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Title: VOLUME CONTROL IN A HEARING AID AND HEARING AID WITH VOLUME CONTROL.

Abstract: The invention concerns a volume control in a hearing aid, which has a signal path from a microphone to a receiver, and where the signal path is adapted to provide an amplification of the signal delivered to the receiver, where a first and a second user input means is provided to allow the user to change the amplification in a downward and an upward direction whereby use of the first and second user input means has different impact on the size of the amplification change effected.
TITLE
Volume control in a hearing aid and hearing aid with volume control.

AREA OF THE INVENTION
People with a hearing loss often maintain the same or nearly the same sensitivity towards loud sounds as people with normal hearing. This means that their dynamic input range is reduced compared to that of people with normal hearing.

Hearing aids try to translate the normal sound pressure range to the reduced range and this is basically done by applying amplification and compression.

This means that wearing a hearing aid will compensate the hearing loss, but the reduced dynamic input range means that sounds will be perceived as too loud in more situations than for the person with a normal hearing.

The simple and often used solution to this problem is to supply the hearing aid with a volume control. The user can then adjust the level so that the level of sound is comfortable.

BACKGROUND OF THE INVENTION
Volume controls will mostly adjust the level a fixed dB value in up- or down ward direction, giving the hearing aid user the capability to adjust the sound level to fit both low and high level environments. The adjustment is often made stepwise with a predefine step size, but can also be purely analogue with infinite steps.

The improvement to the normal volume control, which is proposed here is to differentiate between adjusting the volume up and down. Many hearing aid users report that they prefer a volume control that is easy accessible because this enables them to turn down the volume faster in environments with too loud sounds.
But to turn the volume down fast is also depending on the step size used for the given hearing aid.

It is therefore good to have a large step size when regulating the volume down. In the known hearing aids this means that the upward step size also becomes large because the hearing aids do not differentiate the step size for up and down regulation.

And the users do not want large step sizes when regulating the volume up, because this increases the risk of adjusting to a too loud volume setting.

**SUMMARY OF THE INVENTION**

According to the invention the problem is solved by a volume control in a hearing aid, where the hearing aid has a signal path from a microphone to a receiver, and where the signal path is adapted to provide an amplification of the signal delivered to the receiver, where a first and a second user input means is provided to allow the user to change the volume delivered by the receiver in a downward and an upward direction whereby use of the first and second user input means has different impact on the size of the volume change effected.

By having one size of the volume change in the upward direction and another size in the downward direction it becomes possible have the hearing aid effect a volume change which provides the user with the possibility to fine tune the setting of the volume and at the same time ensures fast reaction to changes in the sound environment.

Preferably the size of the change in the downward direction is bigger than the size of the change in the upward direction. Hereby it is ensured that the user at all times can react quickly to onset of loud sounds in the environment. The invention may be realized with the use of a volume control wheel, whereby the wheel is made to be more sensitive in the down direction than in the up-direction.
In an embodiment of the invention the first and second user input means comprises push buttons and each activation of the push buttons corresponds to a downward or upward step of the amplification, whereby the size of the volume change by a downward step is bigger than the size of the volume change by an upward step. Push buttons presents a special problem, because the user both requires the possibility of accurate adjustment of the volume and at the same time a quick or immediate and adequate reaction to the onset of loud sounds. By having a button function, which reacts with bigger steps in the downward direction than in the upwards direction the user can both effect quick and adequate volume reduction and perform a precise fine tuning of the volume. Here the finetuning will have to be done in the upward direction.

In an embodiment of the hearing aid according to the invention the step size is programmable. This allows the user to choose the step size for up- and downward adjustment of the volume. The user could for example select 3 dB as the size of the downward steps and 1 dB as the size of the upward steps and a regulation range of ±9 dB. This would mean that there are 6 steps from +9 dB down to −9dB but 18 steps from −9 dB to +9 dB. This surely offers fast down and fine pitch up volume regulation.

DESCRIPTION OF A PREFERRED EMBODIMENT

A hearing aid according to the prior art has one register for storing of the step size used for the volume control. This step size is used both for volume up and for volume down action. If the user chooses a large step size in order to allow for quick action of the turning down of the volume, he will have to accept a large pitch, and loss of possibility of fine tuning of the volume setting. If alternatively he chooses a small step size, the step size for turning down the volume will also be small. This means that the volume down button will have to be touched several times to effect adequate damping of the sound by
the onset of high sounds in the environment.

Table 1 Volume regulation.

Table 1 shows an example of possible gain adjustments in a hearing aid according to the invention. Initially the Volume Control is set at index 4 (middle of gain table) resulting in a gain of 0 dB. This is indicated by arrow a.

The user then turns the volume control one step up changing the index to 5 (4+1). Volume index 5 corresponds to a gain adjustment of +1 dB i.e. the volume is increased by 1 dB. This is shown by arrow b. Any gain adjustment in the up-direction will result in a 1 dB increase in the gain setting as long as the setting is within the legal boundaries.
The next step is the user turning the volume control 1 step down whereby the index is change to 2 (5-3) and the volume is decreased with 3 dB. This is shown at arrow c. Any gain adjustment in the down direction will result in a 3 dB down adjustment as long as the gain remains within the legal boundaries.

The final table shows that the index must never excide the minimum (or maximum) limit. This means that the second step down only results in a decrease of 2 dB instead of 3 dB because the index reaches the lower limit (0). This is shown by arrow d.
CLAIMS

1. Volume control in a hearing aid, which has a signal path from a microphone to a receiver, and where the signal path is adapted to provide an amplification of the signal delivered to the receiver, where a first and a second user input means is provided to allow the user to change the amplification in a downward or an upward direction whereby use of the first and second user input means has different impact on the size of the amplification change effected.

2. Volume control in a hearing aid as claimed in claim 1, wherein the size of the change in the downward direction is bigger than the size of the change in the upward direction.

3. Volume control in a hearing aid as claimed in claim 1, wherein the first and second user input means comprises push buttons and where each activation of the push buttons corresponds to a downward or upward step of the amplification, and whereby the size of a downward step is bigger than the size of an upward step.

4. Hearing aid with a volume control, wherein a hearing aid is provided with a signal path from a microphone to a receiver, and where the signal path is adapted to provide an amplification of the signal delivered to the receiver, where a first and a second user input means is provided to allow the user to change the amplification in a downward or an upward direction whereby the first and second user input means has each their impact on the size of change effected and where this impact is programmable.

5. Hearing aid as claimed in claim 4, wherein a first register is provided for holding a user chosen value for the volume up step size and a second register is provided for holding a user chosen volume down step size value.
### INTERNATIONAL SEARCH REPORT

**A. CLASSIFICATION OF SUBJECT MATTER**

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According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

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Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

**Electronic data base consulted during the international search (name of data base and, where practical, search terms used)**

EPO-Internal, PAJ, WPI Data

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

<table>
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<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
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<tr>
<td>A</td>
<td>EP 0 297 087 A (VIENNATONE GMBH) 28 December 1988 (1988-12-28) abstract; figures 1,2</td>
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<td>A</td>
<td>US 5 727 070 A (CONINX PAUL) 10 March 1998 (1998-03-10) column 5, line 4 - line 29; figure 3</td>
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Further documents are listed in the continuation of box C.

Patent family members are listed in annex.

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