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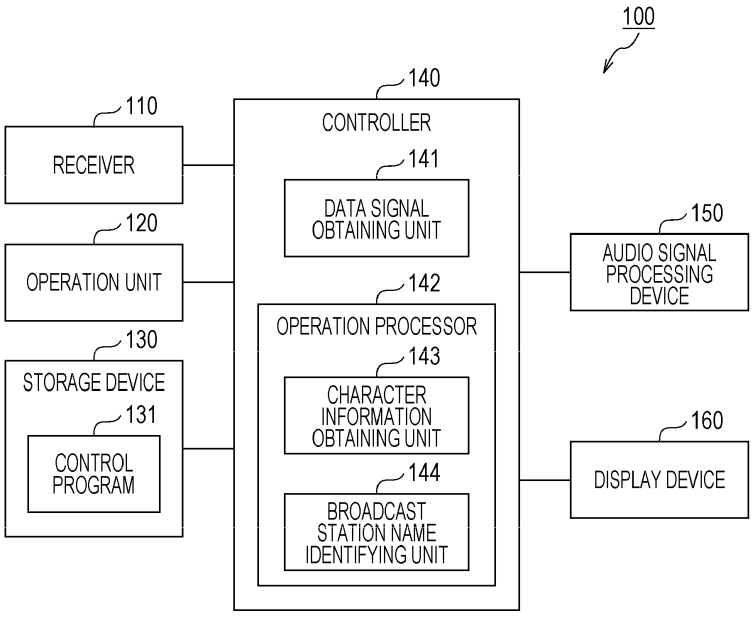
(54) BROADCAST RECEIVING APPARATUS, CONTROL METHOD THEREFOR, AND CONTROL PROGRAM THEREFOR

(57) A broadcast receiving apparatus (100) receives broadcast waves carrying a data signal and an audio signal multiplexed with each other. The data signal transmits first character information and second character information. The first character information is used for transmitting a broadcast station name. The second character information includes character information other than the broadcast station name. The broadcast receiving apparatus (100) includes the following elements. A receiver (110) receives the broadcast waves transmitted from the broadcast station. A data signal obtaining unit (141) obtains the data signal from the received broadcast waves. A character information obtaining unit (143) obtains the first character information and the second character information from the obtained data signal. A broadcast station name identifying unit (144) identifies the broadcast station name, based on a comparison result of comparing the first character information with the second character information.

FIG. 1



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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a broadcast receiving apparatus, a control method therefor, and a control program therefor. More particularly, the invention relates to a broadcast receiving apparatus for identifying the broadcast station name based on data received from the broadcast station, a control method therefor, and a control program therefor.

2. Description of the Related Art

[0002] As disclosed in International Publication No. 2012/073464, in Europe, frequency modulation (FM) radio broadcasting utilizes a protocol standard called the radio data system (RDS) for transmitting broadcast waves carrying an audio signal and a data signal multiplexed with each other. A broadcast receiving apparatus demultiplexes broadcast waves into an audio signal and a data signal and then outputs sound based on the audio signal and obtains various items of information based on the data signal.

[0003] Examples of information transmitted by means of a data signal are program service name (PS) information and radio text (RT) information. PS information is character information constituted by a maximum of eight characters related to a broadcast station name. According to the RDS standard, PS information only indicates the broadcast station name. RT information is character information constituted by a maximum of 64 characters indicating a program name, a title of a song, weather forecasts, advertisement, and so on. In reality, however, according to the operation unique to a broadcast station, a protocol standard called the dynamic PS system which allows information other than the broadcast station name to be transmitted as PS information may be utilized. According to the dynamic PS system, PS information includes part of RT information, for example.

[0004] According to the dynamic PS system, it is not possible to identify the broadcast station name from PS information. In the broadcast receiving apparatus disclosed in Japanese Unexamined Patent Application Publication No. 2014-127901, to identify the broadcast station name according to the dynamic PS system, the received items of PS information are compared with broadcast station names stored in a storage device of the broadcast receiving apparatus, and then, an item of PS information that is found to match one of the stored broadcast station names is used as the broadcast station name.

SUMMARY OF THE INVENTION

[0005] In the method disclosed in this publication, however, it is necessary to store all the existing broadcast station names. Thus, an enormous amount of data space is required in the storage device, comparing of PS information with broadcast station names is time-consuming, and updating of a broadcast station name is not supported.

[0006] In view of this background, the present invention provides a broadcast receiving apparatus which allows the broadcast station name to be speedily identified with a small storage capacity, a control method therefor, and a control program therefor.

[0007] According to an aspect of the invention, there is provided a broadcast receiving apparatus (100) for receiving broadcast waves. The broadcast waves carry a data signal and an audio signal multiplexed with each other. The data signal is capable of transmitting first character information and second character information. The first character information is used for transmitting a broadcast station name. The second character information includes character information other than the broadcast station name. The broadcast receiving apparatus (100) includes a receiver (110), a data signal obtaining unit (141), a character information obtaining unit (143), and a broadcast station name identifying unit (144). The receiver (110) receives the broadcast waves transmitted from the broadcast station. The data signal obtaining unit (141) obtains the data signal from the received broadcast waves. The character information obtaining unit (143) obtains the first character information and the second character information from the obtained data signal. The broadcast station name identifying unit (144) identifies the broadcast station name, based on a comparison result of comparing the first character information with the second character information.

[0008] The above-described configuration eliminates the need to store all broadcast station names and to compare the first character information with all the broadcast station names. It is thus possible to speedily identify a broadcast station name with a small storage capacity.

[0009] Preferably, in the broadcast receiving apparatus (100), the broadcast station name identifying unit (144) may extract one or more candidate character strings appearing at least one time as the first character information from among a plurality of items of the first character information obtained at different times. The broadcast station name identifying unit (144) may obtain the comparison result of comparing the first character information with the second character information indirectly by comparing the candidate character strings with the second character information. The broadcast station name identifying unit (144) may determine, based on the comparison result of comparing the first character information with the second character information, whether or not there is only one candidate character string that is not included in the second character information. If it is determined that there is only one candidate character string that is not included in the second character information, the broadcast station name identifying unit (144)

may identify the candidate character string that is not included in the second character information as the broadcast station name.

[0010] This configuration makes it possible to precisely identify the broadcast station name by excluding candidate character strings included in the second character information that are unlikely to be the broadcast station name.

[0011] Preferably, in the broadcast receiving apparatus (100), the broadcast station name identifying unit (144) may count, as appearance frequency, how many times each of the candidate character strings appears among the plurality of items of the first character information. The broadcast station name identifying unit (144) may identify the broadcast station name further based on the appearance frequency.

[0012] This configuration makes it possible to identify the broadcast station name further precisely, based on the assumption that the first character information used for transmitting the broadcast station name is highly likely to be the broadcast station name.

[0013] Preferably, in the broadcast receiving apparatus (100), if it is determined that there is not only one candidate character string that is not included in the second character information, and that there is only one candidate character string that appears most frequently among the candidate character strings that are not included in the second character information, the broadcast station name identifying unit (144) identifies the candidate character string that appears most frequently as the broadcast station name.

[0014] This configuration makes it possible to identify the broadcast station name further precisely, based on the appearance frequency in addition to the comparison result of comparing the first character information with the second character information.

[0015] Preferably, in the broadcast receiving apparatus (100), the broadcast station name identifying unit (144) may identify the broadcast station name further based on a comparison result of comparing the first character information with at least one of predetermined keywords.

[0016] This configuration makes it possible to identify the broadcast station name further precisely by preparing some keywords that are highly likely to be used for the broadcast station names as the predetermined keywords.

[0017] Preferably, in the broadcast receiving apparatus (100), if it is determined that there is not only one candidate character string that is not included in the second character information, that there is not only one candidate character string that appears most frequently among the candidate character strings that are not included in the second character information, and that there is only one candidate character string that includes at least one of the predetermined keywords among the candidate character strings that appear most frequently, the broadcast station name identifying unit (144) may identify the candidate character string that includes at least one of the predetermined keywords as the broadcast station name.

[0018] This configuration makes it possible to identify the broadcast station name further precisely, based on the comparison result of comparing the first character information with the predetermined keywords in addition to the appearance frequency and the comparison result of comparing the first character information with the second character information.

[0019] Preferably, in the broadcast receiving apparatus (100), the broadcast station name identifying unit (144) may start identifying the broadcast station name upon detecting that a plurality of items of the first character information obtained at different times are different from each other.

[0020] This configuration makes it possible to precisely identify the broadcast station name when it is likely that the first character information has been transmitted according to the dynamic PS system.

[0021] According to an aspect of the invention, there is provided a control method for a broadcast receiving apparatus (100). The broadcast receiving apparatus (100) receives broadcast waves. The broadcast waves carry a data signal and an audio signal multiplexed with each other. The data signal is capable of transmitting first character information and second character information. The first character information is used for transmitting a broadcast station name. The second character information includes character information other than the broadcast station name. The control method includes: a step (171) of receiving the broadcast waves transmitted from the broadcast station; a step (172) of obtaining the data signal from the received broadcast waves; a step (173) of obtaining the first character information and the second character information from the obtained data signal; and a step (186, 189, 192) of identifying the broadcast station name, based on a comparison result of comparing the first character information with the second character information.

[0022] According to an aspect of the invention, there is provided a control program for a broadcast receiving apparatus (100). The control program causes a computer to execute the above-described control method.

BRIEF DESCRIPTION OF THE DRAWINGS

[0023]

Fig. 1 is a block diagram illustrating a broadcast receiving apparatus according to an embodiment of the invention;

Fig. 2 is a flowchart illustrating a first control method performed by the broadcast receiving apparatus shown in Fig. 1;

Fig. 3 illustrates an example of a first character information table stored in a storage device of the broadcast receiving apparatus shown in Fig. 1;

Fig. 4 illustrates an example of a second character information table stored in the storage device;
Fig. 5 is a flowchart illustrating a second control method performed by the broadcast receiving apparatus shown in Fig. 1;
Fig. 6 illustrates a first decision table created by a broadcast station name identifying unit of the broadcast receiving apparatus shown in Fig. 1;
Fig. 7 illustrates a second decision table created by the broadcast station name identifying unit;
Fig. 8 illustrates a third decision table created by the broadcast station name identifying unit;
Fig. 9 illustrates a fourth decision table created by the broadcast station name identifying unit; and
Fig. 10 illustrates a fifth decision table created by the broadcast station name identifying unit.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

(Description of Overall Embodiment)

[0024] A broadcast receiving apparatus 100 according to an embodiment of the invention will be described below. Fig. 1 is a block diagram illustrating the broadcast receiving apparatus 100. A broadcast station, which is not shown, transmits FM radio broadcast waves carrying an audio signal and a data signal multiplexed with each other according to the RDS standard in Europe. The broadcast receiving apparatus 100 receives the broadcast waves and then plays back sound from the audio signal and also obtains character information from the data signal.

[0025] The broadcast station transmits PS information and RT information by means of the data signal. The data signal also indicates other items of information. Character information transmitted by means of the data signal may be transmitted at one time together or may be divided and transmitted at different times.

[0026] PS information is character information based on the RDS standard and constituted by a maximum of eight characters for transmitting a broadcast station name. PS information is transmitted regularly, for example. The content of PS information is fixed in some cases and changes over time in other cases. PS information may be character information constituted by more than or less than eight characters at a maximum. In this specification, PS information may also be called first character information.

[0027] RT information is character information based on the RDS standard and constituted by a maximum of 64 characters representing a program name, a title of a song, weather forecasts, advertisement, and so on. RT information is transmitted regularly, for example. The content of RT information is fixed in some cases and changes over time in other cases. RT information may be character information constituted by more than or less than 64 characters at a maximum. Although RT information is character information mainly representing information other than the broadcast station name, it may indicate the broadcast station name in some cases. In this specification, RT information may also be called second character information.

[0028] According to the RDS standard, PS information only indicates the broadcast station name. In reality, however, according to the operation unique to a broadcast station, a protocol standard called the dynamic PS system which allows information other than the broadcast station name to be transmitted as PS information may be utilized. According to the dynamic PS system, PS information includes part of RT information, for example.

(Configuration of Broadcast Receiving Apparatus)

[0029] The broadcast receiving apparatus 100 includes a receiver 110, an operation unit 120, a storage device 130, a controller 140, an audio signal processing device 150, and a display device 160. The receiver 110 receives broadcast waves. The operation unit 120 receives input operations from an operator. The controller 140 extracts an audio signal and a data signal from broadcast waves and executes processing, which will be discussed below. The audio signal processing device 150 plays back the audio signal output from the controller 140. The display device 160 displays characters in accordance with an instruction from the controller 140. The broadcast receiving apparatus 100 demultiplexes broadcast waves into an audio signal and a data signal, and then outputs sound based on the audio signal and obtains various items of information based on the data signal.

[0030] The receiver 110 includes an antenna which can receive FM radio broadcast waves. Broadcast waves received by the receiver 110 are sent to the controller 140 in the state in which an audio signal and a data signal are multiplexed in the broadcast waves.

[0031] The operation unit 120 includes various buttons which receive various input operations from an operator. Examples of the buttons are an ON/OFF button for turning ON and OFF the main power of the broadcast receiving apparatus 100, a channel selection button for receiving the selection of a broadcast station from an operator, and a volume button for adjusting the volume of output sound. Such buttons are not shown. The operation unit 120 may be constituted by buttons other than those described in this embodiment. The operation unit 120 may be another type of operation unit other than buttons, such as a touch panel or a dial.

[0032] The storage device 130 includes a control program 131. The control program 131 is read by an operation processor 142 of the controller 140, which will be discussed later in detail. The control program 131 causes the operation processor 142 to implement the function of performing a first control method and part of a second control method and other functions. While the operation processor 142 is executing various functions, the storage device 130 stores various items of information including PS information and RT information under the control of

the operation processor 142. The storage device 130 is a non-transitory tangible storage medium. The storage device 130 is a volatile or non-volatile storage medium including a read only memory (ROM) and a random access memory (RAM). The storage device 130 may be removable or may be fixed.

[0033] The controller 140 includes a data signal obtaining unit 141 and the operation processor 142. In the controller 140 of this embodiment, the data signal obtaining unit 141 is constituted by an application specific integrated circuit (ASIC), while the operation processor 142 is constituted by a general-purpose computer. Alternatively, the controller 140 may be a general-purpose computer or another circuit which can implement the functions discussed in this embodiment. The operation processor 142 may be an ASIC or another circuit which can implement the functions discussed in this embodiment.

[0034] The data signal obtaining unit 141 demultiplexes broadcast waves received from the receiver 110 into an audio signal and a data signal. The data signal obtaining unit 141 sends the audio signal to the audio signal processing device 150 and the data signal to the operation processor 142.

[0035] The operation processor 142 functions as a character information obtaining unit 143 and a broadcast station name identifying unit 144 as a result of reading the control program 131 stored in the storage device 130 and executing the control program 131.

[0036] The character information obtaining unit 143 obtains the first character information (that is, PS information) and the second character information (that is, RT information) from a data signal, as in a manner similar to the related art. The character information obtaining unit 143 may obtain character information other than the first character information and the second character information. The character information obtaining unit 143 also stores ten items of the first character information that have been received most recently and one item of the second character information that has been received most recently in the storage device 130. The character information obtaining unit 143 may store more than or less than ten items of the first character information and/or may store plurality of items of the second character information.

[0037] The broadcast station name identifying unit 144 identifies the broadcast station name that has transmitted the broadcast waves received by the receiver 110, based on the comparison result of comparing the first character information with the second character information. This will be discussed later in detail.

[0038] The audio signal processing device 150 includes a speaker, for example, and plays back sound based on the audio signal received from the data signal obtaining unit 141. The display device 160 includes a liquid crystal display, for example, and displays the identified broadcast station name in response to an instruction from the broadcast station name identifying unit 144. The display device 160 displays the obtained the second character information at a suitable timing in response to an instruction from the character information obtaining unit 143.

(First Control Method)

[0039] Fig. 2 is a flowchart illustrating a first control method performed by the broadcast receiving apparatus 100 shown in Fig. 1. The first control method is a preparation process prior to a process for identifying a broadcast station name. The first control method will be described below with reference to Fig. 2. The first control method is regularly executed in the state in which a broadcast station is being selected. More specifically, the first control method is executed when the main power is turned ON by the operation unit 120 or when the selection of the broadcast station is changed by the operation unit 120.

[0040] In step 171, the receiver 110 starts receiving broadcast waves.

[0041] Then, in step 172, the data signal obtaining unit 141 obtains a data signal from the broadcast waves received by the receiver 110 and sends the data signal to the operation processor 142. The data signal obtaining unit 141 also obtains an audio signal from the broadcast waves received by the receiver 110 and sends the audio signal to the audio signal processing device 150.

[0042] Then, in step 173, if at least one of the first character information and the second character information is included in the data signal obtained by the data signal obtaining unit 141, the character information obtaining unit 143 stores the first character information and/or the second character information included in the data signal in the storage device 130.

[0043] Fig. 3 illustrates an example of a first character information table 210 storing the first character information. The first character information table 210 stores ten items of the first character information 211-1 through 211-10. Hereinafter, the ten items of the first character information 211-1 through 211-10 may simply be called the first character information 211. If ten items of the first character information 211 are already stored, the oldest item of the first character information 211 is replaced by the latest item of the first character information 211. Examples of the first character information 211 are "ZZZZZ-FM", "AAAAAAAA", and "BBBBBBBB". Another character string may be used as the first character information 211. The first character information 211 may include a broadcast station name or may not include it.

[0044] Fig. 4 illustrates an example of a second character information table 220 storing the second character information. The second character information table 220 stores one item of the second character information 221. If the second character information 221 is already stored, this item of the second character information 221 is replaced by a newer item of the second character information 221. An example of the second character information 221 is a 64-character string constituted by eight 8-char-

acter strings, that is, "AAAAAAAA", "BBBBBBBB", "CCCCCCCC", "DDDDDDDD", "EEEEEEEE", "FFFFFFFF", "GGGGGGGG", and "HHHHHHHH", arranged in this order.

[0045] In this embodiment, for the sake of convenience, meaningless character strings are described as the first character information 211 and the second character information 221. In reality, in most cases, meaningful characters, such as a broadcast station name, a word, for example, "Hello", and a website address, are transmitted as the first character information 211 or the second character information 221. The transmission timing and the transmission frequency of the first character information and those of the second character information may be the same or may be different at the discretion of a broadcast station. For example, the first character information is transmitted several times or several dozens of times during a period from when the second character information is transmitted until when the next second character information is transmitted.

[0046] Referring back to Fig. 2, in step 174, the broadcast station name identifying unit 144 determines whether a predetermined condition is satisfied. An example of the predetermined condition is that ten items of the first character information 211 (Fig. 3) are stored and one item of the second character information 221 (Fig. 4) is stored. Another example of the predetermined condition is that at least one of the ten stored items of the first character information 211 is replaced by a new item of the first character information 211. Another example of the predetermined condition is that the stored item of the second character information 221 is replaced by a new item of the second character information 221.

[0047] If it is determined in step 174 that the predetermined condition is satisfied, the first control method is completed. If it is determined in step 174 that the predetermined condition is not satisfied, steps 172 through 174 are repeated.

(Second Control Method)

[0048] Fig. 5 is a flowchart illustrating a second control method performed by the broadcast receiving apparatus 100 shown in Fig. 1. The broadcast receiving apparatus 100 identifies the broadcast station name that has transmitted the broadcast waves received by the receiver 110 by using the second control method. The second control method will be described below with reference to Fig. 5. The second control method is executed after the first control method shown in Fig. 2 has been completed, for example. At least one item of the first character information 211 (Fig. 3) and/or the second character information 221 (Fig. 4) may be replaced while the second control method is being executed, for example.

[0049] A first decision table 230-1 shown in Fig. 6, a second decision table 230-2 shown in Fig. 7, a third decision table 230-3 shown in Fig. 8, a fourth decision table 230-4 shown in Fig. 9, and a fifth decision table 230-5 shown in Fig. 10 are examples of information created by the broadcast station name identifying unit 144 and stored in the storage device 130 (Fig. 1) in the second control method. Hereinafter, the first through fifth decision tables 230-1 through 230-5 may simply be called the decision table 230.

[0050] For the sake of convenience, the decision table 230 shown in Fig. 7 is created based on the first character information 211 shown in Fig. 3 and the second character information 221 shown in Fig. 4, and the decision tables 230 shown in Figs. 6, 8, 9, and 10 are created based on the first character information and the second character information obtained at different times from the first character information 211 shown in Fig. 3 and the second character information 221 shown in Fig. 4. The decision tables 230 shown in Figs. 6 through 10 are not necessarily based on the first character information obtained from the same broadcast station, nor do they necessarily cover all the examples.

[0051] In step 181 in Fig. 5, the broadcast station name identifying unit 144 (Fig. 1) extracts one or more candidate character strings that appear at least one time as the first character information, from among the plurality of items of the first character information obtained at different times.

[0052] For example, in the example in Fig. 6, as indicated in a candidate character string field 231-1 of the first decision table 230-1, "ZZZZZ-FM" is the only candidate character string. That is, in the example in Fig. 6, the ten stored items of the first character information are all "ZZZZZ-FM". In the example in Fig. 7, candidate character strings indicated in a candidate character string field 231-2 of the second decision table 230-2 are obtained from the ten items of the first character information 211 stored in the first character information table 210 shown in Fig. 3. In the example in Fig. 7, three candidate character strings "ZZZZZ-FM", "AAAAAAAA", and "BBBBBBBB" are extracted.

[0053] In the example in Fig. 8, as indicated in a candidate character string field 231-3 of the third decision table 230-3, three candidate character strings "ZZZZZ-FM", "AAAAAAAA", and "BBBBBBBB" are extracted. In the example in Fig. 9, as indicated in a candidate character string field 231-4 of the fourth decision table 230-4, three candidate character strings "ZZZZZ-FM", "YYYYYYYY", and "XXXXXXXX" are extracted. In the example in Fig. 10, as indicated in a candidate character string field 231-5 of the fifth decision table 230-5, three candidate character strings "ZZZZZ-FM", "AAAAAAAA", and "BBBBBBBB" are extracted.

[0054] In step 182 in Fig. 5, the broadcast station name identifying unit 144 determines whether only one candidate character string has been extracted. If it is determined in step 182 that only one candidate character string has been extracted, the broadcast station name identifying unit 144 identifies this candidate character string as the broadcast station name in step 183. The second control method is then completed. If it is determined in

step 182 that plural candidate character strings have been extracted, the broadcast station name identifying unit 144 proceeds to step 184.

[0055] In the example in Fig. 6, as indicated in the candidate character string field 231-1, "ZZZZZ-FM" is the only candidate character string, and thus, "ZZZZZ-FM" is identified as the broadcast station name. The first character information is used for transmitting a broadcast station name according to the RDS standard. Accordingly, if only one candidate character string is extracted, it is highly likely that this candidate character string represents the broadcast station name. In the examples in Figs. 7 through 10, plural candidate character strings are extracted, and thus, the broadcast station name identifying unit 144 proceeds to step 184.

[0056] In step 184 in Fig. 5, the broadcast station name identifying unit 144 compares each candidate character string with the second character information so as to indirectly compare each item of the first character information with the second character information. The comparison result in step 184 represents the number of candidate character strings that are not included in the second character information.

[0057] An include/not-include decision field 232-2 in Fig. 7 indicates whether each of the candidate character strings indicated in the candidate character string field 231-2 is included in the second character information (Fig. 4). In the example in Fig. 7, "ZZZZZ-FM" is not included in the second character information 221 (Fig. 4), while "AAAAAAAA" and "BBBBBBBB" are included in the second character information 221 (Fig. 4). The comparison result is thus "one". An include/not-include decision field 232-3 in Fig. 8 indicates whether each of the candidate character strings indicated in the candidate character string field 231-3 is included in the second character information. In the example in Fig. 8, all the candidate character strings are included in the second character information, and the comparison result is thus "zero".

[0058] An include/not-include decision field 232-4 in Fig. 9 indicates whether each of the candidate character strings indicated in the candidate character string field 231-4 is included in the second character information. In the example in Fig. 9, none of the candidate character strings are included in the second character information, and the comparison result is thus "three". An include/not-include decision field 232-5 in Fig. 10 indicates whether each of the candidate character strings indicated in the candidate character string field 231-5 is included in the second character information. In the example in Fig. 10, all the candidate character strings are included in the second character information, and the comparison result is thus "zero".

[0059] In step 185 in Fig. 5, the broadcast station name identifying unit 144 determines based on the comparison result obtained in step 184 whether there is only one candidate character string that is not included in the second character information. If it is determined in step 185 that there is only one candidate character string that is not included in the second character information, the broadcast station name identifying unit 144 identifies this candidate character string as the broadcast station name in step 186. The second control method is then completed. If it is determined in step 185 that all the candidate character strings are included in the second character information or that there are two or more candidate character strings that are not included in the second character information, the broadcast station name identifying unit 144 proceeds to step 187.

[0060] In the example in Fig. 7, "ZZZZZ-FM" is the only candidate character string that is not included in the second character information (Fig. 4), and is thus identified as the broadcast station name. While the first character information is used for transmitting a broadcast station name according to the RDS standard, the second character information is used for transmitting various items of information including a broadcast station name. From the viewpoint of effective use of character information, when information concerning a broadcast station name is included in the first character information, the second character information usually includes other items of information. Consequently, when there is only one candidate character string that is not included in the second character information (Fig. 4), it is highly likely that this candidate character string represents the broadcast station name.

[0061] In the examples in Figs. 8 through 10, the comparison result obtained in step 184 is "zero" or "three". The broadcast station name identifying unit 144 thus proceeds to step 187.

[0062] In step 187 in Fig. 5, the broadcast station name identifying unit 144 counts, as the appearance frequency, how many times each candidate character string appears among the plurality of items of the first character information obtained at different times.

[0063] Appearance frequency fields 233-3, 233-4, and 233-5 respectively shown in Figs. 8, 9, and 10 each indicate the appearance frequency of the corresponding candidate character string. In the example in Fig. 8, the appearance frequency of "ZZZZZ-FM" is "5", the appearance frequency of "AAAAAAAA" is "3", and the appearance frequency of "BBBBBBBB" is "2". In the example in Fig. 9, the appearance frequency of "ZZZZZ-FM" is "5", the appearance frequency of "YYYYYYYY" is "4", and the appearance frequency of "XXXXXXXX" is "1". In the example in Fig. 10, the appearance frequency of "ZZZZZ-FM" is "4", the appearance frequency of "AAAAAAAA" is "4", and the appearance frequency of "BBBBBBBB" is "2".

[0064] In step 188 in Fig. 5, the broadcast station name identifying unit 144 determines whether, among the candidate character strings extracted in step 181, only one candidate character string appears most frequently among the plurality of items of the first character information. If it is determined in step 188 that there is only one candidate character string that appears most fre-

quently among the candidate character strings that are not included in the second character information, the broadcast station name identifying unit 144 proceeds to step 189 and identifies this candidate character string as the broadcast station name. The second control method is then completed. In this manner, the broadcast station name identifying unit 144 identifies the broadcast station name based on the comparison result obtained in step 184 and the appearance frequency determined in step 187. If it is determined in step 188 that two or more candidate character strings appear most frequently among the candidate character strings that are not included in the second character information, the broadcast station name identifying unit 144 proceeds to step 190.

[0065] In the example in Fig. 8, the most frequently appearing candidate character string is only "ZZZZZ-FM", and "ZZZZZ-FM" is thus identified as the broadcast station name. In the example in Fig. 9, too, the most frequently appearing candidate character string is only "ZZZZZ-FM", and "ZZZZZ-FM" is thus identified as the broadcast station name. In the example in Fig. 10, there are two most frequently appearing candidate character strings, that is, "ZZZZZ-FM" and "AAAAAAAA". The broadcast station name identifying unit 144 thus proceeds to step 190.

[0066] In step 190, the broadcast station name identifying unit 144 compares each of the candidate character strings with predetermined keywords that are highly likely to be used for the broadcast station names such as "FM" or "Station". These predetermined keywords are stored in the storage device 130. The predetermined keywords may be other character strings.

[0067] A keyword field 234-5 in Fig. 10 indicates whether each of the candidate character strings in the candidate character string field 231-5 matches at least one of the predetermined keywords. In Fig. 10, only "ZZZZZ-FM" matches the keyword "FM".

[0068] In step 191, the broadcast station name identifying unit 144 determines whether or not there is only one candidate character string that includes at least one of the predetermined keywords among the candidate character strings that appear most frequently. If it is determined in step 191 that there is only one candidate character string that includes at least one of the predetermined keywords among the candidate character strings that appear most frequently, the broadcast station name identifying unit 144 identifies this candidate character string as the broadcast station name in step 192. The second control method is then completed. In this manner, the broadcast station name identifying unit 144 identifies the broadcast station name based on a comparison result of comparing each candidate character string with at least one of predetermined keywords, that is, based on a comparison result of comparing the first character information with at least one of predetermined keywords.

[0069] In the example in Fig. 10, "ZZZZZ-FM" is the only candidate character string including a predetermined keyword, and is thus identified as the broadcast station name.

[0070] If it is determined in step 191 that none of the candidate character strings include these predetermined keywords or two or more candidate character strings include these predetermined keywords, the broadcast station name identifying unit 144 does not identify the broadcast station name in step 193. The second control method is then completed.

(Conclusion)

[0071] According to the embodiment, the need to store all broadcast station names and to compare the first character information with all the broadcast station names is eliminated. It is thus possible to speedily identify a broadcast station name with a small storage capacity.

[0072] According to the embodiment, the broadcast station name identifying unit 144 extracts one or more candidate character strings which appear at least one time as the first character information, from among a plurality of items of the first character information obtained at different times. The broadcast station name identifying unit 144 then compares each candidate character string with the second character information and obtains a comparison result. If it is determined based on the comparison result that there is only one candidate character string that is not included in the second character information, the broadcast station name identifying unit 144 identifies this candidate character string as the broadcast station name. It is thus possible to precisely identify the broadcast station name by excluding candidate character strings included in the second character information that are unlikely to be the broadcast station name.

[0073] According to the embodiment, as a result of counting, as the appearance frequency, how many times each candidate character string appears among the plurality of items of the first character information, the broadcast station name identifying unit 144 identifies the broadcast station name based on the above-described comparison result and the appearance frequency. It is thus possible to identify the broadcast station name further precisely, based on the assumption that the first character information used for transmitting a broadcast station name is highly likely to be the broadcast station name.

[0074] According to the embodiment, if it is determined that there is not only one candidate character string that is not included in the second character information, and that there is only one candidate character string that appears most frequently among the candidate character strings that are not included in the second character information, the broadcast station name identifying unit 144 identifies the candidate character string that appears most frequently as the broadcast station name. It is thus possible to identify the broadcast station name further precisely, based on the appearance frequency in addition to the comparison result of comparing the first character information with the second character information. A

case in which it is determined that there is not only one candidate character string that is not included in the second character information includes at least one of a case in which two or more candidate character strings are not included in the second character information and a case in which all the candidate character strings are included in the second character information.

[0075] According to the embodiment, if it is not determined based on the comparison result that there is only one candidate character string that is not included in the second character information and if, among one or more candidate character strings which appear at least one time as the first character information, two or more candidate character strings appear most frequently among the plurality of items of the first character information, the broadcast station name identifying unit 144 identifies, among the two or more most frequently appearing candidate character strings, a candidate character string including at least one keyword as the broadcast station name. Preparing of keywords that are likely to be included in broadcast station names enhances the precision in identifying the broadcast station name.

[0076] According to the embodiment, the broadcast station name identifying unit 144 identifies the broadcast station name based on the result of comparing the first character information with one or more keywords. Preparing of keywords that may be used for identifying the broadcast station names enhances the precision in identifying the broadcast station name.

(Modified Examples)

[0077] According to one modified example, the broadcast station name identifying unit 144 starts identifying the broadcast station name upon detecting that a plurality of items of the first character information obtained at different times are different from each other.

[0078] According to this modified example, if it is likely that the first character information has been transmitted according to the dynamic PS system, the broadcast station name can be identified precisely. If it is likely that the first character information has been transmitted according to the RDS standard, processing necessary for executing the second control method may be omitted, thereby reducing the processing load on the broadcast receiving apparatus 100.

[0079] The present invention is not restricted to the above-described embodiment. That is, within the technical scope of the invention and equivalents thereof, those skilled in the art may make various changes to the components described in the embodiment, make combinations and subcombinations for the components, and may replace at least some of these components by other components.

[0080] The present invention is applicable to various broadcast receiving apparatuses for receiving broadcast waves carrying first character information and the second character information multiplexed with an audio signal. The first character information is used for transmitting a broadcast station name, and the second character information includes character information other than the broadcast station name. Such a broadcast receiving apparatus may be a receiver for FM radio broadcasting only or a receiver for FM radio broadcasting and AM radio broadcasting. The broadcast receiving apparatus may be an apparatus installed in a vehicle or may be part of an apparatus including another function, such as a vehicle navigation function. The broadcast receiving apparatus may include the function of receiving broadcasts in a different area.

[0081] A broadcast receiving apparatus (100) receives broadcast waves carrying a data signal and an audio signal multiplexed with each other. The data signal transmits first character information and second character information. The first character information is used for transmitting a broadcast station name. The second character information includes character information other than the broadcast station name. The broadcast receiving apparatus (100) includes the following elements. A receiver (110) receives the broadcast waves transmitted from the broadcast station. A data signal obtaining unit (141) obtains the data signal from the received broadcast waves. A character information obtaining unit (143) obtains the first character information and the second character information from the obtained data signal. A broadcast station name identifying unit (144) identifies the broadcast station name, based on a comparison result of comparing the first character information with the second character information.

Claims

1. A broadcast receiving apparatus (100) for receiving broadcast waves, the broadcast waves carrying a data signal and an audio signal multiplexed with each other, the data signal being capable of transmitting first character information and second character information, the first character information being used for transmitting a broadcast station name, the second character information including character information other than the broadcast station name, the broadcast receiving apparatus (100) comprising:

   a receiver (110) for receiving the broadcast waves transmitted from the broadcast station;
   a data signal obtaining unit (141) for obtaining the data signal from the received broadcast waves;
   a character information obtaining unit (143) for obtaining the first character information and the second character information from the obtained data signal; and
   a broadcast station name identifying unit (144) for identifying the broadcast station name, based on a comparison result of comparing the

first character information with the second character information.

2. The broadcast receiving apparatus (100) according to Claim 1, wherein:

the broadcast station name identifying unit (144) extracts one or more candidate character strings appearing at least one time as the first character information from among a plurality of items of the first character information obtained at different times;
the broadcast station name identifying unit (144) obtains the comparison result of comparing the first character information with the second character information indirectly by comparing the candidate character strings with the second character information;
the broadcast station name identifying unit (144) determines, based on the comparison result of comparing the first character information with the second character information, whether or not there is only one candidate character string that is not included in the second character information; and
if it is determined that there is only one candidate character string that is not included in the second character information, the broadcast station name identifying unit (144) identifies the candidate character string that is not included in the second character information as the broadcast station name.

3. The broadcast receiving apparatus (100) according to Claim 2, wherein:

the broadcast station name identifying unit (144) counts, as appearance frequency, how many times each of the candidate character strings appears among the plurality of items of the first character information; and
the broadcast station name identifying unit (144) identifies the broadcast station name further based on the appearance frequency.

4. The broadcast receiving apparatus (100) according to Claim 3, wherein, if it is determined that there is not only one candidate character string that is not included in the second character information, and that there is only one candidate character string that appears most frequently among the candidate character strings that are not included in the second character information, the broadcast station name identifying unit (144) identifies the candidate character string that appears most frequently as the broadcast station name.

5. The broadcast receiving apparatus (100) according to Claims 4, wherein the broadcast station name identifying unit (144) identifies the broadcast station name further based on a comparison result of comparing the first character information with at least one of predetermined keywords.

6. The broadcast receiving apparatus (100) according to Claim 5, wherein, if it is determined that there is not only one candidate character string that is not included in the second character information, that there is not only one candidate character string that appears most frequently among the candidate character strings that are not included in the second character information, and that there is only one candidate character string that includes at least one of the predetermined keywords among the candidate character strings that appear most frequently, the broadcast station name identifying unit (144) identifies the candidate character string that includes at least one of the predetermined keywords as the broadcast station name.

7. The broadcast receiving apparatus (100) according to one of Claims 1 to 6, wherein the broadcast station name identifying unit (144) starts identifying the broadcast station name upon detecting that a plurality of items of the first character information obtained at different times are different from each other.

8. A control method for a broadcast receiving apparatus (100), the broadcast receiving apparatus (100) receiving broadcast waves, the broadcast waves carrying a data signal and an audio signal multiplexed with each other, the data signal being capable of transmitting first character information and second character information, the first character information being used for transmitting a broadcast station name, the second character information including character information other than the broadcast station name, the control method comprising:

a step (171) of receiving the broadcast waves transmitted from the broadcast station;
a step (172) of obtaining the data signal from the received broadcast waves;
a step (173) of obtaining the first character information and the second character information from the obtained data signal; and
a step (186, 189, 192) of identifying the broadcast station name, based on a comparison result of comparing the first character information with the second character information.

9. A control program for a broadcast receiving apparatus (100), the control program causing a computer to execute the control method according to Claim 8.

FIG. 1

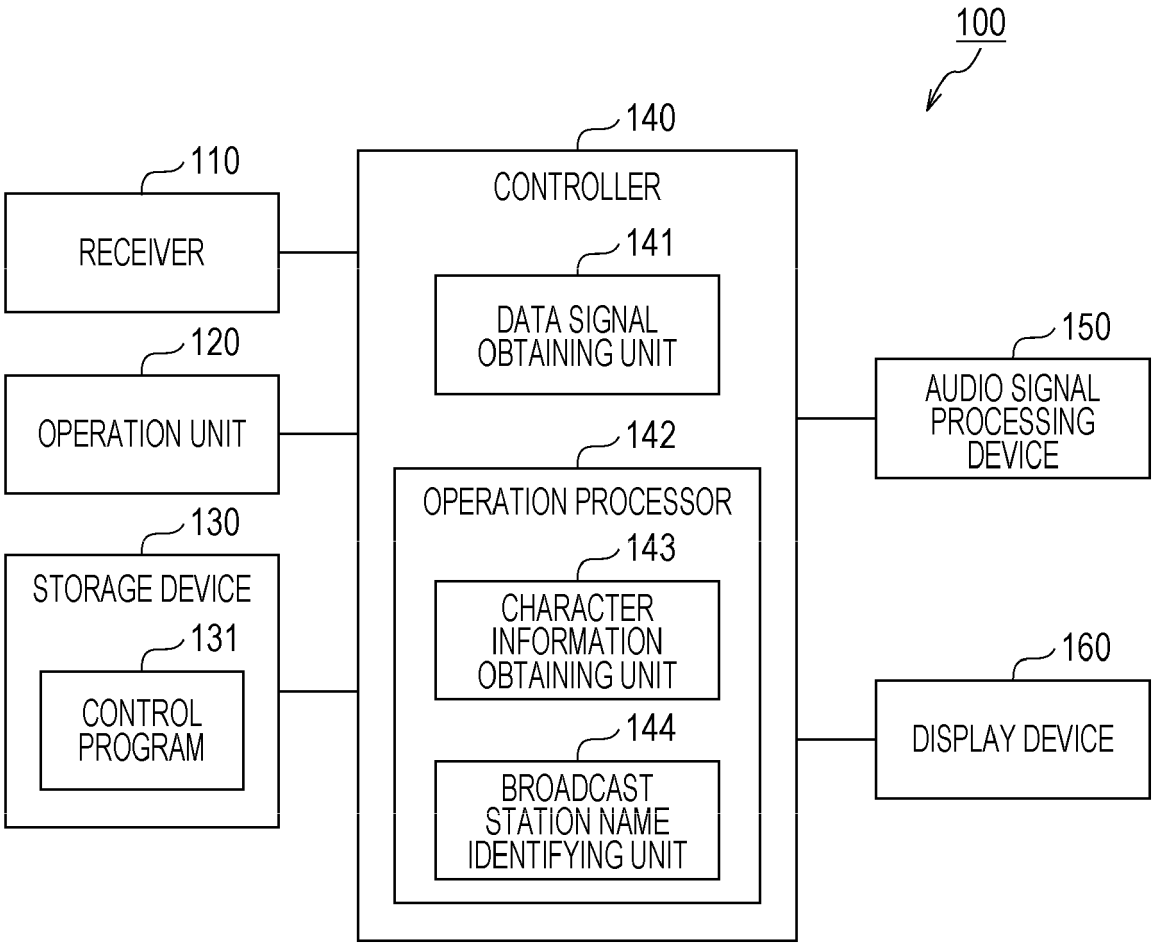
100
140
CONTROLLER
110
RECEIVER
141
DATA SIGNAL OBTAINING UNIT
120
OPERATION UNIT
142
OPERATION PROCESSOR
130
STORAGE DEVICE
143
CHARACTER INFORMATION OBTAINING UNIT
131
CONTROL PROGRAM
144
BROADCAST STATION NAME IDENTIFYING UNIT
150
AUDIO SIGNAL PROCESSING DEVICE
160
DISPLAY DEVICE

FIG. 2

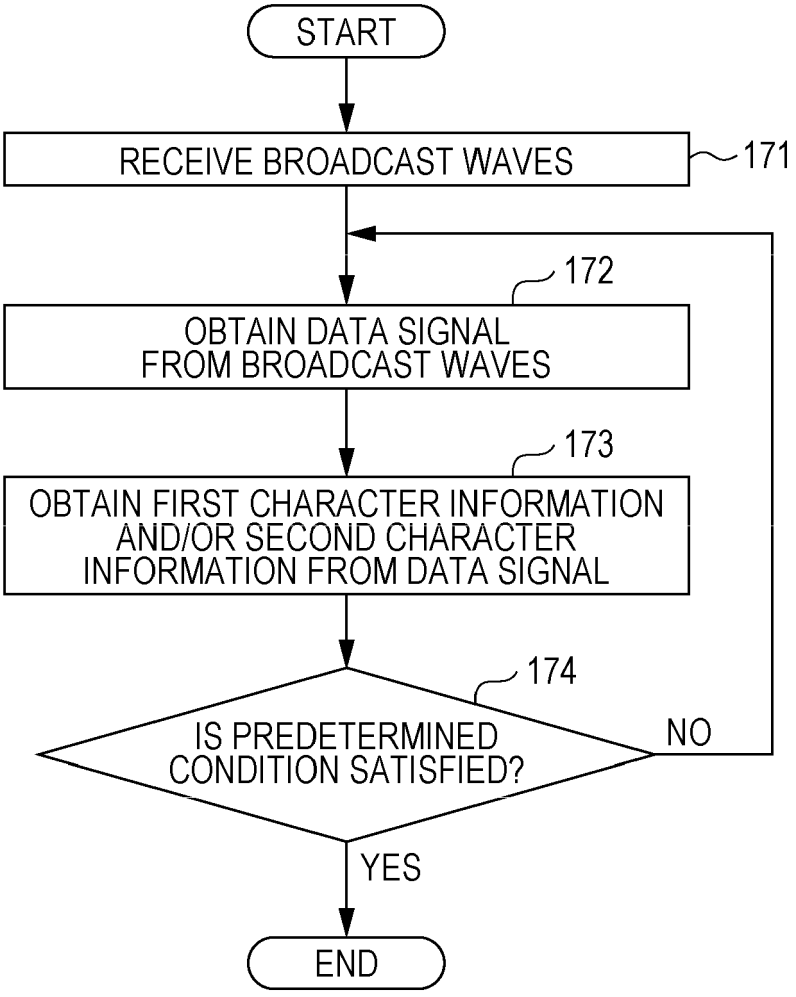
START
RECEIVE BROADCAST WAVES
171
172
OBTAIN DATA SIGNAL FROM BROADCAST WAVES
173
OBTAIN FIRST CHARACTER INFORMATION AND/OR SECOND CHARACTER INFORMATION FROM DATA SIGNAL
174
IS PREDETERMINED CONDITION SATISFIED?
NO
YES
END

FIG. 3

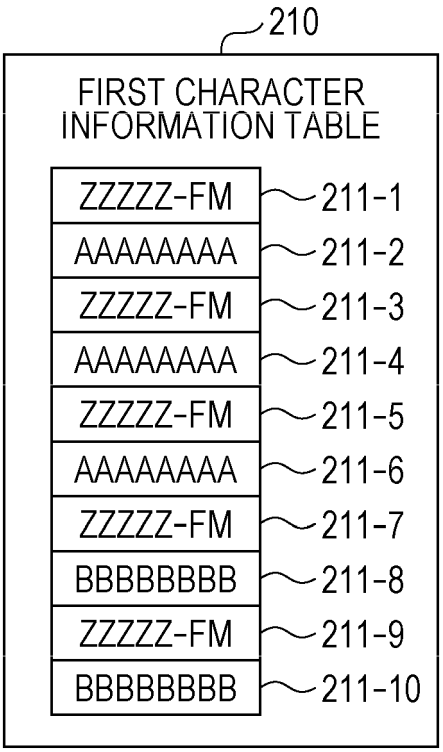
210
FIRST CHARACTER INFORMATION TABLE
ZZZZZ-FM
211-1
AAAAAAAA
211-2
ZZZZZ-FM
211-3
AAAAAAAA
211-4
ZZZZZ-FM
211-5
AAAAAAAA
211-6
ZZZZZ-FM
211-7
BBBBBBBB
211-8
ZZZZZ-FM
211-9
BBBBBBBB
211-10

FIG. 4

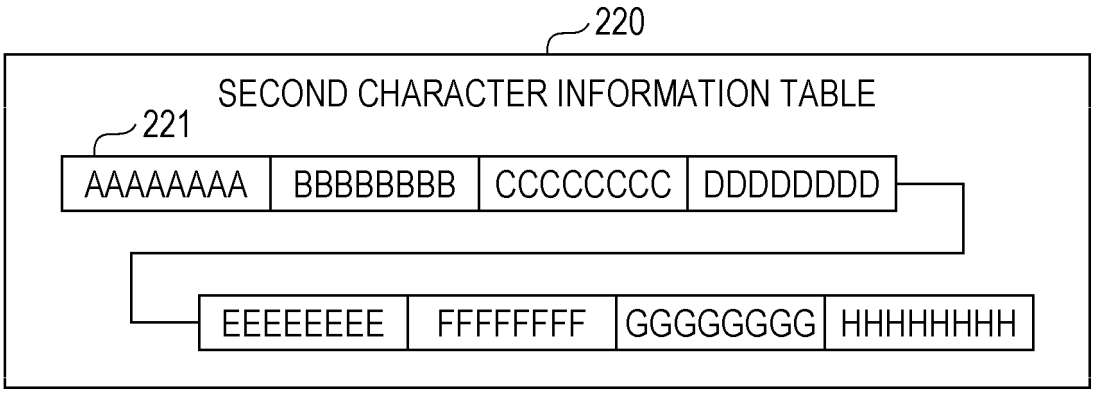
220
SECOND CHARACTER INFORMATION TABLE
221
AAAAAAAA
BBBBBBBB
CCCCCCCC
DDDDDDDD
EEEEEEEE
FFFFFFFF
GGGGGGGG
HHHHHHHH

FIG. 5

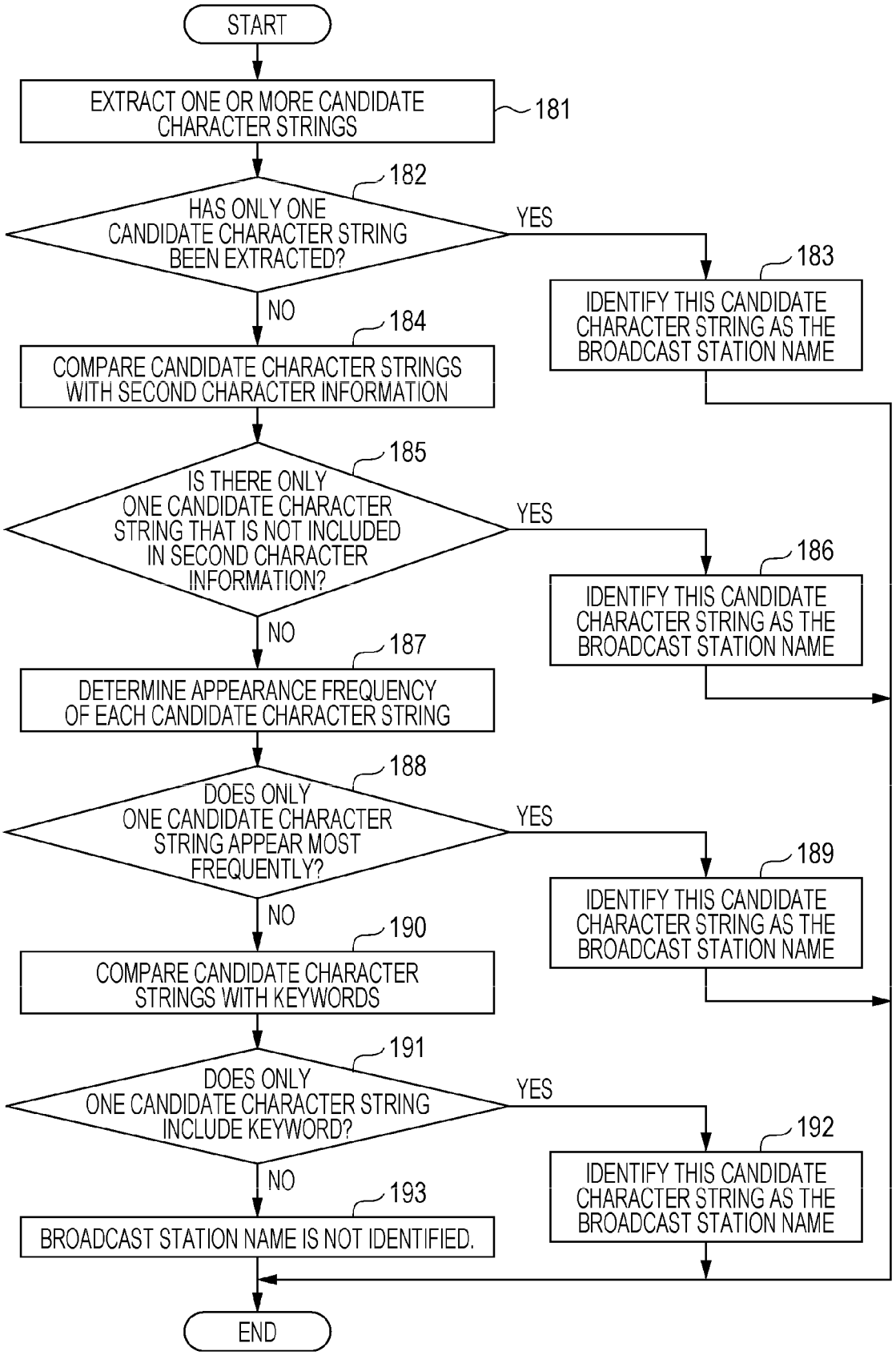
START
EXTRACT ONE OR MORE CANDIDATE CHARACTER STRINGS
181
HAS ONLY ONE CANDIDATE CHARACTER STRING BEEN EXTRACTED?
182
YES
NO
IDENTIFY THIS CANDIDATE CHARACTER STRING AS THE BROADCAST STATION NAME
183
COMPARE CANDIDATE CHARACTER STRINGS WITH SECOND CHARACTER INFORMATION
184
IS THERE ONLY ONE CANDIDATE CHARACTER STRING THAT IS NOT INCLUDED IN SECOND CHARACTER INFORMATION?
185
YES
NO
IDENTIFY THIS CANDIDATE CHARACTER STRING AS THE BROADCAST STATION NAME
186
DETERMINE APPEARANCE FREQUENCY OF EACH CANDIDATE CHARACTER STRING
187
DOES ONLY ONE CANDIDATE CHARACTER STRING APPEAR MOST FREQUENTLY?
188
YES
NO
IDENTIFY THIS CANDIDATE CHARACTER STRING AS THE BROADCAST STATION NAME
189
COMPARE CANDIDATE CHARACTER STRINGS WITH KEYWORDS
190
DOES ONLY ONE CANDIDATE CHARACTER STRING INCLUDE KEYWORD?
191
YES
NO
IDENTIFY THIS CANDIDATE CHARACTER STRING AS THE BROADCAST STATION NAME
192
BROADCAST STATION NAME IS NOT IDENTIFIED.
193
END

FIG. 6

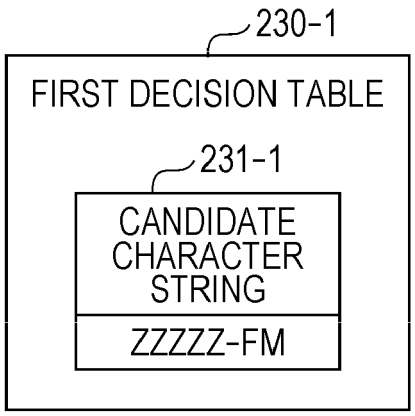
230-1
FIRST DECISION TABLE
231-1
CANDIDATE CHARACTER STRING
ZZZZZ-FM

FIG. 7

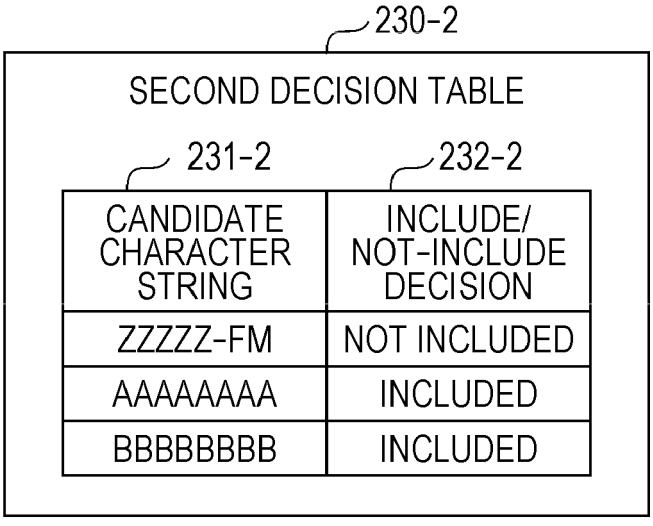
230-2
SECOND DECISION TABLE
231-2
232-2
CANDIDATE CHARACTER STRING
INCLUDE/ NOT-INCLUDE DECISION
ZZZZZ-FM
NOT INCLUDED
AAAAAAAA
INCLUDED
BBBBBBBB
INCLUDED

FIG. 8

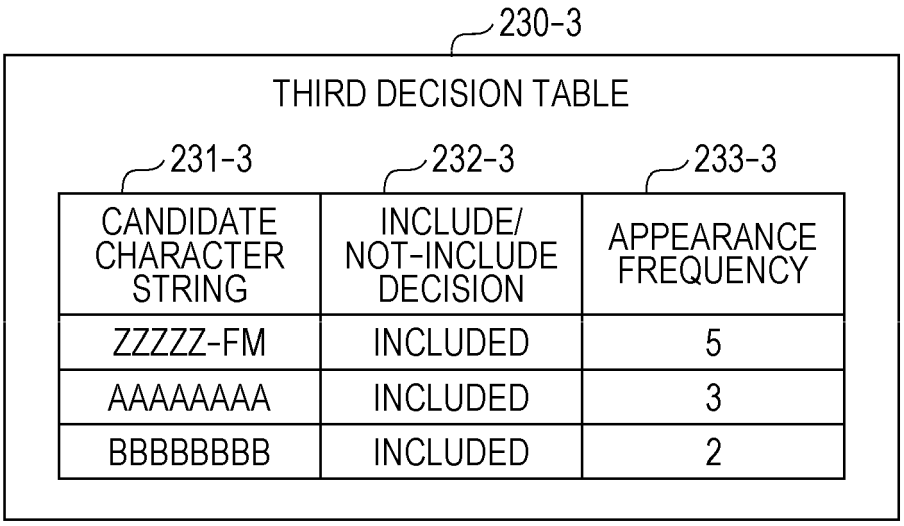
230-3
THIRD DECISION TABLE
231-3
232-3
233-3
CANDIDATE CHARACTER STRING
INCLUDE/ NOT-INCLUDE DECISION
APPEARANCE FREQUENCY
ZZZZZ-FM
INCLUDED
5
AAAAAAAA
INCLUDED
3
BBBBBBBB
INCLUDED
2

FIG. 9

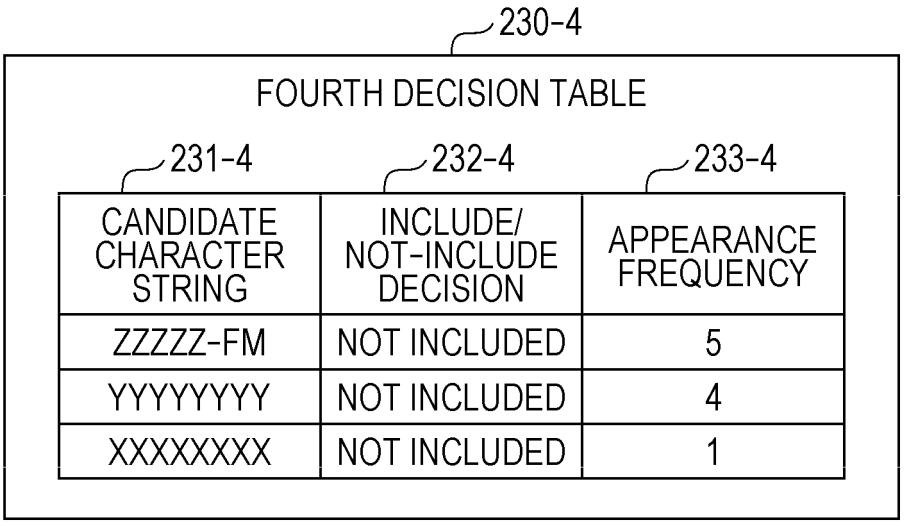
230-4
FOURTH DECISION TABLE
231-4
232-4
233-4
CANDIDATE CHARACTER STRING
INCLUDE/ NOT-INCLUDE DECISION
APPEARANCE FREQUENCY
ZZZZZ-FM
NOT INCLUDED
5
YYYYYYYY
NOT INCLUDED
4
XXXXXXXX
NOT INCLUDED
1

FIG. 10

230-5

FIFTH DECISION TABLE

231-5 CANDIDATE CHARACTER STRING	232-5 INCLUDE/ NOT-INCLUDE DECISION	233-5 APPEARANCE FREQUENCY	234-5 KEYWORD
ZZZZZ-FM	INCLUDED	4	MATCHED
AAAAAAAA	INCLUDED	4	NOT MATCHED
BBBBBBBB	INCLUDED	2	NOT MATCHED

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EUROPEAN SEARCH REPORT

Application Number
EP 17 20 7261

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 A	US 2014/273908 A1 (ENGLERT RICHARD [US]) 18 September 2014 (2014-09-18) * paragraph [0001] * * paragraphs [0015] - [0016]; figure 1 * * paragraph [0018] * * paragraph [0020] * * paragraph [0024] * * paragraph [0048] *	1,8,9 5,6	INV. H04H60/44
X	EP 2 034 641 A2 (CONTINENTAL AUTOMOTIVE GMBH [DE]) 11 March 2009 (2009-03-11) * paragraph [0001] * * paragraphs [0003] - [0005] * * paragraph [0013] * * paragraphs [0021] - [0022] * * paragraph [0030] * * paragraph [0036] *	1-9	
A	EP 2 863 562 A1 (CONTINENTAL AUTOMOTIVE GMBH [DE]) 22 April 2015 (2015-04-22) * paragraphs [0001] - [0003] * * paragraph [0006] * * paragraphs [0010] - [0012] *	3,4	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	29 June 2018	Torcal Serrano, C

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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L : document cited for other reasons

& : member of the same patent family, corresponding document

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 17 20 7261

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29-06-2018

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REFERENCES CITED IN THE DESCRIPTION

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- JP 2014127901 A **[0004]**