(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
19 January 2017 (19.01.2017)

WIPO | PCT

(10) International Publication Number
WO 2017/008855 A1

(51) International Patent Classification:
H04R 25/00 (2006.01) *G06F 12/02* (2006.01)

(21) International Application Number:
PCT/EP2015/066230

(22) International Filing Date:
16 July 2015 (16.07.2015)

(25) Filing Language: English

(26) Publication Language: English

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(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report (Art. 21(3))*

WO 2017/008855 A1

(54) Title: METHOD FOR MANAGING ERASURE OPERATIONS ON A NON VOLATILE MEMORY OF A HEARING AID AND HEARING AID OPERATING ACCORDING TO SUCH METHOD

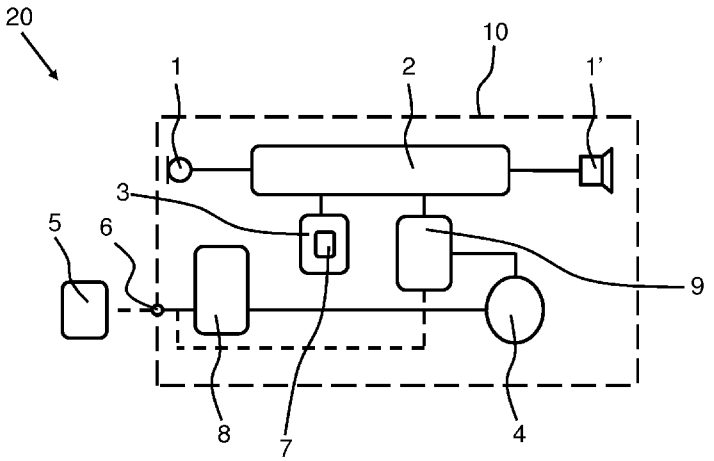


Fig. 2

(57) Abstract: The present invention relates to method for managing operations on at least a portion (3P) of non volatile memory (3) of a hearing aid (10), the hearing aid (10) comprising at least one electroacoustic transducer (1, 1'); signal processing means (2), configured to receive from the at least an electroacoustic transducer (1) an electrical input signal and/or to provide the at least an electroacoustic transducer (1') with an electrical output signal, the signal processing means (2) cooperating with a non volatile memory (3) for storing, retrieving and/or erasing data; an internal power storage means (4) configured to provide power to said electroacoustic transducer (1, 1') and to said signal processing means (2) when said hearing aid (10) is worn by a user; and means for receiving power (6) from an external power source (5) comprising detection means for sensing whether said hearing aid (10) is connected to said external power source (5). The memory managing method comprises the steps of verifying, by the detection means, if the hearing aid (10) is connected to the external power source (5); and, only if it is verified that the hearing aid is connected to the external power source 5, performing erasure operations on at least a portion 3P of the non volatile memory 3. The present invention also relates to a hearing aid (10) configured to operate according to the above method and to a hearing aid system (20) comprising such a hearing aid 10 and an external power source (5).

Method for managing erasure operations on a non volatile memory of a hearing aid and hearing aid operating according to such method.

[0001] The present invention relates generally to hearing aids, particularly to a method for managing operations on a non volatile memory of a hearing aid and to a hearing aid operating according to such a method. More specifically, the method according to the present invention is designed to perform erasure on at least a portion of a non volatile memory of a hearing aid only when the hearing aid is connected to an external, reliable power source.

[0002] In the following, the term hearing aid shall be understood as a device to be worn at the vicinity or directly within the ear of a person to improve the individual hearing capacity of this person. Such an improvement may include the prevention of the receiving of certain acoustic signals in terms of ear protection.

[0003] In relation to their application and user indication, and according to the corresponding main solutions available on the market, such hearing devices can be worn, for instance, behind the ear (BTE), within the ear (ITE) or completely within the ear (CIC). The latest design developments have made available hearing devices that are even smaller than completely within the ear (CIC) devices, aptly named invisible in the canal (IIC) hearing aids.

[0004] It will be recognized that the inventive features of the present invention are substantially compatible with any style of hearing aids, including the abovementioned models, as well as with hearing aids which are eyewear-mounted, implanted, body-worn, etc.

[0005] Hearing aids normally comprise at least one microphone as acoustic input element; at least one speaker as acoustic output element; and an electronic processing element, connected with said microphone and said speaker, for the processing and manipulation of electronic signals. This electronic processing element may comprise analogue or digital signal processing devices. Said elements are usually arranged within at least one main case or shell of the hearing device.

[0006] Typically, the microphone acts as an electroacoustic transducer and receives acoustic signals, converts such signals into electrical signals and transmits them to the abovementioned electronic processing element.
The electronic processing element is part of a signal processing circuit which, normally, performs various signal processing functions. Such signal processing functions can include amplification, background noise reduction, tone control, etc..
Normally, the signal processing circuit outputs an electrical signal to a speaker. The speaker acts as an electroacoustic transducer and converts the electrical signal from the signal processing circuit into an acoustic signal which is transmitted as audio into a user's ear.

[0007] The signal processing circuit of current hearing aids typically comprises a digital signal processor, or DSP, which can be programmed to execute the functional tasks of dedicated signal processing algorithms. In today’s hearing aids, the DSP can operate according to several different algorithms comprising respective systems of instructions, rules and parameters for performing specific tasks relative to the processing of the input signal. Thanks to such algorithms, the signal can be manipulated to more closely comply with the acoustic needs of a user and in modern hearing aids not only amplification, filtering and compression are enabled, but also

more complex functions are made possible, such as adaptive directional functions for reducing the sound levels from the sides and rear, automatic mode switching dependent on the nature of the input sound or calibration based on measurements for better fitting to the individual ear.

[0008] In order to execute the above signal processing algorithms, a programmable digital signal processor generally cooperates in operation with a non volatile memory, also designatable as NVM, for storing and retrieving data. Such data can comprise setting, measurement or calibration parameters and characteristics to be taken into account in executing the step-by-step set of signal processing operations performed by the DSP, and in general the set of rules and instructions corresponding to the signal processing algorithms, commonly designated as firmware.

[0009] Current hearing aids are therefore faced with the problem of allocating sufficient memory space to allow the DSP to effectively carry out all of the increasingly complex signal processing functions that are meant to optimize the sound customization to user's needs, based on aforementioned data.

[00010] Currently, state of the art hearing aids incorporate a non volatile memory of up to about 2.4 Mbit. The variety of applications designed for today's hearing aid models generate a NVM fill rate of about 90%, when taking into account the combination of firmware and customer-specific configurations.

[00011] In consideration of the latest developments in the field of Flash-type memories, even a non volatile memory as large as 32 Mbit or even more can be made compatible, in terms of physical size, with a use in hearing aids

[00012] At any rate, indefinitely packing more memory into the restricted space of a hearing aid, however miniaturized, cannot be the sole, viable solution to the ever more demanding tasks that such devices can be programmed to execute and to the proportionally increasing storage capacity requirements. These considerations are similarly valid for all non volatile memories employable, such as for instance EEPROM memories or Flash memories.

[00013] EEPROM memories are a specific type of non volatile ROM comprising a large number of memory cells that can be erased and reprogrammed in small blocks, typically one byte at a time.

[00014] Flash memories are an evolution of EEPROM that can be erased and reprogrammed in larger erase blocks rather than one byte at a time. Flash memories comprise memory cells that are grouped into sections called "erase blocks". The cells in an erase block of a Flash memory are typically erased all at once, the re-write operation on a Flash memory thus necessarily implying first a block erase operation. Flash memories can be read or programmed a byte, or a word, at a time in a random access mode, but they can only be erased one erasure block at a time. Based on the fact that erasure cycles are anyway slow, the larger block sizes used in Flash memories contribute to a significant speed advantage over the non-Flash EEPROM when writing or erasing of large amounts of data needs to be carried out. Flash-type non volatile memories are proportionally less space consuming and faster when compared to EEPROM memories, representing potentially a good option for hearing aid applications.

[00015] Anyways, for each unit of data to be written to a non volatile memory, a corresponding amount of data must be erased

from such non volatile memory in respective memory units, whether in the form of bytes or blocks, depending on the type of non volatile memory as above explained. The sole employment of large-sized memories does not per se solve the issues inherently linked to the management of memory units at the moment of erasure.

[00016] Current hearing aids typically carry out erasure of data from the incorporated non volatile memories during normal hearing aid operation. This practice brings about the risk of overloading the capacity of the batteries of such prior art devices. Moreover, the complicated power management linked to the standard practice of erasing data at hearing aid runtime increases the risk that a not perfectly executed erasure cycle results into corrupt or invalid data.

[00017] Current technologies in the field of hearing aids do not offer valid solutions to the outstanding problem of managing non volatile memories, particularly large-sized such memories, in connection with write and erasure operations.

[00018] Document US 2006/0256989 A1 discloses a hearing device, comprising an EEPROM non volatile memory, powered by a rechargeable battery. In the memory of such hearing device, charging control information is stored associated with charging of the rechargeable battery. Upon establishing a releasable connection to an external charger unit, the memory of the hearing device is arranged to communicate charging control information to the external charger unit by data communications means. Thus, the data communication means can be used to update the charging control information stored in the memory of the hearing device when a new rechargeable battery is installed in the hearing device.

[00019] US 2006/0256989 A1 does not propose a management method of a non volatile memory which deals with the issues of writing and/or erasing data therefrom.

[00020] Document US 8,265,315 B2 discloses a hearing aid mounting a volatile memory configured to store the basic data for its configuration during normal operation of the hearing aid. A charging station is provided that allows battery recharge when the hearing aid is mounted thereon. A communication connection between hearing aid and charging station can be established to allow transfer of basic configuration data of the hearing aid from the volatile memory of the hearing aid to a non volatile memory of the charging station, when the hearing aid is mounted in the charging station.

[00021] US 8,265,315 B2 purposely adopts a configuration in which the hearing aid does not comprise any non-volatile memory, thus making the connected charging station the unit that drives the transferring of basic configuration data of the hearing aid, which would remain stored on the charging unit when the hearing aid is not in operation.

[00022] Shifting the primary storage of data that remains available across power cycles from a hearing aid to a charging station follows an approach opposite to the one adopted in the present invention. It is not desirable to externalize a non volatile memory for the storage of data that need to remain available even across different usage sessions and/or runtimes to an external unit distinct from the hearing actually performing the signal processing.

On the contrary, it is advantageous to keep a non-volatile memory incorporated in a hearing aid, so that also the management and execution of substantial signal processing functions are maintained within the hearing aid itself.

[00023] Moreover, US 8,265,315 B2 does not propose a method of managing data erasure operations on a non volatile memory of a hearing aid.

[00024] Thus, there exists a need for a method for managing operations on at least a portion of non volatile memory of a hearing aid which allows:

- effectively enabling use of non volatile memories on hearing aids whose capacity is large enough to support implementation of as many signal processing functions as desired;
- advantageously making the increased power consumption linked to data erasure operations executed on non volatile memories of hearing aids compatible with the requirement that the batteries of a hearing aid in normal operation be preserved;
- carrying out of data erasure operations executed on non volatile memories of hearing aids in a reliable and controlled fashion;
- safely completing data erasure operations executed on non volatile memories of hearing aids, avoiding any risk of data corruption in the process.

[00025] Accordingly, a major objective of the present invention is to provide a method for managing operations on at least a portion of non volatile memory of a hearing aid which guarantees the possibility of safely and completely carrying out erasure operations, while increasing the versatility and flexibility of the hearing aid functions thanks to an improved ability to deal with larger memory capacities.

[00026] At the same time, performing the erasure operations on the non volatile memory of the hearing aid should be enabled in a way that the rechargeable batteries of the

hearing aid are preserved to be optimally employed at runtime, or normal operation, of the hearing device.

[00027] These problems are solved by a method, a hearing aid and a hearing aid system according to the independent claims. Dependent claims further introduce particularly advantageous embodiments for such a method, device and system.

[00028] The inventive solution according to the present invention basically requires to configure a hearing aid such that erasure operations are performed on at least a portion of non volatile memory thereof under verified, controlled conditions that ensure correct and complete erasure, namely by letting erasure operations be performed only if the hearing aid is connected to an external power source.

[00029] In fact, configuring a hearing aid in a way that the non volatile memory therein incorporated carries out erasure operations only when it is connected to a reliable energy source, time-wise decoupled from the battery-supported normal operation of the hearing device when worn by a user, advantageously achieves that erasure of data units on the memory happens correctly, safely and without impacting the effectiveness of the hearing device during normal usage.

[00030] Other objectives, features and advantages of the present invention will be now described in greater detail with reference to specific embodiments represented in the attached drawings, wherein:

- Figure 1 is a schematic cross-section view of a Behind-the-Ear (BTE) hearing aid according to the prior art, wherein erasure actions in a non volatile memory are performed during normal operation of the hearing aid;

- Figures 2-2C are schematic circuit diagrams respectively exemplifying four embodiments of the present invention, wherein voltage boost means for increasing the voltage provided to a non volatile memory of the hearing aid are represented in corresponding four possible configurations;
- Figures 3A-3C are a schematic illustration of the erasure and defragmenting operations which a method according to the present invention allows to safely and effectively execute on at least a portion of a non volatile memory of a hearing aid.

[00031] With reference to Figure 1, a Behind-the-Ear (BTE) hearing aid 11 according to the prior art is a device that normally comprises a casing which accommodates a multiplicity of electric components. According to the terminology commonly employed in the present technical field, a casing can alternatively be designated as a shell.

Such a multiplicity of electric components generally comprises an internal power storage means 4, such as a battery, configured to be engageable in a respective compartment. Rechargeable batteries that do not need to be removed from the hearing aid in order to be recharged represent an option in today's hearing devices.

Moreover, a hearing aid 11 such as the one of Figure 1 usually comprises a first electroacoustic transducer 1, such as a microphone, for converting sound waves into electrical signals.

In addition to this, a hearing device 11 according to the prior art can also comprise a second electroacoustic transducer 1', such as a receiver, for converting electrical signals into sound waves compatible with human hearing and reception thereof by the hearing aid's user.

Electroacoustic transducers 1, 1' are known in the prior art that can also operate in both directions, converting sound waves into electrical signals and vice versa.

A signal processing circuitry 2, typically comprising a processor, is also provided. Such signal processing circuitry 2, normally designated as DSP, is configured to receive from an electroacoustic transducer 1 -functioning as a microphone- an electrical input signal. Such an electrical input signal results from the above conversion of input sound waves into electrical signals.

The signal processing circuitry 2 can be also configured to provide an electroacoustic transducer 1' -functioning as a receiver- with an electric output signal. This way, the receiver can carry out the above conversion of output electrical signals into sound waves for a user's benefit.

In today's hearing aids, the signal processing means 2 can cooperate with a memory for storing and retrieving data. Models of hearing aids are known wherein the DSP is configured to cooperate with a non volatile memory 3.

Internal power storage means 4 are generally configured to provide power to electric transducers 1, 1' and to the signal processing means 2 during the ordinary use of the hearing aid 10, that is whenever the hearing aid is worn by a user.

[00032] As explained above, it is common practice in prior art hearing aids 11 to manage operations on an embedded non volatile memory during normal operation of the hearing aid. It has already been previously explained how such customary procedure actually negatively affects the lifespan and functionality of a battery, to the detriment of a reliable and continued usage of the hearing aid. Further drawbacks of such prior art reside in the risk of incompletely and ineffectively carrying out the desired operations on the non volatile memory in case of insufficient power supply from the battery, whether it is erasing and/or re-writing and/or defragmenting, for

instance in connection with restoring corrupted sections or updating firmware.

[00033] As portrayed in Figures 2-2C, a hearing aid according to the present invention analogously comprises at least an electroacoustic transducer 1,1'; signal processing circuitry 2 and an internal power storage means 4 which is preferably a rechargeable battery.

As already pointed out, the at least one electroacoustic transducer can be a microphone 1; alternatively, it can be a receiver 1'. According to one favorite embodiment, the hearing aid according to the present invention can comprise both a microphone 1 and a receiver 1', as represented.

The signal processing circuitry 2 typically comprises a processor or CPU and is configured to receive from the at least one electroacoustic transducer 1 an electrical input signal and/or to provide the at least one electroacoustic transducer 1' with an electric output signal.

As already explained, an electrical input signal is the result of a conversion of sound waves picked up by a microphone 1 into an electrical signal, to be further elaborated by the signal processing circuitry 2; whereas an electrical output signal transmitted from the signal processing circuitry 2 is used by a receiver 1' for conversion into sound waves optimized for the hearing aid's user.

[00034] The signal processing means 2 of a hearing aid 10 according to the present invention cooperates with a non volatile memory 3 for storing and retrieving data. Such a cooperation can also include embodiments wherein the non volatile memory 3 is physically connected to a further component, e.g. a micro-controller, which in turn manages the operation of the non volatile memory 3 and passes data on to/from the signal processing means 2.

In the present context, data stored in the memory 3 can comprise firmware including setting, measurement or calibration parameters and/or characteristics to be taken into account in executing a step-by-step set of signal processing operations performed by the signal processing means 2 or DSP. In the following, data will be intended in general as the set of rules and instructions corresponding to the signal processing algorithms.

[00035] Differently from the prior art exemplified in Figure 1, a hearing aid 10 according to the present invention additionally comprises means for receiving power 6 from an external power source 5.

[00036] An external power source 5 to be coupled to a hearing aid 10 according to the present invention can take the form of a charging station or of a network mains or of a charging device, for instance battery-driven or solar energy-driven. In the case of external power source 5 incorporated in a charging device, the charging device can also be hand-held by a user.

[00037] Said means for receiving power 6 can be adapted depending on the technology used for transferring power from an external power source 5 to the hearing aid 10 in order to charge its batteries and/or run its signal processing means. In fact, the means for receiving power 6 can comprise means for establishing a releasable, wired electrical connection between the hearing aid 10 and the external power source 5. In another embodiment, if an electromagnetic field is employed, means for receiving power 6 can be configured for supporting wireless charging, for instance by incorporating induction coils.

[00038] Advantageously, the means for receiving power 6 comprises detection means for sensing whether the hearing aid

10 is connected, be it electrically or wirelessly, to the external power source 5.

[00039] A hearing aid 10 according to the present invention , as portrayed in Figure 2-2C, is advantageously configured to erase data from at least a portion 3P of a non volatile memory 3 only under the condition that the above detection means senses that power is received from the external power source 5.

[00040] Accordingly, the present invention relates to a corresponding method for managing operations on at least a portion 3P of a non volatile memory 3 of such a hearing aid 10.

[00041] The method according to the present invention comprises the steps of:

- verifying, for instance by the above detection means, if a hearing aid 10 is connected to an external power source 5; and
- only if it is thus verified that said hearing aid 10 is connected to the external power source 5, performing erasure operations on at least a portion 3P of said the hearing aid's volatile memory 3.

[00042] In order to sense and verify whether the hearing aid 10 is connected to the external power source 5, different types of detection means can be equivalently used. Detection means can be part of a physical detection circuitry, for instance including contact or proximity sensors, or can comprise logic detection means responsive to signals exchanged between hearing aid 10 and external power source 5.

[00043] Preferably, the means for receiving power 6 comprises such detection means and/or cooperates with such detection means. Thus, whenever it is detected that a hearing aid 10 is energetically coupled with an external power source 5, erase operations on the non volatile memory 3 can be authorized and started. This advantageously allows to benefit from a reliable and/or unlimited energy source which does not impact the functionality of rechargeable batteries 4. Locking the management of the non volatile memory 3 to a state of the hearing aid 10 wherein power is received from an external power source 5 also guarantees that the memory management process can also be interrupted in a controlled way, preventing any undesired corruption of the memory management process. Internal power storage means 4, such as rechargeable batteries, during ordinary runtime of the hearing aid 10 when worn by a user cannot offer such a safety measure, because their charge status is generally unknown in normal operation.

[00044] As it is evident from the representations of Figures 2-2C, a hearing aid 10 according to the present invention, when connected to an external power source 5, can optionally use the power received therefrom:

- to energize and recharge the internal power storage means 4; and, consequently
- to feed power to the signal processing means 2 and to the non volatile memory 3 associated thereto, as well as to the electroacoustic transducers 1, 1', while drawing energy from the internal power storage means 4 that is concurrently being recharged.

[00045] Conversely, as also represented in Figures 2-2c by the provision of an additional power feeding line represented by a dashed line, it can additionally be envisaged that the means for receiving power 6 comprise power control means, such as a switch, configured to alternatively supply power to

transducers 1, 1', signal processing means 2 and, ultimately, to the non volatile memory 3 directly from said external power source 5, while by-passing the internal power storage means 4. According to this optional configuration, when performing erasure operations on at least a portion 3P of a non volatile memory 3, power is supplied to the non volatile memory 3 directly by way of the external power source 5, whereas the internal power storage means 4 is by-passed by power control means such as a switch.

[00046] At any rate, power would consistently flow from the external power source 5 to the components of the hearing aid 10 such as acoustic transducers 1, 1', signal processing means 2, and, ultimately, to the non volatile memory 3, through a power feeding path that is characterized by the least internal resistance.

[00047] A hearing aid 10 according to the present invention, as exemplified in the embodiments of Figures 2-2C, can comprise a charging circuitry 8 for recharging a battery 4 from an external power source 5. Such a charging circuitry 8 can be designed to handle the power requirements for correctly and effectively recharging the battery 4 and can include voltage or current regulating means, for instance for adjustments responsive to monitored parameters.

[00048] Additionally, a power supply circuitry 9 can be provided designed to specifically handle the power requirements of the circuitry of the hearing aid 10 downstream of the output of the internal power storage means, or battery, 4.

[00049] Managing operations on a non volatile memory of portable electronic devices such as hearing aids, and particularly managing erasure operations thereon, requires a

voltage higher than the supply voltage and higher than the normal operation voltage. In order to effectively erase memory cells or blocks in a hearing aid 10 according to the present invention, voltage boost means 7, 7a, 7b, 7c are incorporated that allow to generate an increased voltage functional to attaining correct and complete erasure performances. Such voltage boost means 7, 7a, 7b, 7c increasing the voltage provided to the non volatile memory 3 to a voltage value suitable for executing erasure operations can be voltage multipliers or charge pumps.

[00050] The customary operating voltage that is battery-generated when a hearing aid 10 is worn by a user can be comprised in a range of 0.6-2 Volts.
Activation of voltage boost means 7, 7a, 7b, 7c can multiply the voltage up to 10-20 Volts, and stably maintain it for the required amount of time, in connection with performing erasure operations on the non volatile memory 3. Voltage boosting is especially relevant in case memory 3 is a Flash-type memory.

[00051] In a preferred embodiment of the hearing aid according to the present invention, as exemplified in Figure 2, a voltage boost means 7 is incorporated or encapsulated in the non volatile memory 3 itself.

[00052] Alternatively, the voltage boost means can be placed on other components of the hearing aid 10.

[00053] In a further embodiment of a hearing aid 10 according to the present invention, as exemplified in Figure 2A, a voltage boost means 7a is integrated in the charging circuitry 8 for charging the internal power storage means 4.

[00054] In another embodiment of a hearing aid 10 according to the present invention, as exemplified in Figure 2B, a

voltage boost means 7b is integrated in the power supply circuitry 9 for power feeding the signal processing means 2, the acoustic transducers 1, 1' and, ultimately, the memory 3.

[00055] The present invention also relates to a hearing aid system 20 which comprises a hearing aid 10 as above described and an external power supply 5, configured to cooperate in a way that data erasure on the non volatile memory 3 of the hearing aid 10 is performed only when it is detected that the hearing aid 10 is connected to the external power source 5.

[00056] As illustrated in Figure 2C, a voltage boost means 7c can alternatively also be integrated in the external power supply 5 of a hearing aid system 20 according to the present invention.

[00057] Managing erasure operations on at least a portion 3P of a non volatile memory 3 according to the present invention can comprise the steps of:

- scanning for corrupt or invalid memory segments and erasing such corrupted memory segments; and/or
- restoring corrupt or invalid memory segments; and/or
- converting corrupt or invalid memory segments into newly writable memory segments; and/or
- defragmenting; and/or
- updating firmware.

[00058] With reference to Figures 3A-3C, a sequence of erasure-related steps executable on a portion 3P of a non volatile memory 3 of a hearing aid 10 according to the present invention is represented, by way of example.
The illustration of Figures 3A-3C is specifically adapted to the structure of a Flash memory 3, each portion 3P of which comprises a multiplicity of memory segments. In the context of

Flash memories, memory segments are typically designated as memory erase blocks.

In this instance, memory management can thus comprise erasing and/or writing and/or defragmenting at least a part of the memory erase blocks. It can also comprise mapping at least a part of the memory erase blocks to track the state thereof.

In Figure 3A, memory erase blocks 3Pv are validly filled with data, partially or fully. Memory erasure blocks 3Pi are invalid or corrupt; whereas memory erasure blocks 3Pw are available for writing of new data.

In Figure 3B it is shown how invalid or corrupt memory erasure blocks 3Pi are first erased, thus making them again available as memory erasure blocks 3Pe to be used and to receive new data, in a way equivalent to that of memory erasure blocks 3Pw.

By executing defragmentation, as shown in Figure 3C, memory erase blocks 3Pv that are already validly filled with data, and the whole number of memory erasure blocks 3Pw made available for storing additional data are advantageously grouped together into larger regions, respectively made up of the same kind of memory erasure blocks, for speedier data access.

[00059] By shifting the memory management tasks of a non volatile memory, and specifically the tasks involving erasure, to a stage when a reliable external source of power is made available and is energetically coupled with a hearing aid, the present invention effectively enables use of non volatile memories on hearing aids substantially larger than the ones employed on hearing aids currently on the market.

[00060] Consequently, additional and more advanced functions beneficial to hearing aid users can be effectively added to the signal processing algorithms used in the DSP of hearing aids designed according to the present invention, which would

otherwise require a capacity that memories mounted on current hearing aids do not provide for.

[00061] At the same time, the present solution is power efficient and keeps unaltered the capacities of internal power storage means, such as batteries and more particularly rechargeable batteries, which need to be fully available at runtime of the hearing aids, that is when they are worn by users.

CLAIMS

1. Method for managing operations on at least a portion (3P) of non volatile memory (3) of a hearing aid (10),
said hearing aid (10) comprising
- o at least one electroacoustic transducer (1, 1');
- o signal processing means (2), configured to receive from said at least an electroacoustic transducer (1) an electrical input signal and/or to provide said at least an electroacoustic transducer (1') with an electrical output signal,
said signal processing means (2) cooperating with a non volatile memory (3) for storing, retrieving and/or erasing data;
- o an internal power storage means (4) configured to provide power to said electroacoustic transducer (1, 1') and to said signal processing means (2) when said hearing aid (10) is worn by a user;
- o means for receiving power (6) from an external power source (5) comprising detection means for sensing whether said hearing aid (10) is connected to said external power source (5);

comprising the steps of
- verifying, by said detection means, if said hearing aid (10) is connected to said external power source (5) ; and
- only if it is verified that said hearing aid is connected to said external power source (5), performing erasure operations on at least a portion (3P) of said non volatile memory (3).

2. The method of claim 1, comprising the step of activating voltage boost means (7, 7a, 7b, 7c) in order to execute said erasure operations on said at least a portion (3P) of non volatile memory (3), thereby increasing the voltage provided

to said non volatile memory (3) to a voltage value suitable for executing said erasure operations.

3. The method of claim 1 or 2, comprising the step of when performing said erasure operations on at least a portion (3P) of said non volatile memory (3),
supplying power to said non volatile memory (3) by said external power source (5) while by-passing said internal power storage means (4).

4. The method of anyone of claims 1 to 3, wherein executing said erasure operations comprises the steps of:
scanning for corrupt or invalid memory segments (3Pi) and erasing such corrupted memory segments (3Pi); and/or
restoring corrupt or invalid memory segments (3Pi); and/or
converting corrupt or invalid memory segments (3Pi) into newly writable memory segments (3Pw); and/or
defragmenting; and/or
updating firmware.

5. The method of anyone of claims 1 to 4, wherein said non volatile memory (3) is a Flash memory comprising a multiplicity of memory erase blocks (3Pi, 3Pw, 3Pi, 3Pe), wherein said memory erase blocks (3Pi, 3Pw, 3Pi, 3Pe) are managed only if it is verified that said hearing aid (10) is connected to said external power source (5).

6. Hearing aid (10) comprising:
- at least one electroacoustic transducer (1, 1');
- a signal processing means (2), configured to receive from said at least an electroacoustic transducer (1) an electrical input signal and/or to provide said at least an electroacoustic transducer (1') with an electrical output signal,

said signal processing means (2) cooperating with a non-volatile memory (3) for storing, retrieving and/or erasing data;

- an internal power storage means (4) configured to provide power to said at least one electroacoustic transducer (1, 1') and said signal processing means (2) when said hearing aid (10) is worn by a user;
- means for receiving power (6) from an external power source (5) comprising detection means for sensing whether said hearing aid (10) receives power from said external power source (5);

characterized in that

the hearing aid (10) is configured to erase data from at least a portion (3P) of said non volatile memory (3) only when said detection means senses that power is received from said external power source (5).

7. The hearing aid of claim 6, comprising voltage boost means (7, 7a, 7b, 7c) in order to increase the voltage provided to said non volatile memory (3) to a voltage value suitable for executing and completing said erasure operations on said non volatile memory (3).

8. The hearing aid of claim 7, wherein said voltage boost means (7) is encapsulated in said non volatile memory (3) or said voltage boost means (7a) is integrated in a charging circuitry (8) for said internal power storage means (4) or said voltage boost means (7b) is integrated in a power supply circuitry (9) for power feeding said signal processing means (2), said electroacoustic transducers (1, 1') and said non volatile memory (3).

9. The hearing aid of anyone of claims 6 to 8, wherein said means for receiving power (6) comprises power control means

configured to supply power to said non volatile memory (3) by said external power source (5), whenever said detection means senses that the hearing aid (10) is connected to said external power source (5), wherein said power control means are configured to by-pass said internal power storage means (4).

10. The hearing aid of any of claims 6 to 9, wherein said non volatile memory (3) comprises an EEPROM memory medium and/or a Flash memory medium.

11. Hearing aid system (20), comprising
- a hearing aid (10) as defined in any of claims 6 to 10, and
- an external power supply (5),
configured to cooperate in a way that means for data erasure on said non volatile memory (3) are activated only when a detection means senses that the hearing aid (10) is connected to said external power source (5).

12. The hearing aid system of claim 12, wherein said external power source (5) is a charging station or a network mains or a battery driven charging device or a solar energy driven charging device.

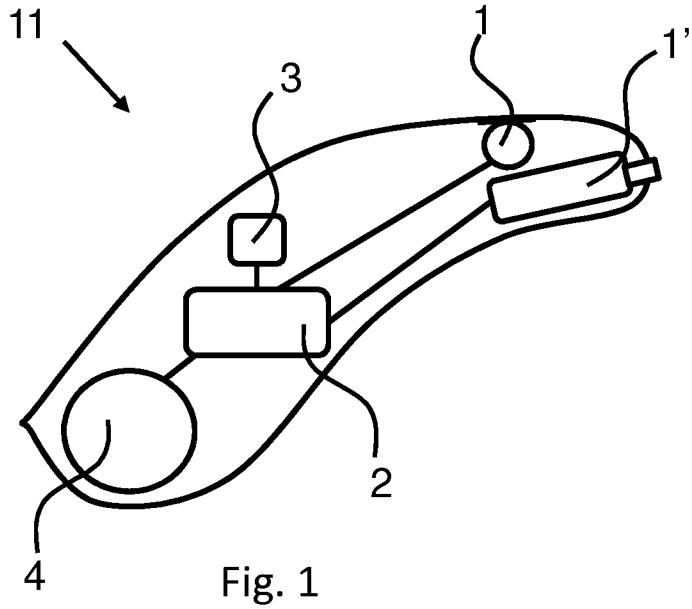


Fig. 1

(Prior Art)

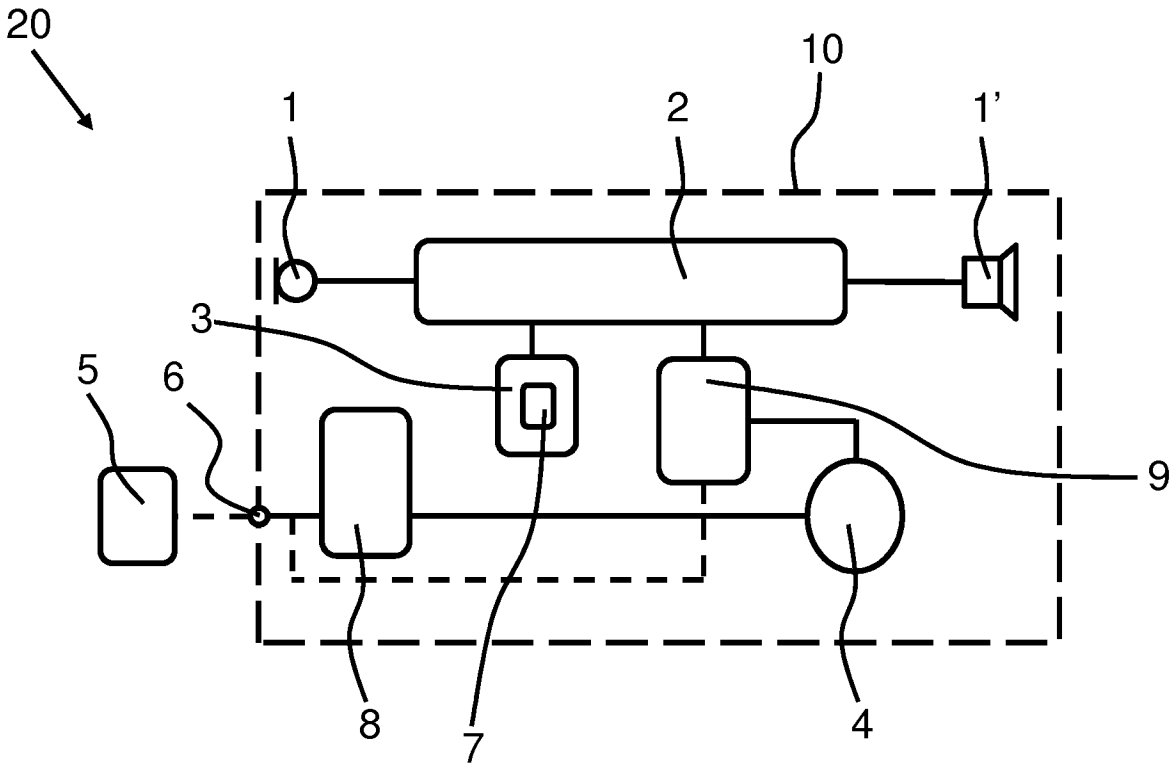


Fig. 2

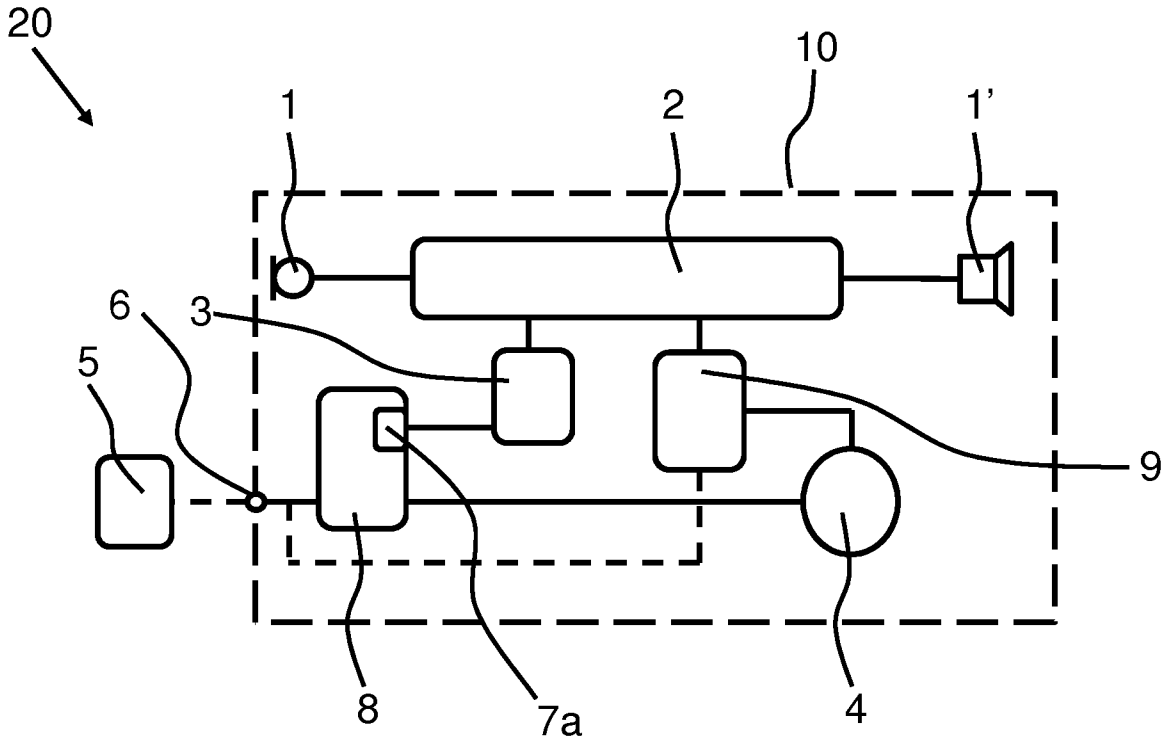


Fig. 2A

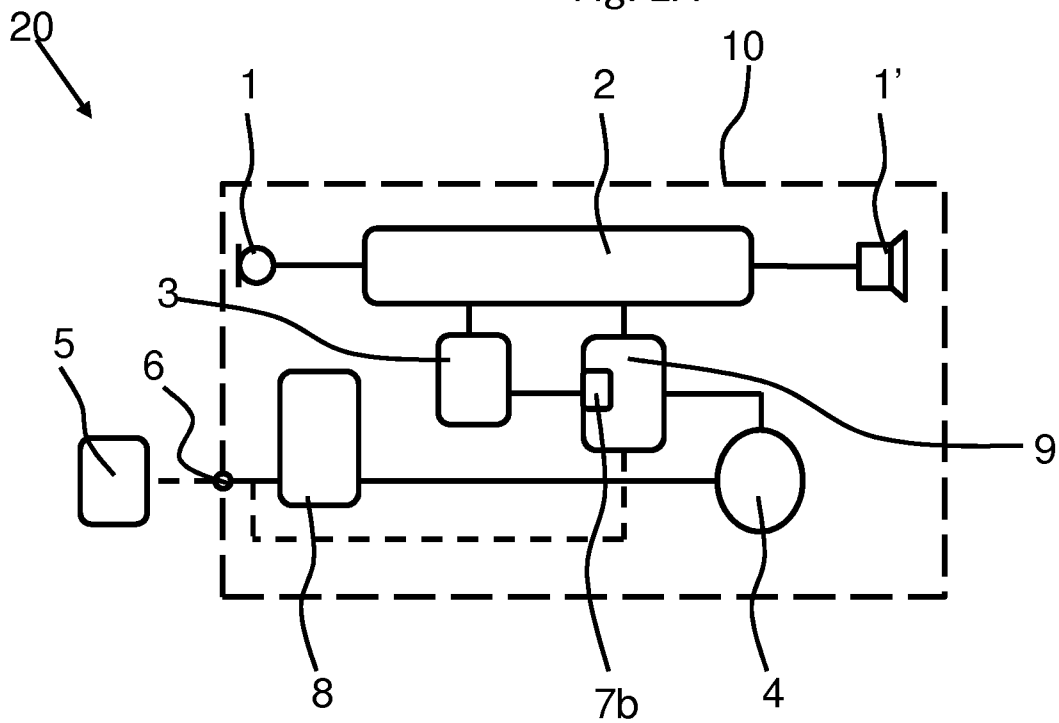


Fig. 2B

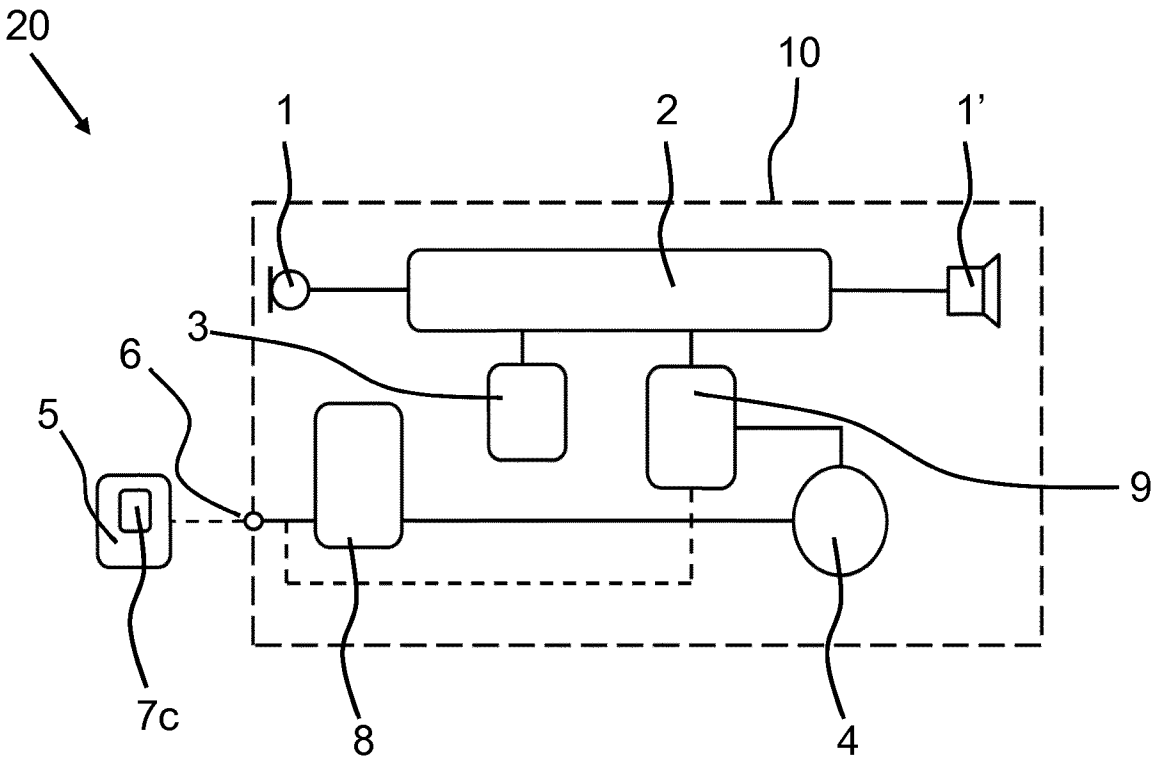


Fig. 2C

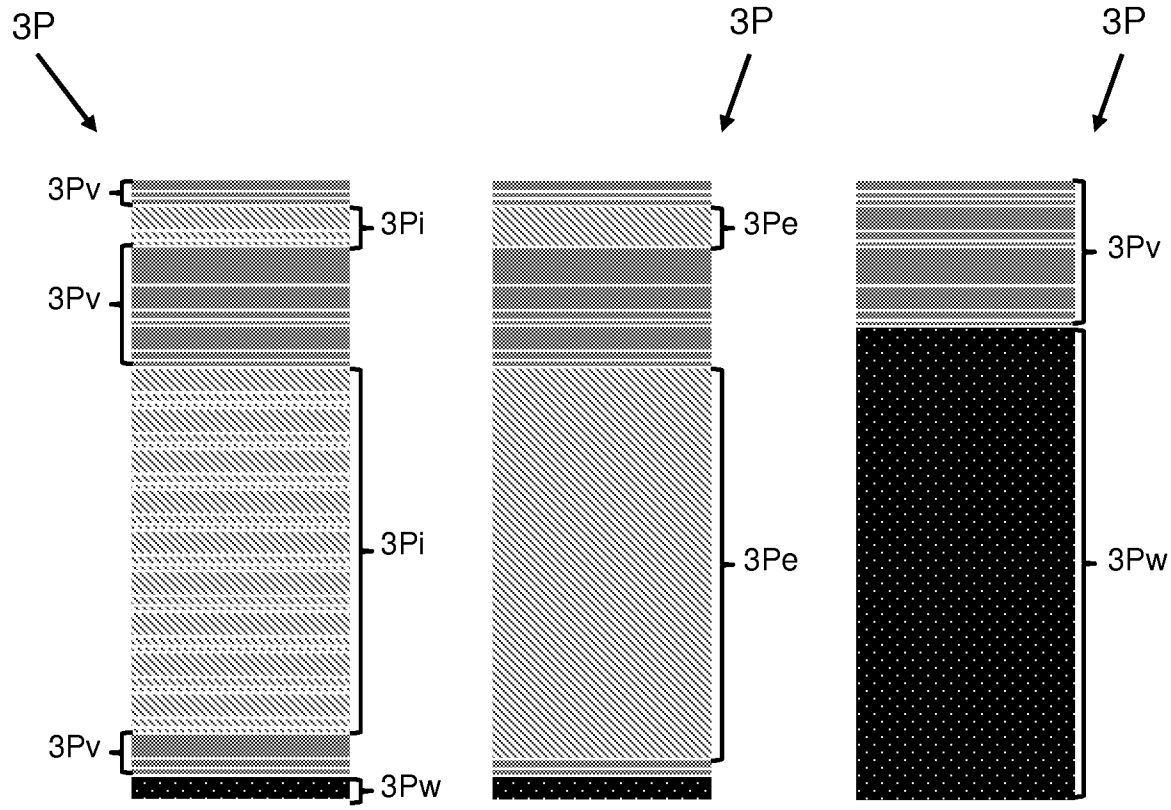


Fig. 3A Fig. 3B Fig. 3C

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2015/066230

A. CLASSIFICATION OF SUBJECT MATTER
INV. H04R25/00
ADD. G06F12/02

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)
H04R G06F

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 practicable, search terms used)
EPO-Internal, WPI Data

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X	EP 1 727 393 A1 (VARIBEL B V [NL]) 29 November 2006 (2006-11-29) paragraphs [0003], [0020], [0021], [0034], [0053], [0054], [0061], [0083] - [0088]; figure 1 -----	1-12
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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

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"P" document published prior to the international filing date but later than the priority date claimed

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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
28 January 2016	05/02/2016

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Carrière, Olivier

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INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2015/066230

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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