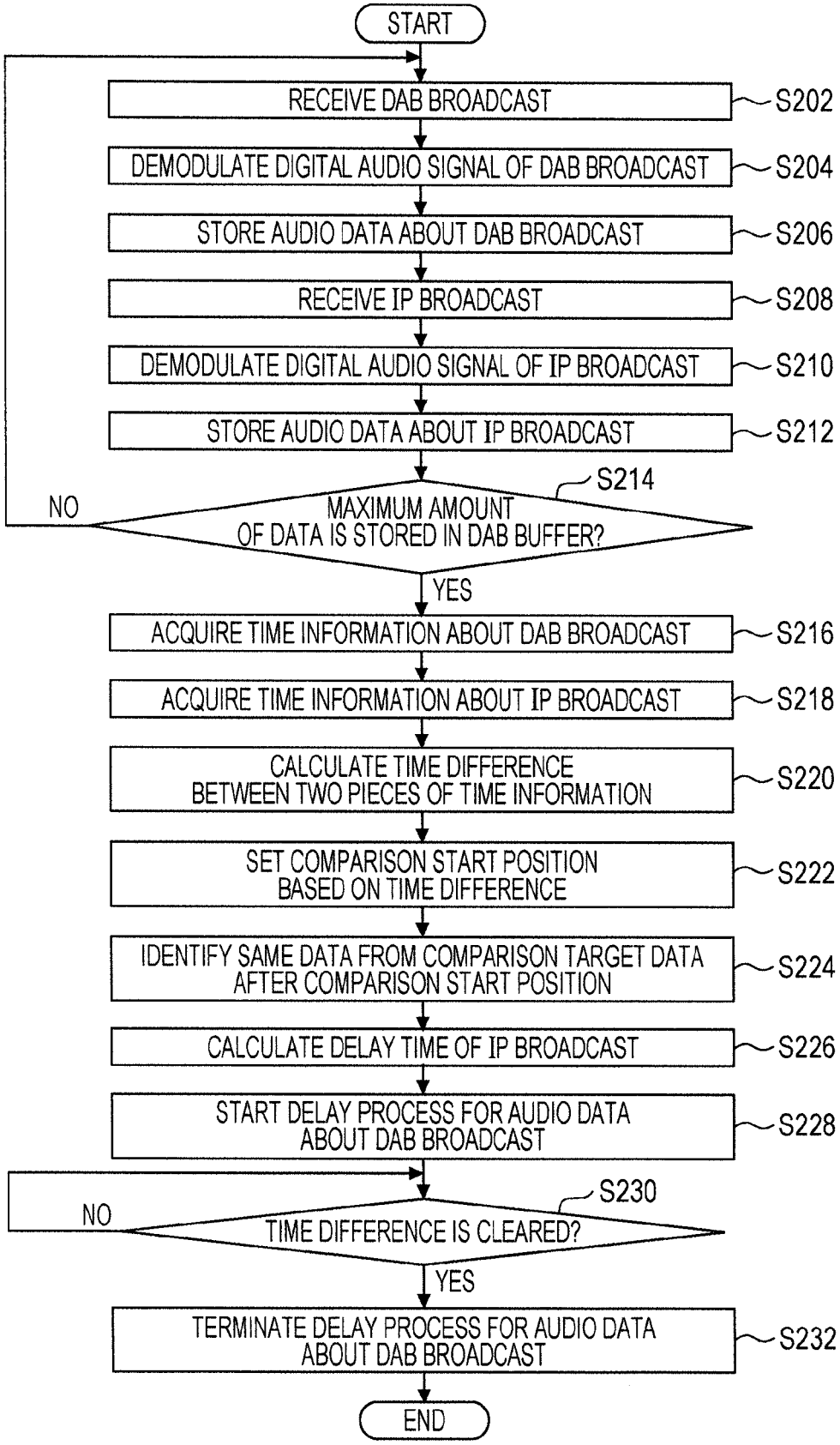

START
RECEIVE DAB BROADCAST
S202
DEMODULATE DIGITAL AUDIO SIGNAL OF DAB BROADCAST
S204
STORE AUDIO DATA ABOUT DAB BROADCAST
S206
RECEIVE IP BROADCAST
S208
DEMODULATE DIGITAL AUDIO SIGNAL OF IP BROADCAST
S210
STORE AUDIO DATA ABOUT IP BROADCAST
S212
S214
NO
MAXIMUM AMOUNT OF DATA IS STORED IN DAB BUFFER?
YES
ACQUIRE TIME INFORMATION ABOUT DAB BROADCAST
S216
ACQUIRE TIME INFORMATION ABOUT IP BROADCAST
S218
CALCULATE TIME DIFFERENCE BETWEEN TWO PIECES OF TIME INFORMATION
S220
SET COMPARISON START POSITION BASED ON TIME DIFFERENCE
S222
IDENTIFY SAME DATA FROM COMPARISON TARGET DATA AFTER COMPARISON START POSITION
S224
CALCULATE DELAY TIME OF IP BROADCAST
S226
START DELAY PROCESS FOR AUDIO DATA ABOUT DAB BROADCAST
S228
S230
NO
TIME DIFFERENCE IS CLEARED?
YES
TERMINATE DELAY PROCESS FOR AUDIO DATA ABOUT DAB BROADCAST
S232
END

FIG. 3

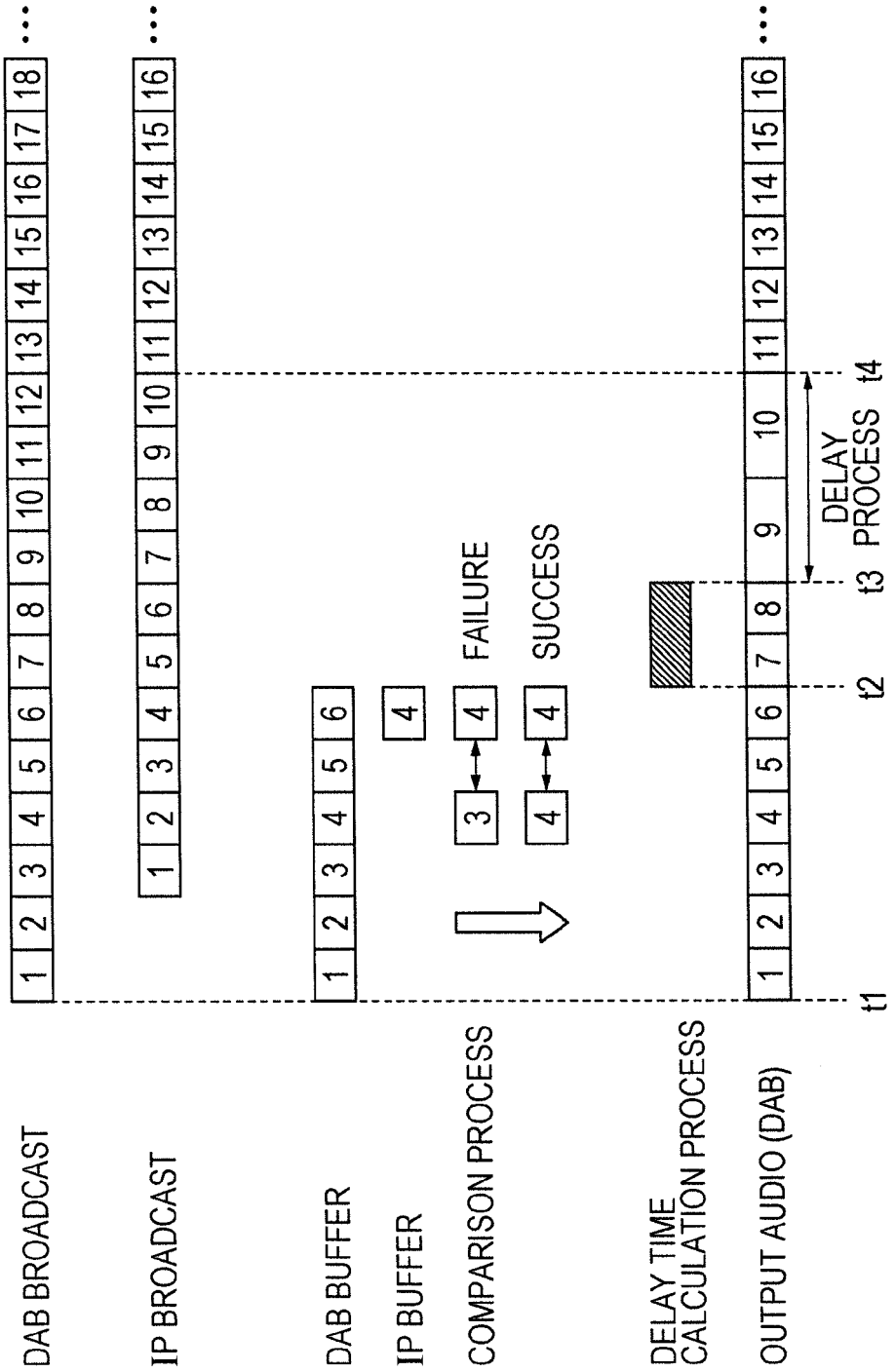

DAB BROADCAST
IP BROADCAST
DAB BUFFER
IP BUFFER
COMPARISON PROCESS
DELAY TIME CALCULATION PROCESS
OUTPUT AUDIO (DAB)
FAILURE
SUCCESS
DELAY PROCESS
t1
t2
t3
t4

FIG. 4

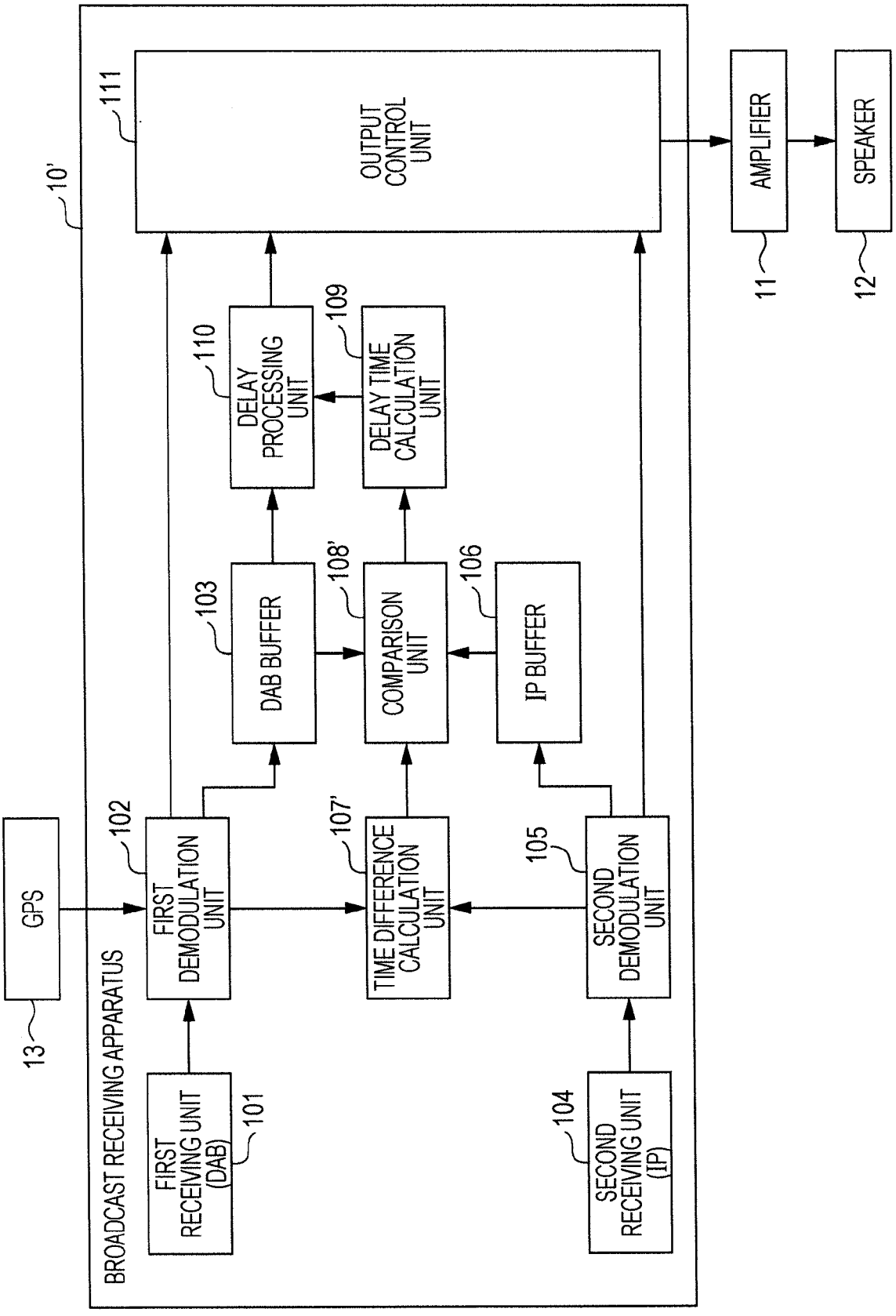

10'
BROADCAST RECEIVING APPARATUS
13
GPS
FIRST RECEIVING UNIT (DAB)
101
FIRST DEMODULATION UNIT
102
DAB BUFFER
103
SECOND RECEIVING UNIT (IP)
104
SECOND DEMODULATION UNIT
105
IP BUFFER
106
DELAY TIME CALCULATION UNIT
109
DELAY PROCESSING UNIT
110
OUTPUT CONTROL UNIT
111
TIME DIFFERENCE CALCULATION UNIT
107'
COMPARISON UNIT
108'
AMPLIFIER
11
SPEAKER
12

FIG. 5

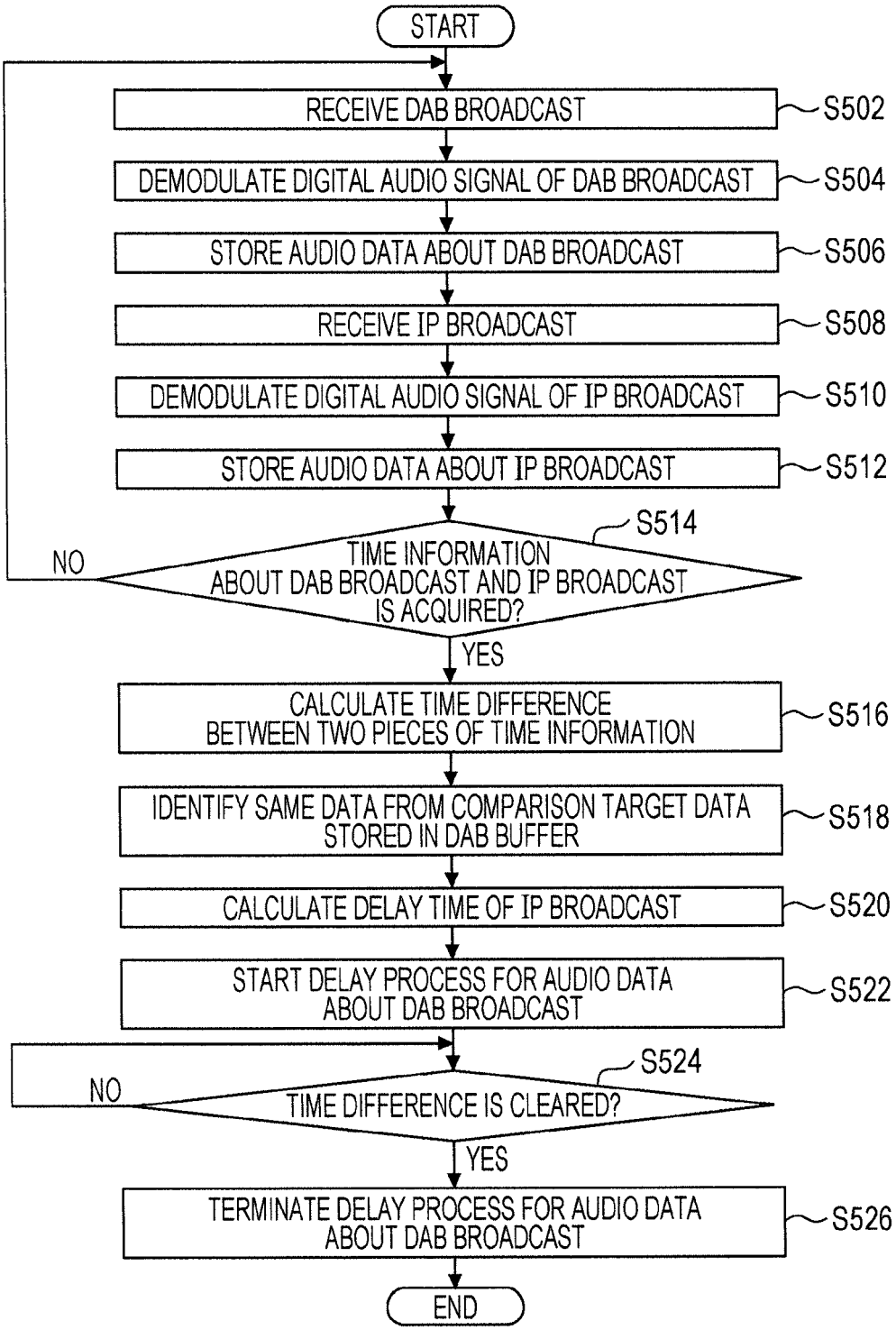

START
RECEIVE DAB BROADCAST
S502
DEMODULATE DIGITAL AUDIO SIGNAL OF DAB BROADCAST
S504
STORE AUDIO DATA ABOUT DAB BROADCAST
S506
RECEIVE IP BROADCAST
S508
DEMODULATE DIGITAL AUDIO SIGNAL OF IP BROADCAST
S510
STORE AUDIO DATA ABOUT IP BROADCAST
S512
S514
TIME INFORMATION ABOUT DAB BROADCAST AND IP BROADCAST IS ACQUIRED?
NO
YES
CALCULATE TIME DIFFERENCE BETWEEN TWO PIECES OF TIME INFORMATION
S516
IDENTIFY SAME DATA FROM COMPARISON TARGET DATA STORED IN DAB BUFFER
S518
CALCULATE DELAY TIME OF IP BROADCAST
S520
START DELAY PROCESS FOR AUDIO DATA ABOUT DAB BROADCAST
S522
S524
NO
TIME DIFFERENCE IS CLEARED?
YES
TERMINATE DELAY PROCESS FOR AUDIO DATA ABOUT DAB BROADCAST
S526
END

FIG. 6

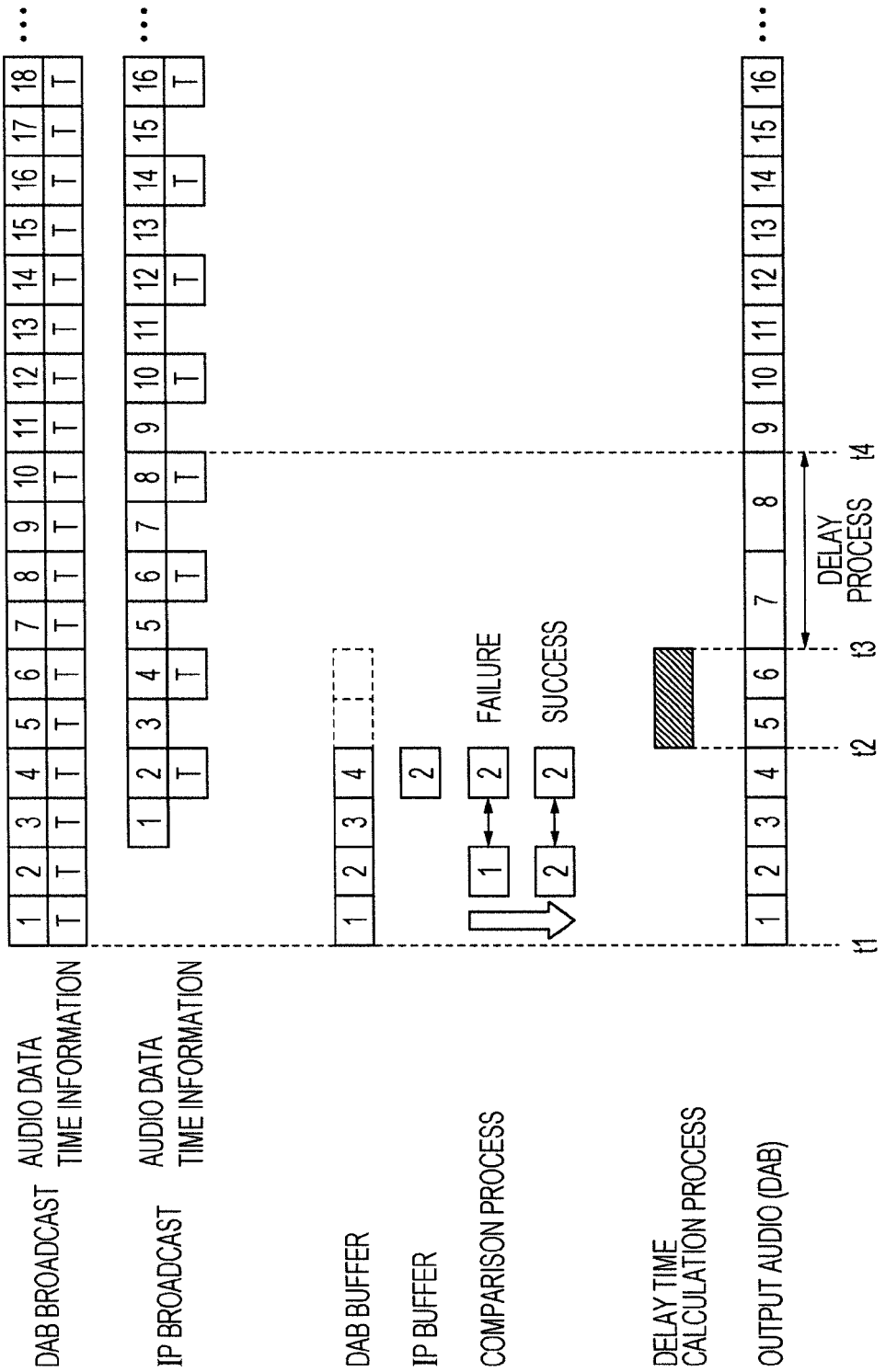

DAB BROADCAST
AUDIO DATA
TIME INFORMATION
IP BROADCAST
AUDIO DATA
TIME INFORMATION
DAB BUFFER
IP BUFFER
COMPARISON PROCESS
FAILURE
SUCCESS
DELAY TIME CALCULATION PROCESS
OUTPUT AUDIO (DAB)
DELAY PROCESS
t1
t2
t3
t4

FIG. 7

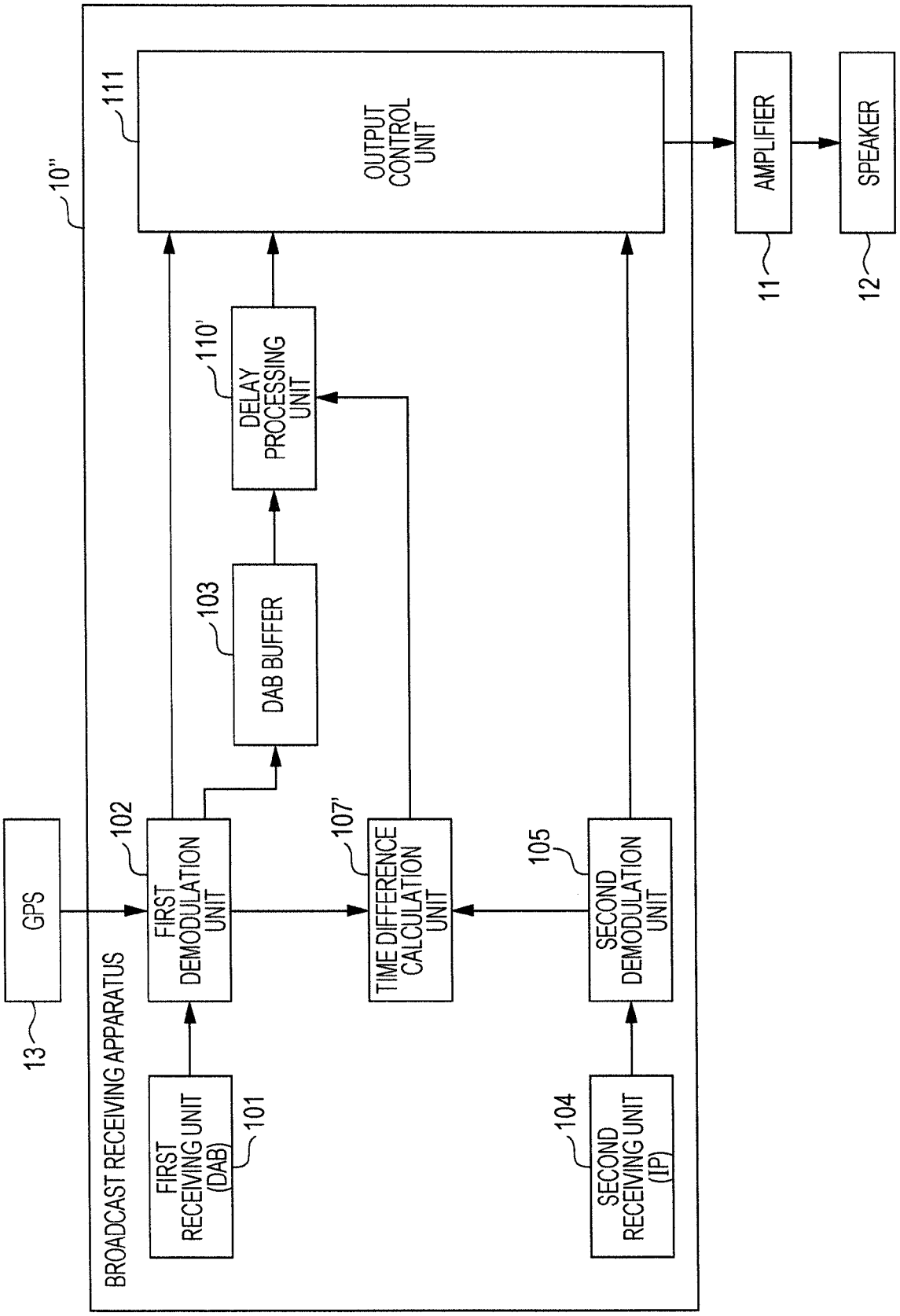

10"
BROADCAST RECEIVING APPARATUS
13
GPS
102
FIRST DEMODULATION UNIT
101
FIRST RECEIVING UNIT (DAB)
103
DAB BUFFER
110'
DELAY PROCESSING UNIT
107'
TIME DIFFERENCE CALCULATION UNIT
105
SECOND DEMODULATION UNIT
104
SECOND RECEIVING UNIT (IP)
111
OUTPUT CONTROL UNIT
11
AMPLIFIER
12
SPEAKER

FIG. 8

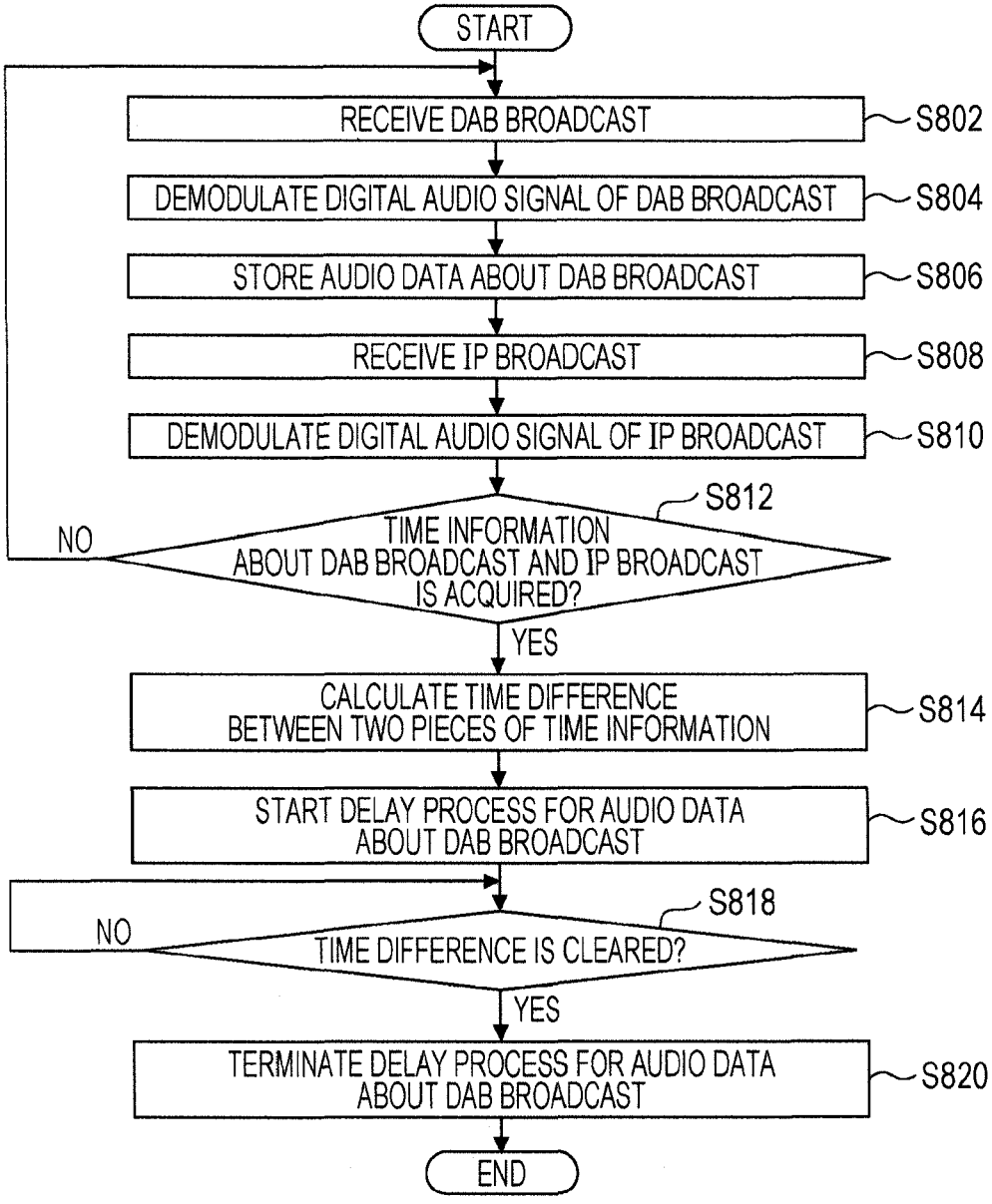

START
RECEIVE DAB BROADCAST
S802
DEMODULATE DIGITAL AUDIO SIGNAL OF DAB BROADCAST
S804
STORE AUDIO DATA ABOUT DAB BROADCAST
S806
RECEIVE IP BROADCAST
S808
DEMODULATE DIGITAL AUDIO SIGNAL OF IP BROADCAST
S810
S812
TIME INFORMATION ABOUT DAB BROADCAST AND IP BROADCAST IS ACQUIRED?
NO
YES
CALCULATE TIME DIFFERENCE BETWEEN TWO PIECES OF TIME INFORMATION
S814
START DELAY PROCESS FOR AUDIO DATA ABOUT DAB BROADCAST
S816
S818
TIME DIFFERENCE IS CLEARED?
NO
YES
TERMINATE DELAY PROCESS FOR AUDIO DATA ABOUT DAB BROADCAST
S820
END

FIG. 9

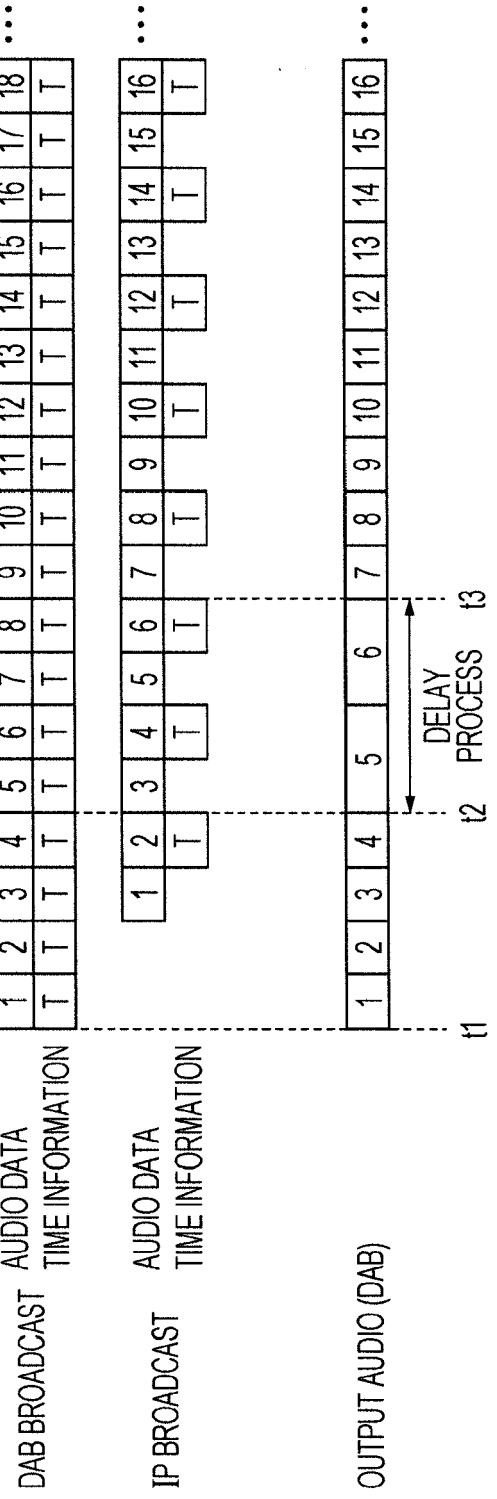

DAB BROADCAST
AUDIO DATA
TIME INFORMATION
IP BROADCAST
AUDIO DATA
TIME INFORMATION
OUTPUT AUDIO (DAB)
DELAY PROCESS
t1
t2
t3

FIG. 10

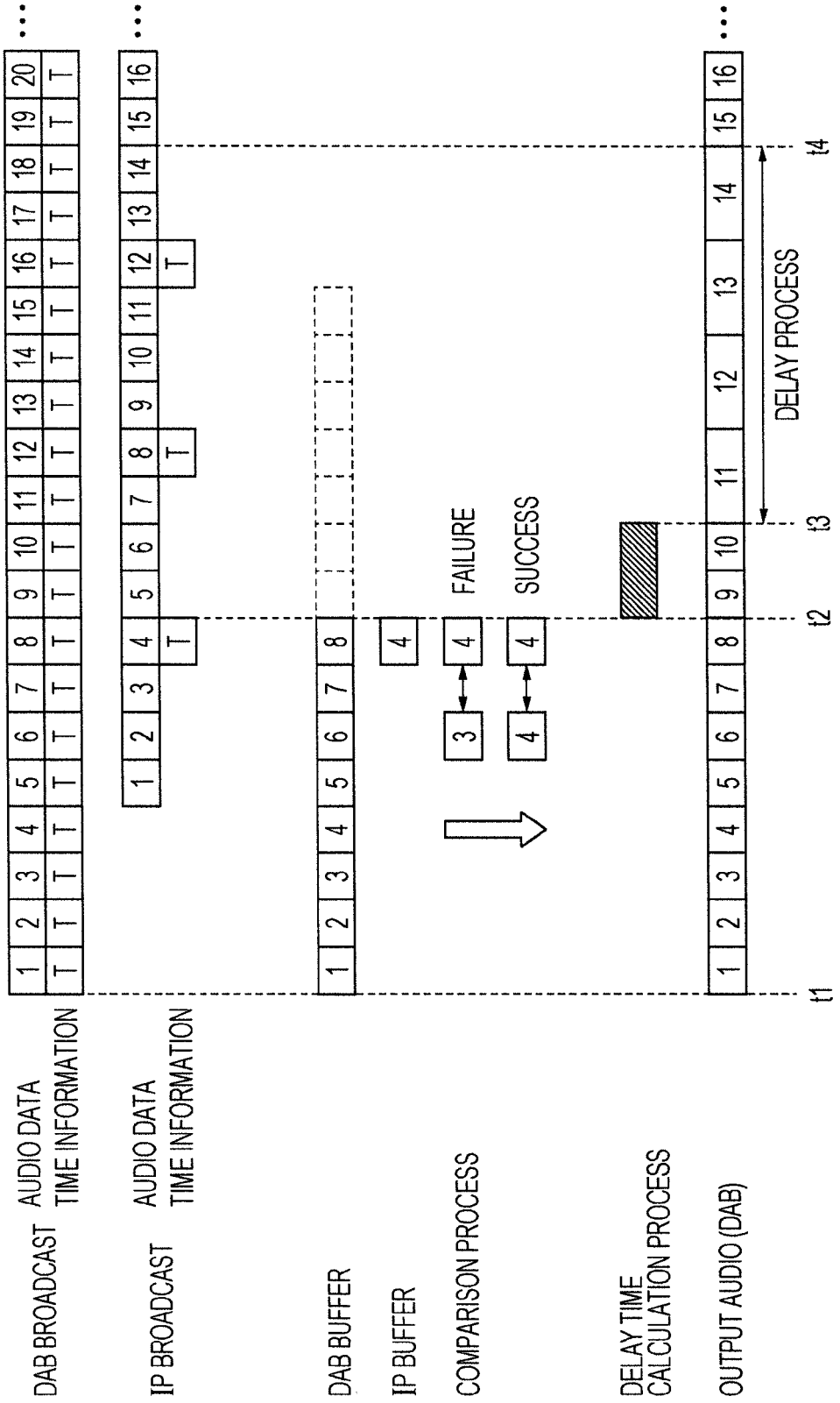
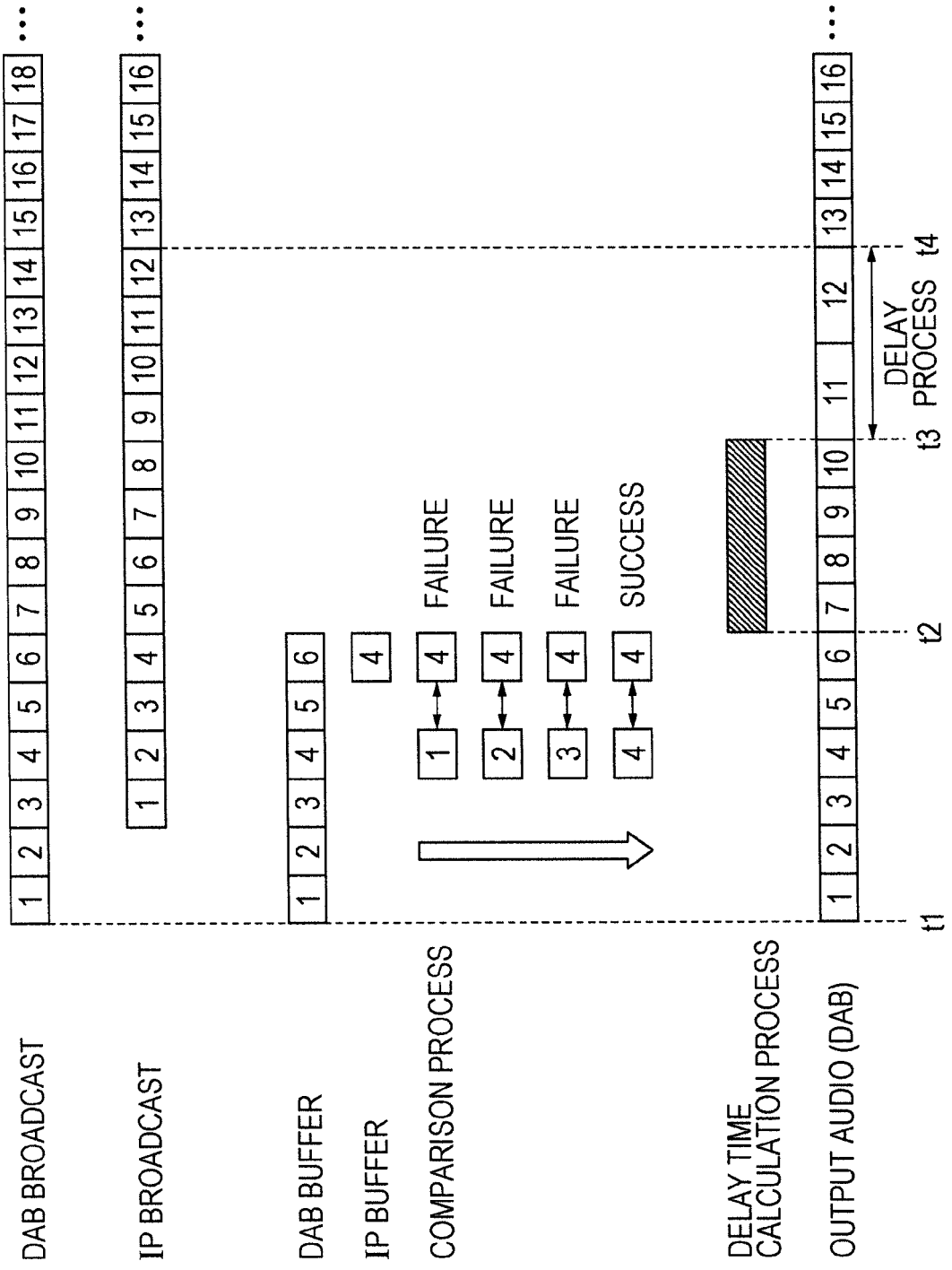

DAB BROADCAST
AUDIO DATA
TIME INFORMATION
IP BROADCAST
AUDIO DATA
TIME INFORMATION
DAB BUFFER
IP BUFFER
COMPARISON PROCESS
FAILURE
SUCCESS
DELAY TIME CALCULATION PROCESS
OUTPUT AUDIO (DAB)
DELAY PROCESS
t1
t2
t3
t4

FIG. 11


DAB BROADCAST
IP BROADCAST
DAB BUFFER
IP BUFFER
COMPARISON PROCESS
DELAY TIME CALCULATION PROCESS
OUTPUT AUDIO (DAB)
FAILURE
FAILURE
FAILURE
SUCCESS
DELAY PROCESS
t1
t2
t3
t4

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EUROPEAN SEARCH REPORT

Application Number
EP 16 15 9160

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 2010/319047 A1 (MITSUTAKE TOSHIKAZU [JP] ET AL) 16 December 2010 (2010-12-16) * paragraphs [0014], [0016], [0056] - [0059] * * figures 2-3 * -----	1-7	INV. H04H20/24 H04H20/26 H04H20/18
X	US 2013/053058 A1 (LI XINTIAN [US]) 28 February 2013 (2013-02-28) * paragraphs [0035] - [0037], [0041], [0045] - [0049] * * figure 3 * -----	1,5-7	

TECHNICAL FIELDS SEARCHED (IPC)

H04H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	5 August 2016	Iovescu, Vladimir

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		WO 2013032653 A1	07-03-2013

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