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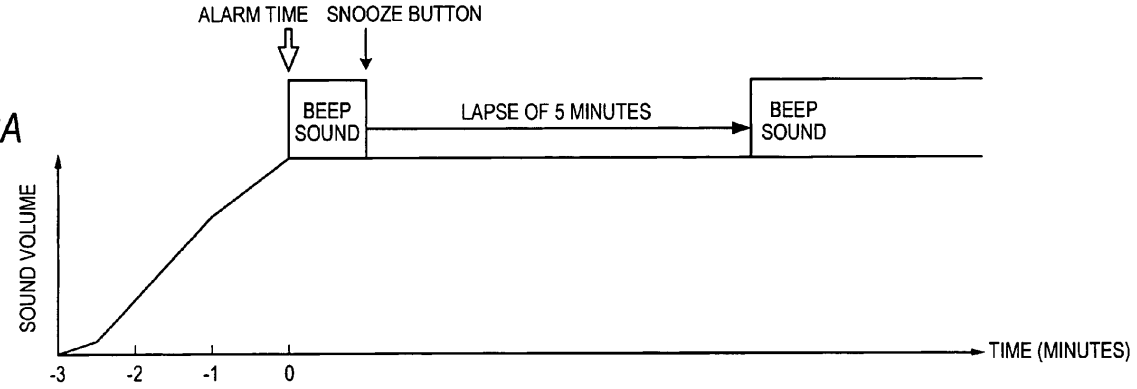
(54) Audio reproducing device

(57) An audio reproducing device includes a time setting section configured to set an alarm time, an audio signal processing section configured to start outputting of an audio signal when arrival of the alarm time set by the time setting section or arrival of a time point that is a predetermined time period before the alarm time, while gradually increasing a sound volume of the audio signal for a predetermined rising time period and changing a characteristic of a filtering process to the audio signal for the predetermined rising time period, and a sound outputting section configured to output the audio signal received from the audio signal processing section as a sound.

FIG. 2A



EP 2 323 003 A2

Description

BACKGROUND

[0001] The present invention relates to an audio reproducing device that has an alarming function of starting output of a sound of an audio signal from a radio receiver or a mobile terminal at a preset time.

[0002] A device having a radio receiver incorporated with a wake-up call function (an alarming function) has been utilized (for example, patent document 1). Such a device has a function of awakening a user by turning on a reception of radio broadcasting or generating an alarm sound when an alarm time set by the user comes.

[0003] Patent Document 1: JP-A-5-022172

[0004] However, in this type of device, when an alarm time comes, a sound of a radio receiver suddenly starts at a large volume so that a user is awakened rapidly by the large sound, which may make the user uncomfortable in the wake-up time. In addition, while such a device that gradually increases a sound volume has been also put into practical use, a user is possibly awakened by a rudeness sound even by that device, which may not be comfortable to the user.

SUMMARY

[0005] A purpose of the invention is to provide an audio reproducing device capable of allowing a user to comfortably wake up.

[0006] In accordance with claim 1 of the invention, an audio reproducing device comprising:

> a time setting section configured to set an alarm time;
> an audio signal processing section configured to start outputting of an audio signal when arrival of the alarm time set by the time setting section or arrival of a time point that is a predetermined time period before the alarm time, while gradually increasing a sound volume of the audio signal for a predetermined rising time period and changing a characteristic of a filtering process to the audio signal for the predetermined rising time period; and
> a sound outputting section configured to output the audio signal received from the audio signal processing section as a sound.

[0007] Preferably, the audio signal processing section starts the outputting of the audio signal at a time that is the predetermined rising time period before the alarm time so as to make the sound volume of the audio signal to a preset sound volume when the alarm time comes and controls the characteristic of the filtering process so that the characteristic of the filtering process does not limit a frequency band of the audio signal when the alarm time comes.

Here, it is preferable that, the characteristic of the filtering process to the audio signal is a low-pass filter characteristic for cutting off a high frequency band of the audio signal.

[0008] Preferably, the audio reproducing device further includes an alarm sound generating section configured to generate an alarm sound different from the audio signal, wherein the alarm sound generating section generates the alarm sound when the alarm time comes.

[0009] Preferably, the audio reproducing device further includes a snooze operation section configured to temporarily stop the audio signal, wherein the audio signal processing section stops the outputting of the audio signal for a predetermined snooze time period when the snooze operation section is operated, and wherein after the snooze time period has elapsed, the audio signal processing section increases the sound volume of the audio signal to the preset sound volume in a time period shorter than the predetermined rising time period while not performing the filtering process.

[0010] In accordance with the invention, since an uncomfortable frequency band is removed and generation of a sound such as a music piece having quality of an ear-friendly sound is started, a user is gradually awakened from sleep so that the user can comfortably wake up.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] The above objects and advantages of the present invention will become more apparent by describing in detail preferred exemplary embodiments thereof with reference to the accompanying drawings, wherein:

> Fig. 1 is a block diagram showing an audio reproducing device according to an embodiment of the invention;
> Figs. 2A and 2B are explanatorily views showing operations in a combination mode for alarming;
> Figs. 3A, 3B and 3C are explanatorily views showing controlling of a volume value and controlling of a cut-off frequency in the combination mode;
> Figs. 4A and 4B are explanatorily views showing operations for the alarming in an audio mode and a beep sound mode;
> Fig. 5 is a flowchart showing an operation of a control section in an alarm mode;
> Fig. 6 is a flowchart showing an operation of the control section in the alarm mode;
> Figs. 7A and 7B are flowcharts showing operations of the control section in the alarm mode; and
> Fig. 8 is a flowchart showing an operation of the control section in the alarm mode.

DETAILED DESCRIPTION OF EXEMPLARY EMBODIMENTS

[0012] Preferred embodiments of an audio reproducing device of the invention will be described with reference to the accompanying drawings. The audio repro-

ducing device has a function of amplifying and outputting a reproduction sound of a radio tuner or a portable reproducing device. In addition, the audio reproducing device has a function of alarming. The audio reproducing device starts reproduction of an audio signal and generates a beep sound depending on modes of the function of alarming when a preset time comes.

[0013] Fig. 1 is a block diagram of the audio reproducing device. A control section 10 controls operations of the entirety of the device. An operation section 11, a display section 12, a clock (a time counter) 13, a signal processing section 22, a tuner 20, a selector 21, a sound source 23, an amplifier 24 and etc. are connected to the control section 10.

[0014] The operation section 11 includes various kinds of switches and buttons such as a selection switch 11A for switching between audio sources, an alarm set/stop button 11B, a time setting button 11C, a snooze button 11D, a volume switch 11E, and etc. The display section 12 is a dot matrix display unit having LED elements arranged in lateral and longitudinal directions and displays a time, a radio channel, a name of a music piece in a state of reproduction, and the like.

[0015] A portable audio reproducing device 2 and the built-in tuner 20 are connected to the selector 21. The selector 21 selects one of the portable audio reproducing device 2 and the built-in tuner 20 in response to an operation of the selection switch 11A so as to connect the selected one to the signal processing section 22 at a subsequent stage. Meanwhile, the portable audio reproducing device 2 is connected to the audio reproducing device 1 in wired or wireless communication.

[0016] The signal processing section 22 is configured by a DSP (Digital Signal Processor) and performs a filtering process or a sound volume regulation process of an input audio signal. The sound source 23 is an FM sound source, and generates a beep sound for alarming and inputs it to the signal processing section 22. An audio signal processed by the signal processing section 22 is input to the amplifier 24. The amplifier 24 amplifies the audio signal and outputs the amplified audio signal to the speaker 25. The speaker 25 outputs the audio signal as a sound.

[0017] The audio reproducing device 1 has the function of alarming. The function of alarming means a function wherein a user sets a time (an alarm time) and a sound is output when the alarm time comes. As a sound, a user can select one of reproduction of an audio signal (an audio mode) selected by the selector 21 as the source, generation of a beep sound (a beep sound mode) and a combination of the reproduction of the audio signal and the generation of the beep sound (a combination mode).

[0018] Operations of the audio reproducing device 1 in the combination mode are described below with reference to Figs. 2A through 3C. Figs. 2A and 2B are drawings showing controlling of a sound volume of an audio signal and controlling of generation of a beep sound before and after the alarm time, each of the drawings having a horizontal axis representing an elapsed time and a vertical axis representing an auditory sound volume (an actual sound volume). In addition, Figs. 3A, 3B and 3C are drawings showing controlling of a filtering characteristic, controlling of a volume value and change in the actual sound volume in the starting of reproduction of the audio signal.

[0019] In Figs. 2A and 2B, reproduction of the audio signal is started at a time 3 minutes before the alarm time set by the user. A volume value as a sound volume control value of the audio signal and a cut-off frequency of the filtering process for controlling sound quality of the audio signal are gradually increased for a time period of 3 minutes. The time period of 3 minutes is the rising time period for alarming.

[0020] The filtering process functions as a low-pass filter for cutting off a high frequency band. Fig. 2A shows a control characteristic of the cut-off frequency of the filtering process. The cut-off frequency is maintained at 300 Hz for 30 seconds from the start of the reproduction. With this operation, a sound in the middle to high frequency range is cut off and only a sound in the low frequency range (like a sound of a fetal heartbeat) is output. The cut-off frequency is controlled in such a manner that the cut-off frequency is gradually increased from a time 30 seconds after the start of reproduction to a time 2 minutes after the start thereof. When a time period of 2 minutes has elapsed from the start thereof, the cut-off frequency is made to be infinite (non-filtering process).

[0021] Fig. 3B is a drawing showing a control characteristic of the volume value. The volume value is controlled so as to be linearly increased from -100 dB to a preset value (dB value). The preset value of the volume value is a sound volume value which is set by the user when setting the alarm. When a change of the sound volume by the volume controlling and a change of the sound volume by cut-off frequency controlling in the filtering process are synthesized with each other, the sound volume is changed as shown in Fig. 3C.

[0022] Turning to Figs. 2A and 2B, when the time period of 3 minutes has elapsed from the start of the reproduction of the audio signal and the alarm time comes, the volume of the reproduction sound of the audio signal is increased to the value set by the user as well as the beep sound is generated. After that, the audio signal is output in the preset sound volume and the beep sound is generated so as to awaken the user.

[0023] When the snooze button 11D is turned on by the user in the above state, the audio reproducing device 1 stops the beep sound and goes into a snooze state while continuing reproduction of the audio signal as shown in Fig. 2A. The time period of the snooze state is 5 minutes. When the time period of 5 minutes has elapsed, the audio reproducing device 1 generates the beep sound, again. When the snooze button 11D is turned on by the user in this state, the snooze state is repeated similarly to the above. In addition, when the alarm set/stop button 11B is turned on by the user, the

audio reproducing device 1 finishes the alarm operation and the power source is turned off.

[0024] When the snooze button 11D is turned on while the audio signal is reproduced and the beep sound is generated as shown in Fig. 2A, the audio reproducing device 1 stops only the beep sound while reproducing the audio signal. On the other hand, when the snooze button 11D is turned on while the beep sound is not generated and only the audio signal is reproduced, the audio reproducing device 1 also stops the reproduction of the audio signal and goes into the snooze state (see Fig. 2B). While Fig. 2B shows a sequence in which after stopping the beep sound by the snooze button 11D, the snooze button 11D is turned on again to stop the audio signal. Even when the snooze button 11D is turned on before the beep sound is generated (in the way of increasing the sound volume of the audio signal), the audio reproducing device 1 goes into the snooze state similarly to the above.

[0025] The time period of 5 minutes has elapsed in the snooze state, the audio reproducing device 1 starts the reproduction of the audio signal again, and gradually increases the sound volume of the audio signal. At that time, the audio reproducing device 1 controls the volume value in such a manner that the volume value is increased from -100 dB to the preset value for 1 minute. In the above, the audio reproducing device 1 does not perform the filtering process. That is because it can be understood that the user is possibly already awakened to some degree. After the lapse of 1 minute from the completion of controlling the volume value, the audio reproducing device 1 generates the beep sound. The operation in a time period in which the audio signal and the beep sound are generated together, is as shown in Fig. 2A.

[0026] The operations of the audio reproducing device 1 in the audio mode and the beep sound mode are described below with reference to Figs. 4A and 4B. The Figs. 4A and 4B are drawings showing controlling of a sound volume of an audio signal and controlling of generation of a beep sound right after the alarm time, each of the drawings having a horizontal axis representing an elapsed time and a vertical axis representing an auditory sound volume (an actual sound volume) similarly to Figs. 2A and 2B.

[0027] Fig. 4A is the drawing showing the controlling of the volume value in the audio mode. In a case of the audio mode, since the audio signal itself is a sound for awaking the user, the audio reproducing device 1 starts reproduction of the audio signal when the alarm time comes. While the control characteristic of the volume value is similar to that in Fig. 3B, the audio reproducing device 1 does not perform the filtering process as shown in Fig. 3A. That is because the audio signal itself is a sound for awakening the user.

[0028] When the snooze button 11D is turned on after the reproduction of the audio signal is started, the audio reproducing device 1 stops the audio signal and goes into the snooze state for a time period of 5 minutes. When the time period of 5 minutes has elapsed in the snooze state, the audio reproducing device 1 restarts the reproduction of the audio signal and controls the volume value so as to allow the volume value to reach the preset value from -100 dB in 1 minute.

[0029] Fig. 4B is a drawing showing controlling of generation in the beep sound mode. When the alarm time comes, the audio reproducing device 1 starts generation of the beep sound. When the snooze button 11D is turned on in a state that the beep sound is generated, the audio reproducing device 1 stops the beep sound and goes into the snooze state for 5 minutes. When the time period of 5 minutes has elapsed, the audio reproducing device 1 restarts the generation of the beep sound.

[0030] Next, operations of the control section 10 in an alarm mode are described below with reference to flowcharts shown in Figs. 5 through 8. Fig. 5 is the flowchart showing the operation of the control section 10 during the setting of the alarm. When the alarm set button 11B is turned on by the user, this operation is started. First, selection of the alarm mode is received (S1). The alarm mode includes the above described audio mode, the beep sound mode and the combination mode. In a case where the audio mode is selected by the user, the fact that the audio mode is selected is stored in a memory (S2) and the operation is proceeded to step S5. In a case where the beep sound mode is selected by the user, the fact that the beep sound mode selected is stored in a memory (S3) and the operation is proceeded to step S7. In a case where the combination mode is selected by the user, the fact that the combination mode is selected is stored in a memory (S4) and the operation is proceeded to step S5.

[0031] In step S5, selection of the audio source is received. While the selectable audio sources are a portable reproducing device 2 and a radio tuner 20 in Fig. 3, the audio sources are not limited to the portable reproducing device 2 and the radio tuner 20. Next, setting of the volume value in the alarm mode is received (S6). This volume value in the alarm mode is not associated with a volume value in a normal mode of reproducing a sound and is only used in the alarm mode. Next, setting of the alarm time is received (S7). After receiving the alarm time, the setting items are stored into the memory and the power source is turned off (S8).

[0032] Fig. 6 is the flowchart showing the operation of controlling an activation of alarming of the control section 10. This operation is processed from the setting of the alarm to the activation of the alarming operation. The operation is performed periodically at a constant interval (for example, 1 second) after the alarm setting operation shown in Fig. 5.

[0033] When the operation is started, it is determined whether or not a mode of alarming is the combination mode (S11). In a case where the mode of alarming is the combination mode (YES in S11), it is determined whether the current time is 3 minutes before the alarm time (S12), or the alarm time (S18). When the current time is neither

the alarm time nor 3 minutes before the alarm time, the present operation is completed. When the current time is 3 minutes before the alarm time (YES in S12), the operations of step S13 through step S17 are performed.

[0034] When the current time is 3 minutes before the alarm time, the power source of the entirety of the audio reproducing device 1 is turned on (S13), a value of 300 Hz is set to the signal processing section 22 as the cut-off frequency for the filtering process (S14), and a value of -100 dB is set as the volume value (S15). And then, the reproduction of the audio signal is started (S16). In a case of the tuner 20, the starting of the reproduction of the audio signal is a process in which a reception signal obtained by tuning to a selected channel is input into the signal processing section 22. In a case of the portable reproducing device 2, the starting of the reproduction of the audio signal is a process in which a power source of the portable reproducing device 2 is turned on in a remote control manner and reading (reproducing) of a predetermined audio file is started. The control characteristics shown in Figs. 3A and 3B are set to the signal processing section 22, and the signal processing section 22 performs controlling of the filtering and controlling of the sound volume for 3 minutes (S17).

[0035] Here, while the controlling of the cut-off frequency in the filtering process and controlling of the volume value are performed by the signal processing section 22 itself, it is possible to cause the control section 10 to set the cut-off frequency and the volume value to the signal processing section 22 every second in another processing operation.

[0036] In addition, in a case where the alarm time comes in the combination mode (YES in S18), the beep sound is generated in addition to the reproduction of the audio signal (S26).

[0037] When the mode of alarming is not the combination mode (NO in S11), it is determined whether or not the current time is the alarm time (S20). When the current time is the alarm time (YES in S20), it is determined whether or not the mode of alarming is the audio mode (S21). When the mode of alarming is the audio mode (YES in S21), operations of steps S22 through 25 are performed.

[0038] When the alarm time comes in the audio mode, the power source of the entirety of the audio reproducing device 1 is turned on (S22), and a value of -100 dB is set to the signal processing section 22 as the volume value (S23). And then, the reproduction of the audio signal is started (S24). The control characteristic shown in Fig. 3B is set to the signal processing section 22 and the controlling of the sound volume is performed for 3 minutes (S25). Here, while the controlling of the volume value is performed by the signal processing section 22 itself, it is possible to cause the control section 10 to set the volume value to the signal processing section 22 every second in another processing operation.

[0039] In a case where the mode of alarming is not the audio mode, i.e., but the beep sound mode in step 21 (NO in S21), the power source of the audio reproducing device 1 is turned on (S26) and the sound source 23 generates the beep sound so as to output it from the speaker 25 (S27).

[0040] Fig. 7A is a flowchart showing an operation when the snooze button 11D is turned on. When the snooze button 11D is turned on, it is first determined whether or not the beep sound is being generated (S30). When the beep sound is being generated, the beep sound is stopped (S31) and a timer is started (S34). When the beep sound is not being generated (NO in S30), it is determined whether or not the audio signal is being reproduced (S32). When the audio signal is being reproduced (YES in S32), the reproduction of the audio signal is stopped (S33) and the timer is started (S34). When both of generation of the beep sound and reproduction of the audio signal are not being performed, the operation is completed.

[0041] A case where the beep sound is not being generated and the audio signal is not being reproduced, means that the alarm time has not come yet in the alarm mode or the audio reproducing device 1 is in the snooze state shown in Fig. 2B. In addition, when the alarm mode is not set, the turn-on operation of the snooze button 11D is ignored.

[0042] Fig. 7B is a flowchart showing an operation when the alarm stop button 11B is turned on. When the alarm stop button 11B is turned on, the beep sound being generated and the audio sound being reproduced at that time are stopped (S40 and S41). After the alarm mode is canceled and the operation is proceeded to the normal mode (S42), the power source is turned off (S43). After that, when the power source is turned on by the user, the audio reproducing device 1 operates in the normal mode. The operation in the normal mode means that the audio source selected by the user via the selection switch 11A is reproduced at the volume value set via the volume switch 11E.

[0043] Fig. 8 is a flowchart showing a time management operation. That is, the operation of managing the timer that starts in response to the operation of the snooze button 11D. The operation is periodically performed at a predetermined time interval (for example, 1 second) while the timer operates.

[0044] First, it is determined whether the current time is a timing that a time period of 5 minutes has elapsed from the start of the timer (S49). When the current time is the timing that the time period of 5 minutes has elapsed, the snooze state is cancelled and the reproduction of the audio signal or the generation of the beep sound is restarted.

[0045] When the time period of 5 minutes has elapsed (YES in S49), it is determined whether the mode of alarming is the beep sound mode (S50) or the combination mode in a state of reproducing of the audio signal (S51). In a case of the beep sound mode (YES in S50), or the combination mode in the state of reproducing of the audio signal (YES in S51), the control section 10 generates the

beep sound (S52), stops the timer (S53), and then completes the operation.

[0046] In a case where the mode of alarming is neither the beep sound mode (NO in S50), nor the combination mode in a state of reproduction of the audio signal, that is, in a state in which the audio signal is stopped in the audio mode or combination mode, a value of -100 dB as a volume value is set to the signal processing section 22 (S54) and the reproduction of the audio signal is restarted (S55). A control characteristic for increasing the volume value to a preset value by spending 1 minute is set to the signal processing section 22 so as to allow the signal processing section 22 to perform controlling of the volume value (S56). Here, while the controlling of the volume value is performed by the signal processing section 22 itself, it is possible to cause the control section 10 to set the volume value to the signal processing section 22 every second in another processing operation. And, then it is determined whether or not the mode of alarming is the combination mode (S57). When the mode of alarming is the combination mode (YES in S57), the operation is completed while the timer is left to be in the operating state in order to generate the beep sound 1 minute later. When the mode of alarming is not the combination mode, i.e., it is the audio mode (NO in S57), the timer is stopped and the operation is completed.

[0047] In a case where it is determined at step S49 that it is not a timing that a time period of 5 minutes has elapsed from the start of the timer, the operation is proceeded to step S50 and it is determined whether or not it is a timing that a time period of 6 minutes has elapsed from the start of the timer (S60). Counting of a time period up to 6 minutes is performed only in the case of the combination mode. When the time period of 6 minutes has elapsed (YES in S60), the beep sound is generated in addition to the reproduction of the audio signal (S61) and the timer is stopped (S62).

[0048] In a case where the timer operates, and it neither the timing of the lapse of 5 minutes nor the timing of the lapse of 6 minutes, the operation is completed.

[0049] In the embodiment, the cut-off frequency of the low-pass filter in the filtering process of the signal processing section 22 is changed from 300 Hz to the infinite in the combination mode. However, it is possible to change a rate of decrease (e.g., -100 dB to 0 dB) in a frequency band not less than a predetermined frequency (e.g., 300 Hz). In addition, it is possible to control a low pitch sound side by using a band pass filter in the filtering process of the signal processing section 22.

[0050] Further, while only the volume value of the audio signal is controlled and the filtering process is not performed in the audio mode upon activating the alarming, the filtering process may be performed in addition to the control of the volume value of the audio signal in the audio mode. In the above case, a filtering process having a characteristic different from that in Fig. 3A may be performed. Also, the reproduction is started at a time before the alarm time by a predetermined time period (e.g., 3 minutes) even in the audio mode and the volume value may become a preset value at the alarm time.

[0051] Furthermore, any sound can be used as the beep sound to be generated for alarming. A simple buzzer sound or bell sound can be used, and a music piece that does not conflict with the audio signal can be used.

Claims

1. An audio reproducing device comprising:

   a time setting section configured to set an alarm time;
   an audio signal processing section configured to start outputting of an audio signal when arrival of the alarm time set by the time setting section or arrival of a time point that is a predetermined time period before the alarm time, while gradually increasing a sound volume of the audio signal for a predetermined rising time period and changing a characteristic of a filtering process to the audio signal for the predetermined rising time period; and
   a sound outputting section configured to output the audio signal received from the audio signal processing section as a sound.

2. The audio reproducing device according to claim 1, wherein the audio signal processing section starts the outputting of the audio signal at a time that is the predetermined rising time period before the alarm time so as to make the sound volume of the audio signal to a preset sound volume when the alarm time comes and controls the characteristic of the filtering process so that the characteristic of the filtering process does not limit a frequency band of the audio signal when the alarm time comes.

3. The audio reproducing device according to claim 1 or 2, wherein the characteristic of the filtering process to the audio signal is a low-pass filter characteristic for cutting off a high frequency band of the audio signal.

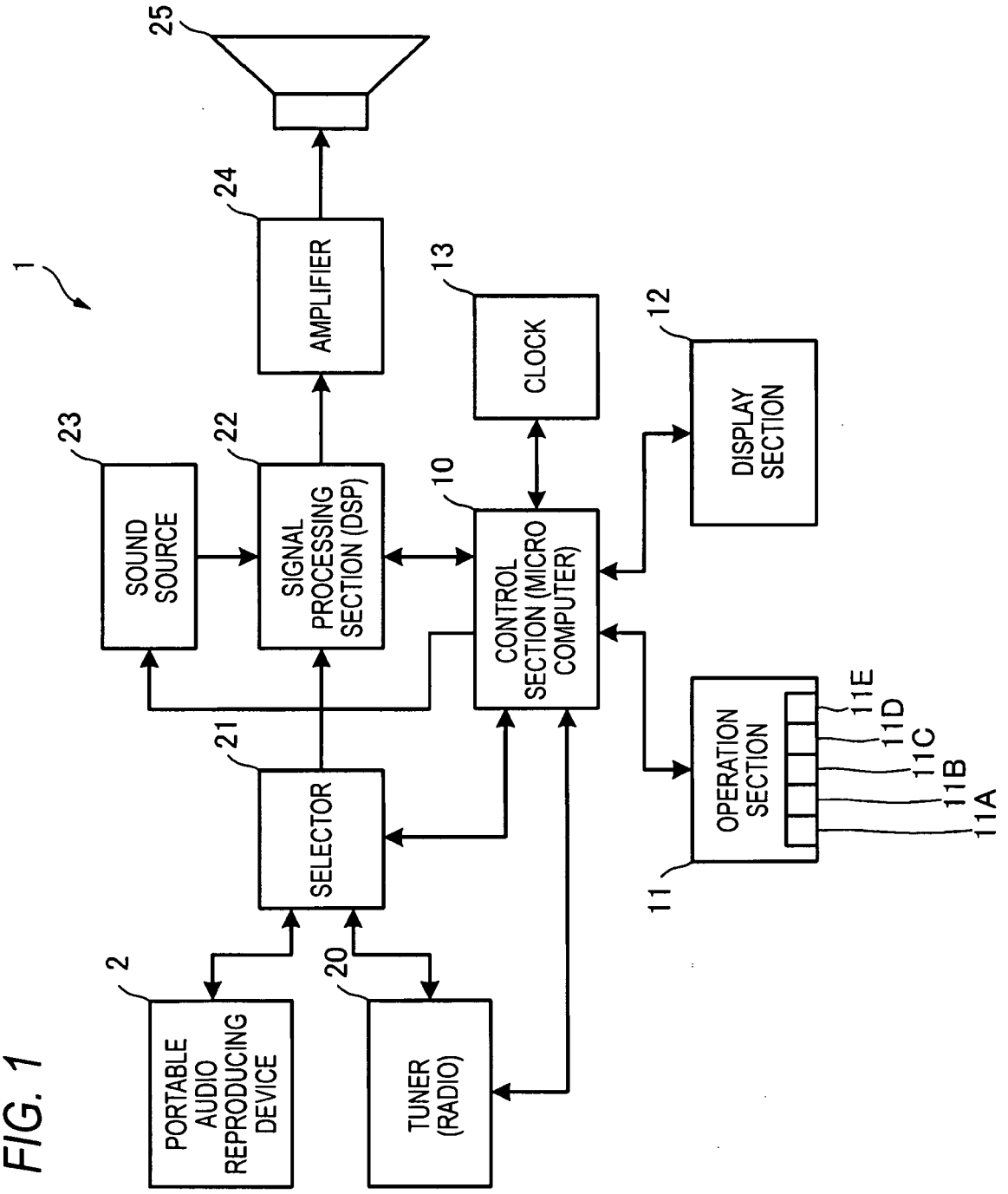
4. The audio reproducing device according to claim 2 or 3, further comprising:

   an alarm sound generating section configured to generate an alarm sound different from the audio signal,
   wherein the alarm sound generating section generates the alarm sound when the alarm time comes.

5. The audio reproducing device according to any one of claims 1 to 4, further comprising:

a snooze operation section configured to temporarily stop the audio signal,
wherein the audio signal processing section stops the outputting of the audio signal for a predetermined snooze time period when the snooze operation section is operated; and
wherein after the snooze time period has elapsed, the audio signal processing section increases the sound volume of the audio signal to the preset sound volume in a time period shorter than the predetermined rising time period while not performing the filtering process.

FIG. 1


1
2
PORTABLE AUDIO REPRODUCING DEVICE
20
TUNER (RADIO)
21
SELECTOR
22
SIGNAL PROCESSING SECTION (DSP)
23
SOUND SOURCE
24
AMPLIFIER
25
10
CONTROL SECTION (MICRO COMPUTER)
11
OPERATION SECTION
11A
11B
11C
11D
11E
12
DISPLAY SECTION
13
CLOCK

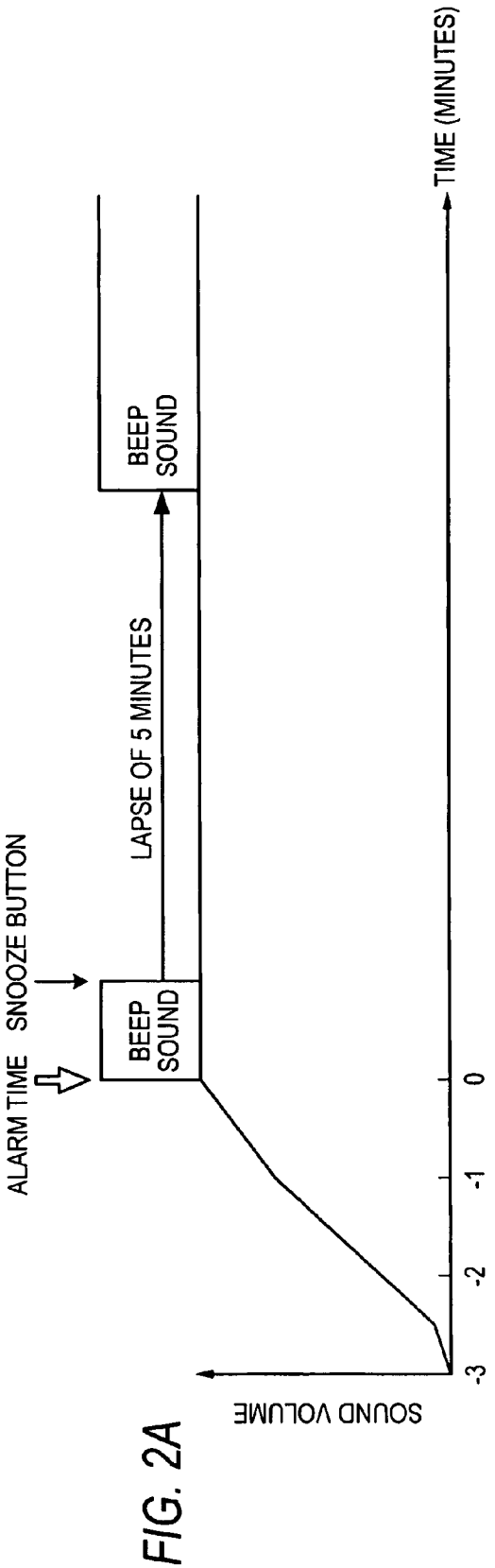

ALARM TIME
SNOOZE BUTTON
BEEP SOUND
LAPSE OF 5 MINUTES
BEEP SOUND
TIME (MINUTES)
0
-1
-2
-3
SOUND VOLUME

FIG. 2A

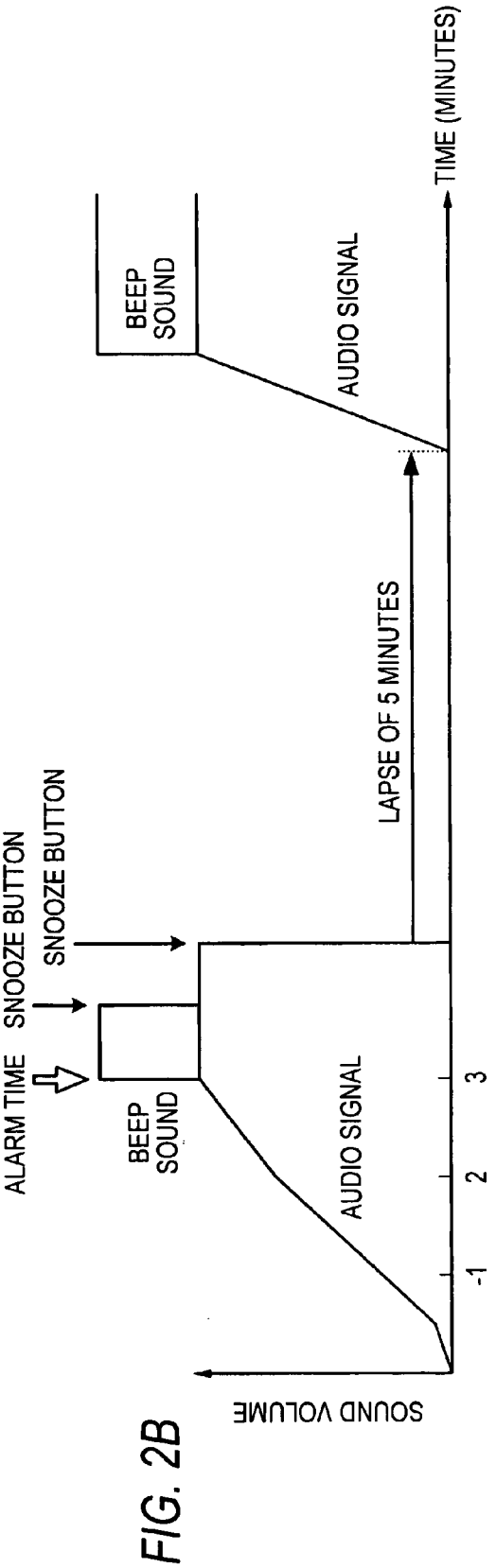

ALARM TIME
SNOOZE BUTTON
SNOOZE BUTTON
BEEP SOUND
BEEP SOUND
AUDIO SIGNAL
LAPSE OF 5 MINUTES
AUDIO SIGNAL
TIME (MINUTES)
3
2
-1
SOUND VOLUME

FIG. 2B

FIG. 3A

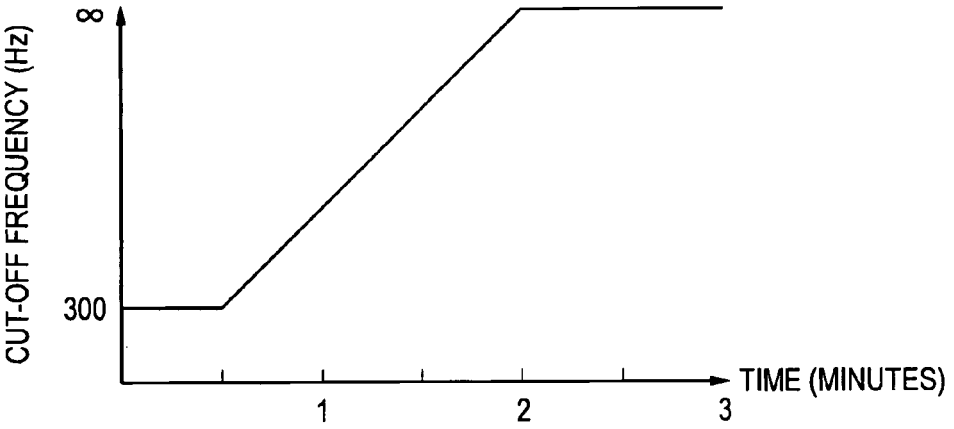


FIG. 3B

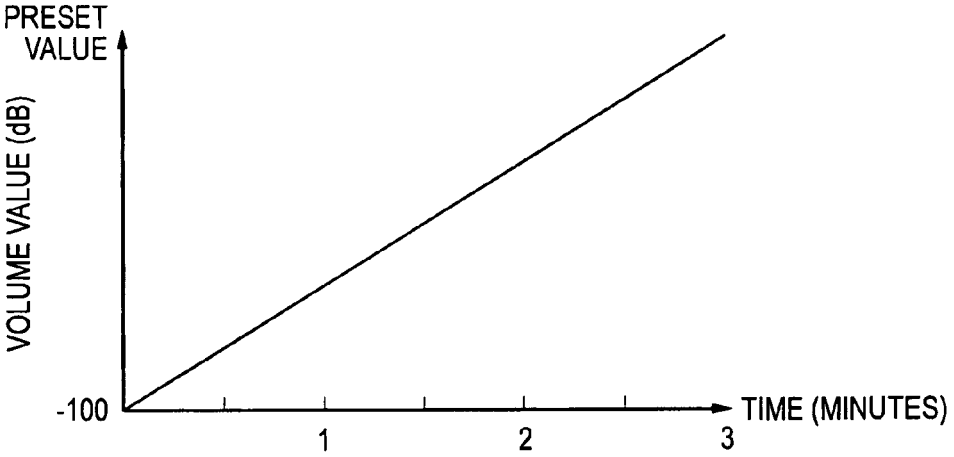


FIG. 3C

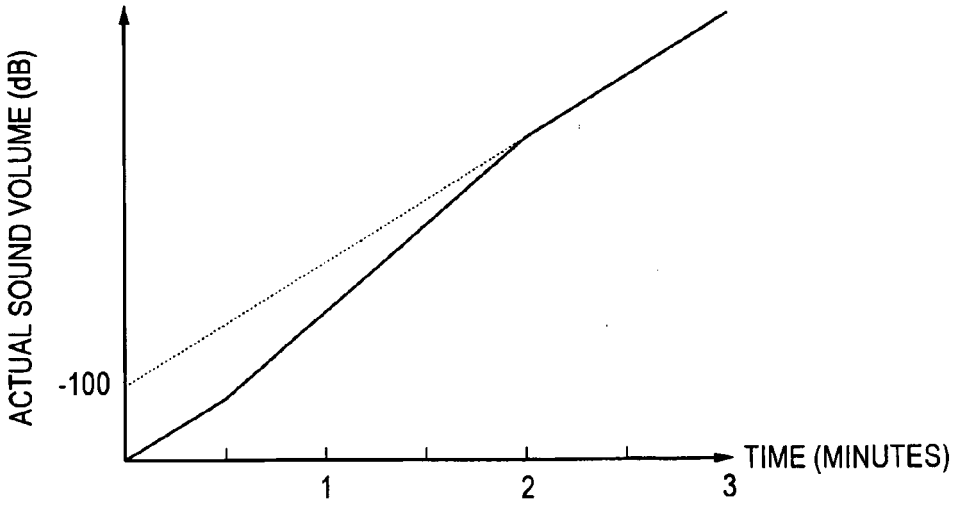


FIG. 4A

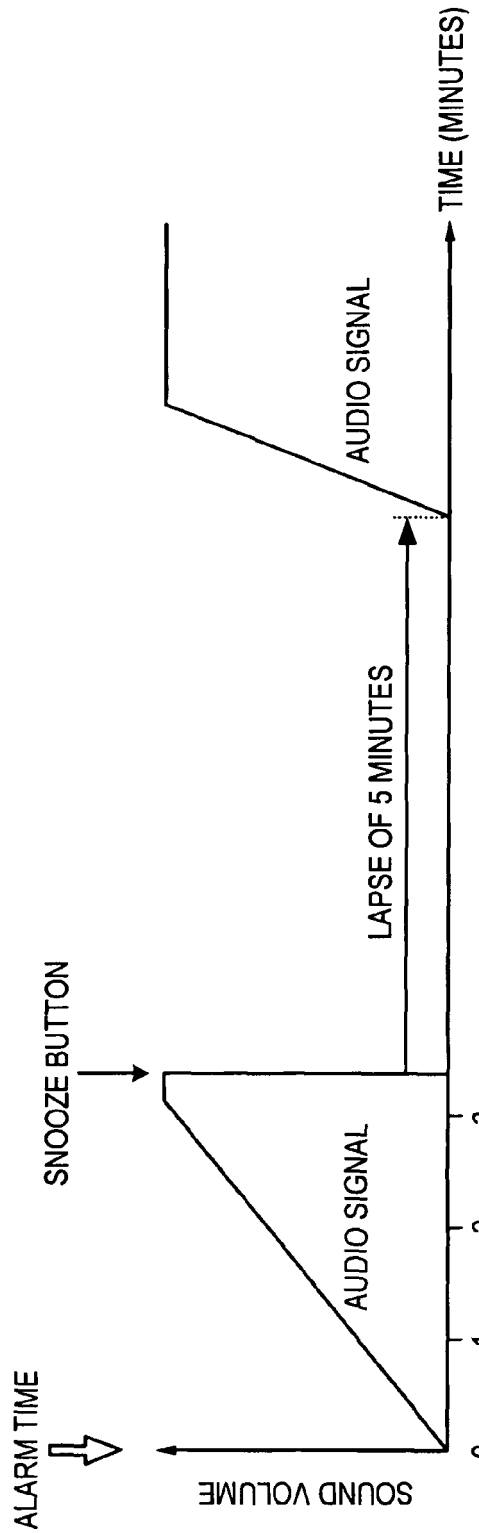

ALARM TIME
SNOOZE BUTTON
SOUND VOLUME
AUDIO SIGNAL
LAPSE OF 5 MINUTES
AUDIO SIGNAL
TIME (MINUTES)
0
1
2
3

FIG. 4B

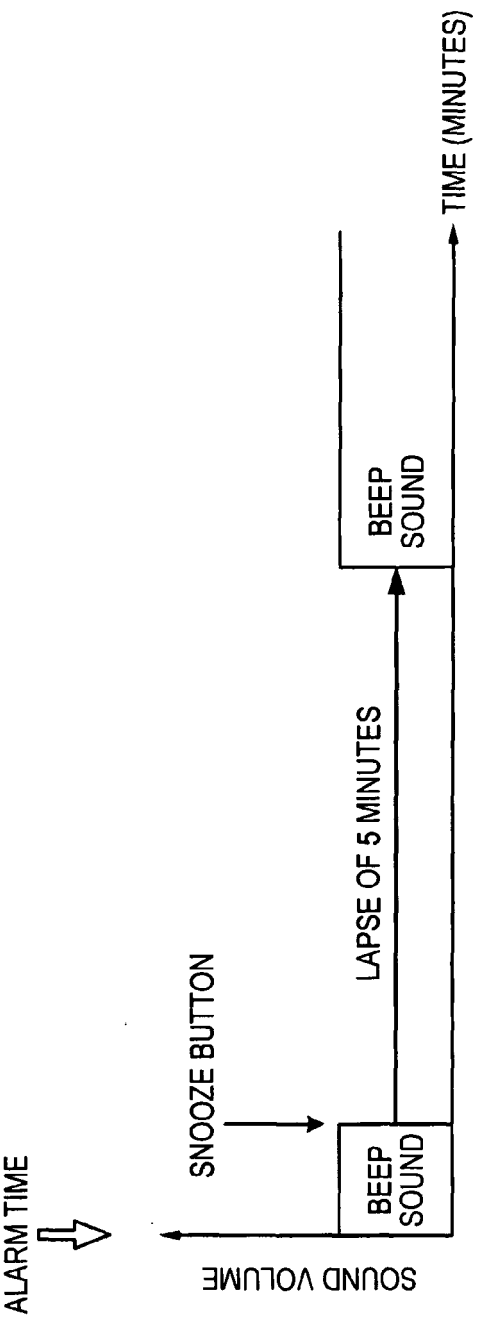

ALARM TIME
SNOOZE BUTTON
SOUND VOLUME
BEEP SOUND
LAPSE OF 5 MINUTES
BEEP SOUND
TIME (MINUTES)

FIG. 5

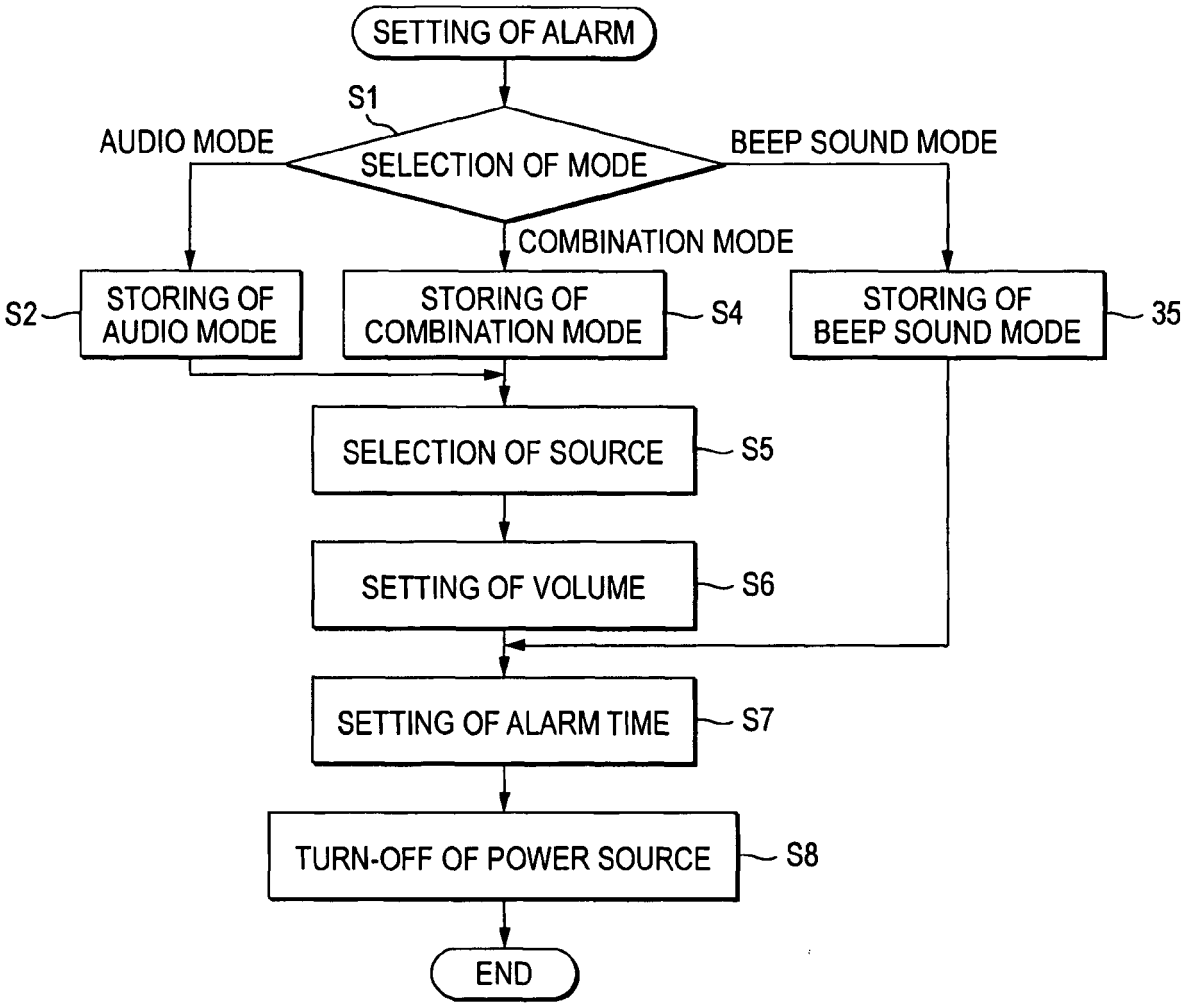

SETTING OF ALARM
S1
AUDIO MODE
SELECTION OF MODE
BEEP SOUND MODE
COMBINATION MODE
S2
STORING OF AUDIO MODE
STORING OF COMBINATION MODE
S4
STORING OF BEEP SOUND MODE
35
SELECTION OF SOURCE
S5
SETTING OF VOLUME
S6
SETTING OF ALARM TIME
S7
TURN-OFF OF POWER SOURCE
S8
END

FIG. 6

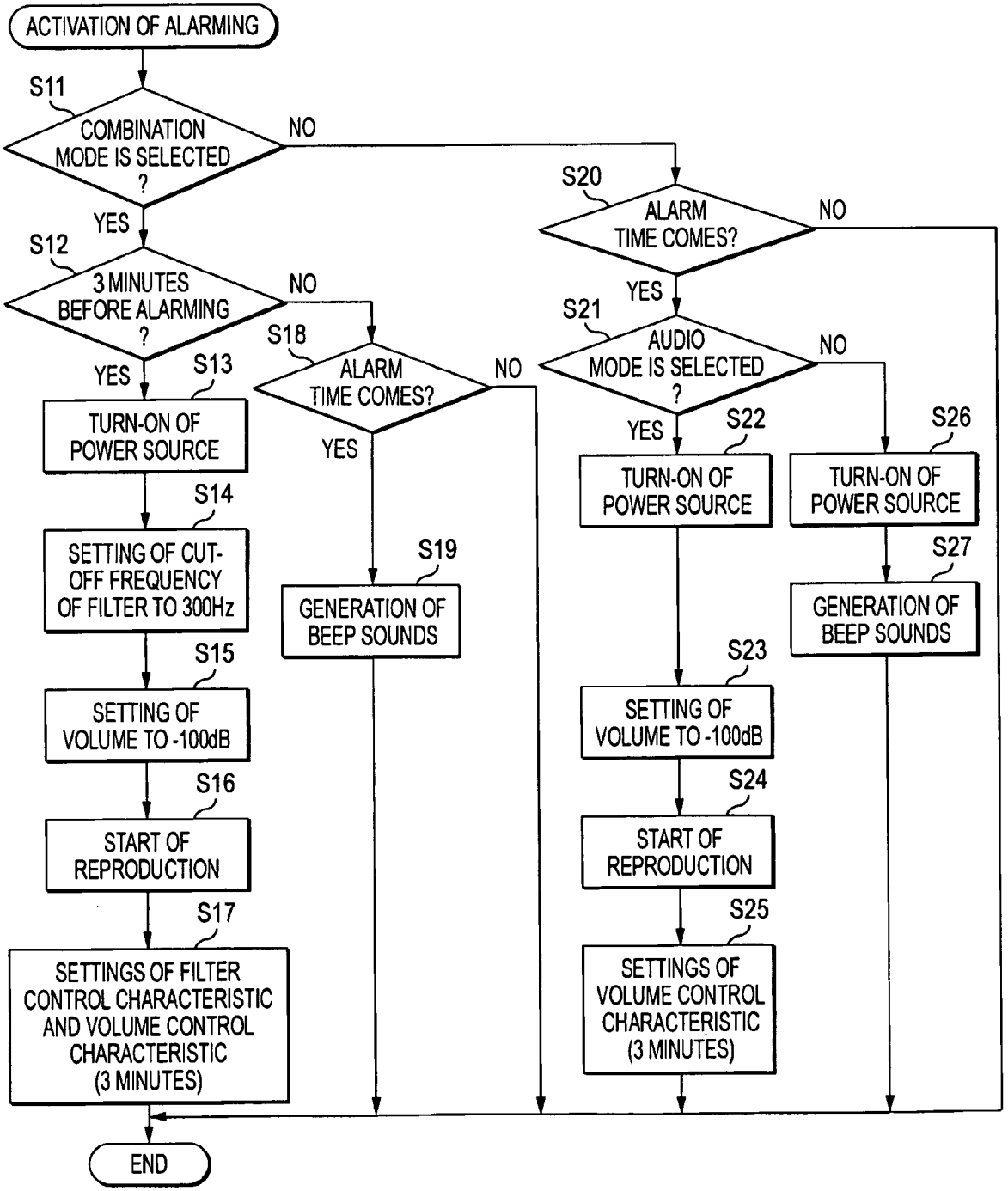

ACTIVATION OF ALARMING
S11
COMBINATION MODE IS SELECTED ?
NO
YES
S12
3 MINUTES BEFORE ALARMING ?
NO
YES
S13
TURN-ON OF POWER SOURCE
S14
SETTING OF CUT-OFF FREQUENCY OF FILTER TO 300Hz
S15
SETTING OF VOLUME TO -100dB
S16
START OF REPRODUCTION
S17
SETTINGS OF FILTER CONTROL CHARACTERISTIC AND VOLUME CONTROL CHARACTERISTIC (3 MINUTES)
S18
ALARM TIME COMES?
NO
YES
S19
GENERATION OF BEEP SOUNDS
S20
ALARM TIME COMES?
NO
YES
S21
AUDIO MODE IS SELECTED ?
NO
YES
S22
TURN-ON OF POWER SOURCE
S23
SETTING OF VOLUME TO -100dB
S24
START OF REPRODUCTION
S25
SETTINGS OF VOLUME CONTROL CHARACTERISTIC (3 MINUTES)
S26
TURN-ON OF POWER SOURCE
S27
GENERATION OF BEEP SOUNDS
END

FIG. 7A

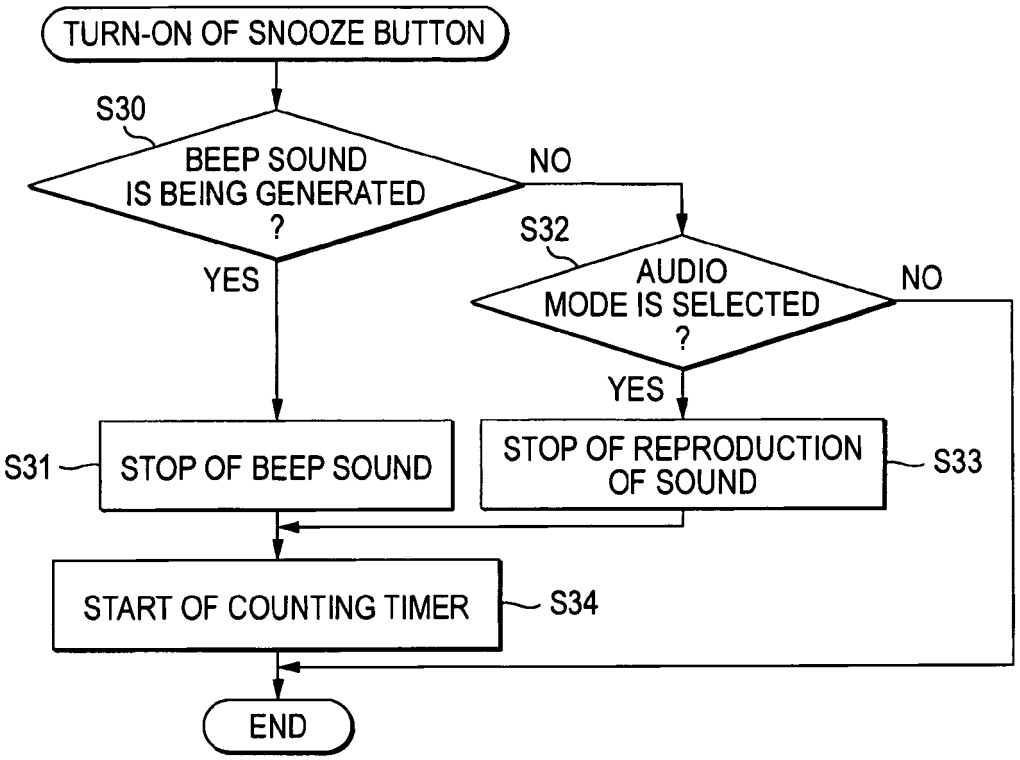

TURN-ON OF SNOOZE BUTTON
S30
BEEP SOUND IS BEING GENERATED ?
NO
YES
S32
AUDIO MODE IS SELECTED ?
NO
YES
S31
STOP OF BEEP SOUND
STOP OF REPRODUCTION OF SOUND
S33
START OF COUNTING TIMER
S34
END

FIG. 7B

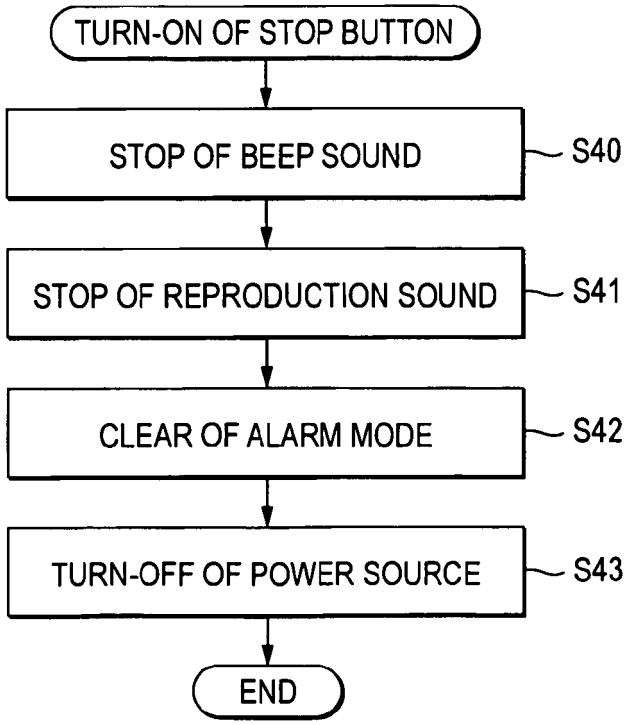
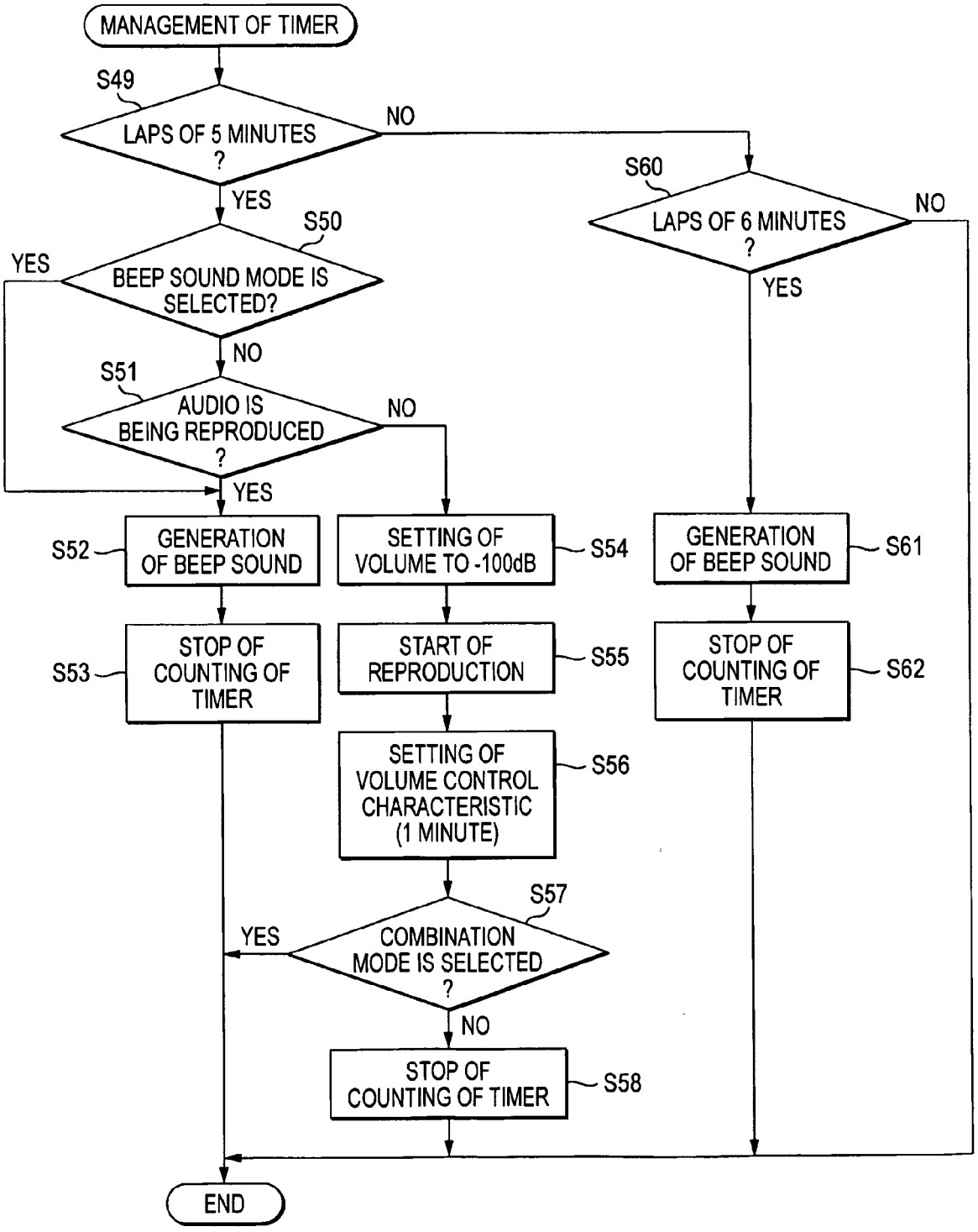

TURN-ON OF STOP BUTTON
STOP OF BEEP SOUND
S40
STOP OF REPRODUCTION SOUND
S41
CLEAR OF ALARM MODE
S42
TURN-OFF OF POWER SOURCE
S43
END

FIG. 8


MANAGEMENT OF TIMER
S49
LAPS OF 5 MINUTES ?
NO
YES
S50
BEEP SOUND MODE IS SELECTED?
YES
NO
S51
AUDIO IS BEING REPRODUCED ?
NO
YES
S52
GENERATION OF BEEP SOUND
S53
STOP OF COUNTING OF TIMER
SETTING OF VOLUME TO -100dB
S54
START OF REPRODUCTION
S55
SETTING OF VOLUME CONTROL CHARACTERISTIC (1 MINUTE)
S56
S57
COMBINATION MODE IS SELECTED ?
YES
NO
STOP OF COUNTING OF TIMER
S58
S60
LAPS OF 6 MINUTES ?
NO
YES
GENERATION OF BEEP SOUND
S61
STOP OF COUNTING OF TIMER
S62
END

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 5022172 A **[0003]**