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PERSONAL CARE DEVICE WITH REMOVABLE ENERGY SOURCE

Abstract

The present disclosure is concerned with a personal care device having an energy source arranged for being removable, the personal care device having an outer housing having a detachable closure element at one end, the detachable closure element enabling access to a cavity of the outer housing after detachment, a chassis disposed in the cavity of the outer housing, the chassis holding the energy source, the chassis having a blocking structure such as a charging coil holder positioned between the energy source and the closure element along an energy source removal direction, the energy source having a first electrical connector non-permanently coupled with a first electrical connector partner and a second electrical connector non-permanently coupled with a second electrical connector partner, the first electrical connector partner and the second electrical connector partner being secured at the chassis, the chassis being arranged for removal from the cavity of the outer housing along a chassis removal direction when the closure element is detached, and the blocking structure having at least one holder arm with a neck section provided for a severance cut so that the blocking structure can be bent away after the severance cut to allow removing the energy source from the chassis.

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Background/Summary

FIELD OF THE INVENTION

[0001] The present disclosure is concerned with personal care devices such as electric toothbrushes comprising a removably arrange energy source.

BACKGROUND OF THE INVENTION

[0002] There is a general interest in ensuring that batteries are collectable, recyclable, and reusable, specifically in connection with the European Green Deal. For certain devices such as personal care devices that are used in a bathroom environment, rechargeable batteries had typically been sealed and often were not easily removable from the device. Thus, new personal care devices are envisaged that allow removal of the energy source, e.g., a battery such as a rechargeable accumulator, from the device. For existing devices, there is an interest in providing minimally invasive changes to the device design allowing to remove the battery.

[0003] It is thus an object to provide a personal care device having a structure that allows removal of the battery while ideally an existing device design is only changed where really needed.

SUMMARY OF THE INVENTION

[0004] In accordance with at least one aspect a personal care device is provided that has an energy source arranged for being removable, the personal care device comprising an outer housing having a detachable closure element at one end, the detachable closure element enabling access to a cavity of the outer housing after detachment, a chassis disposed in the cavity of the outer housing, the chassis holding the energy source, the chassis comprising a blocking structure such as a charging coil holder positioned between the energy source and the closure element along an energy source removal direction, the energy source having a first electrical connector non-permanently coupled with a first electrical connector partner and a second electrical connector non-permanently coupled with a second electrical connector partner, the first electrical connector partner and the second electrical connector partner being secured at the chassis, the chassis being arranged for removal from the cavity of the outer housing along a chassis removal direction when the closure element is detached, and the blocking structure comprising at least one holder arm with a neck section provided for a severance cut so that the blocking structure can be bent away after the severance cut to allow removing the energy source from the chassis.

[0005] In accordance with at least one aspect a personal care device is provided that has an energy source arranged for being removable, the personal care device comprising an outer housing having a detachable closure element at one end, the detachable closure element enabling access to a cavity of the outer housing after detachment, a chassis disposed in the cavity of the outer housing, the chassis holding the energy source, the energy source having a first electrical connector non-

permanently coupled with a first electrical connector partner and a second electrical connector non-permanently coupled with a second electrical connector partner, the first electrical connector partner and the second electrical connector partner being secured at the chassis, the chassis being arranged for removal from the cavity of the outer housing when the closure element is detached, and the energy source being arranged for removal from the chassis in an energy source removal direction perpendicular to a chassis removal direction along which the chassis can be removed from the cavity of the outer housing, the first electrical connector having a first geometry and the second electrical connector having a second geometry being different to the first geometry, in particular where the first electrical connector is an essentially cylindrical structure having a first diameter and the second electrical connector is an essentially cylindrical structure having a second diameter different to the first diameter, and the first electrical connector partner being adapted for the geometry of the first electrical connector and the second electrical connector partner being adapted for the geometry of the second electrical connector so that the energy source has only one correct insertion alignment providing a mistake-proof insertion.

Description

BRIEF DESCRIPTION OF THE DRAWINGS

[0006] The present disclosure will be further elucidated by a detailed description of example embodiments and with reference to figures. In the figures

[0007] FIG. **1** is a depiction of an example embodiment of a personal care device;

[0008] FIG. **2** is a depiction of a chassis holding a removably arranged energy source, which chassis is removed from a cavity of an outer housing after detachment of a closure element from the outer housing;

[0009] FIG. **3** is a depiction of an example holder for holding a removably arranged energy source, the holder typically being a part of a chassis;

[0010] FIG. **4** is a detail depiction of a metal sheet element realizing a first electrical connector partner for getting into non-permanent contact with a first electrical connector of a removable energy source to allow for current flow;

[0011] FIG. **5** is a depiction of an example blocking structure, here realized as a charging coil holder, for being secured at a portion of a chassis;

[0012] FIG. **6** is a depiction of a portion of a chassis holding a removable energy source comprising a blocking structure that is partially bent away after two holder arms were cut;

[0013] FIG. **7**A is a depiction of an example removable energy source comprising a first electrical connector provided for contacting a first electrical connector partner in a longitudinal extension direction of the energy source and a second electrical connector provided for contacting a second electrical connector partner in a direction perpendicular to the longitudinal extension direction of the energy source;

[0014] FIG. **7**B is a perspective view onto the energy source of FIG. **7**A, where the second electrical connector is visible in more detail;

[0015] FIG. **8** is a cross sectional cut through an example personal care device at a position where a closure element and an outer housing of the personal care device are locked at each other;

[0016] FIG. **9** is a depiction of an example part of a chassis such as the backside of a printed circuit board comprising a second electrical connector partner realized as a conductive layer such as a gold-plated conductive layer;

[0017] FIG. **10** is a depiction of an example personal care device;

[0018] FIG. **11** is a depiction of a chassis removed from an outer housing of the personal care device shown in FIG. **10**;

[0019] FIG. **12** is a longitudinal cut through a portion of an example chassis with a removable

energy source already removed from the chassis along an energy source removal direction;
[0020] FIG. **13** is a depiction of a part of an example chassis comprising a holder for holding a removable energy source and of a first and a second electrical connector partner shown in isolation, i.e., prior to being mounted at the holder;
[0021] FIG. **14**A is a detail depiction of the first electrical connector partner shown in FIG. **13**;
[0022] FIG. **14**B is a detail depiction of the second electrical connector partner shown in FIG. **13**; and
[0023] FIG. **15** is a depiction of an example removable energy source having a first and a second electrical connector that have two different geometries for mistake-proof insertion of the removable energy source into a chassis.

DETAILED DESCRIPTION OF THE INVENTION

[0024] In the context of the present description “personal care” shall mean the nurture (or care) of the skin and of its adnexa (i.e. hairs and nails) and of the teeth and the oral cavity (including the tongue, the gums etc.), where the aim is on the one hand the prevention of illnesses and the maintenance and strengthening of health and on the other hand the cosmetic treatment and improvement of the appearance of the skin and its adnexa. It shall include the maintenance and strengthening of wellbeing. This includes skin care, hair care, and oral care as well as nail care. This further includes grooming activities such as beard care, shaving, and depilation. A “personal care device” thus means any device for performing such nurturing or grooming activity, e.g. (cosmetic) skin treatment devices such as skin massage devices or skin brushes; wet razors; electric shavers or trimmers; electric epilators; and oral care devices such as manual or electric toothbrushes, (electric) flossers, (electric) irrigators, (electric) tongue cleaners, or (electric) gum massagers. This shall not exclude that the proposed personal care device may have a more pronounced benefit in one or several of these nurturing or device areas than in one or several other of these areas. In the present description, an electric toothbrush was chosen to present details of the proposed personal care device, which shall be understood as not limiting. To the extent in which the details are not specific for an electric toothbrush, the proposed technology can be used in any other personal care device.
[0025] A personal care device may generally comprise a handle for allowing a user to hold the personal care device in a hand and a head for performing a care action at a care site. E.g., in case of an electric toothbrush, the head may be realized as a brush head for brushing teeth of the dentition. The head may be repeatedly detachable and again attachable to the handle. The handle may comprise an outer housing and a closure element that is detachable from the outer housing. The personal care device comprises a cavity, e.g., a cavity within the outer housing, for accommodating a chassis. The chassis is holding a removable energy source. The chassis may comprise a holder for only holding the energy source. The chassis may comprise further functional elements of the personal care device such as a drive, control electronics, a drive shaft, sensors, switches etc. In particular, the chassis may be the complete functional device structure so that after removal of the chassis, the cavity is empty.
[0026] In the context of the present disclosure, the term “energy source” shall refer to a removable energy source if not otherwise indicated. The term “removable” shall indicate that the energy source itself is non-destructively removable from the personal care device, specifically from the chassis by a user or by untrained service personnel. This shall not exclude that some element of the personal care device needs to be severed to remove the energy source. In some embodiments, the energy source can only be removed by using a tool, e.g., in some examples some pliers may be needed to cut through at least one holder arm of a blocking structure to bend away at least a portion of the blocking structure to thus clear the way for removal of the energy source.
[0027] In accordance with the concept discussed in the present disclosure, a personal care device such as an electric toothbrush comprises an outer housing having an inner cavity that may typically span the complete length of the outer housing in which a chassis is disposed that holds the

removable energy source. In order to allow access to the chassis, the ouster housing may be closed with a closure element that is arranged to be detachable, e.g., under a rotary motion. The closure element may be provided at a bottom or a top of a handle of the personal care device, where “top” refers to an end of the handle proximal the head and “bottom” refers to an end of the handle distal to the handle. The interface between the closure element and the outer housing may be structured to seal the cavity against inflow of liquids. The chassis at least holds the removable energy source, e.g., the chassis itself may be a holder for holding the removable energy source. An elastic element such as a coil spring may be placed between the closure element or some portion of the outer housing and the energy source to keep the energy source in place while the closure clement is attached to the outer housing. The chassis is intended for removal from the outer housing along a chassis removal direction that typically coincides with a longitudinal extension direction or center axis of the outer housing, which removal action can be done by a user or by untrained service personnel once the closure element is removed. The energy source is arranged for being removed from the chassis along an energy source removal direction. This energy source removal direction may coincide with a longitudinal extension direction or center axis of the chassis or, alternatively, may be about perpendicular to the longitudinal extension direction or the center axis of the chassis.

[0028] The energy source has a first electrical connector and a second electrical connector, where the first electrical connector is non-permanently coupled with a first electrical connector partner secured at the chassis and the second electrical connector is non-permanently coupled with a second electrical connector partner secured at the chassis so that a current flow is enabled from the energy source to any energy consumer(s) of the personal care device such as a drive or control electronics or sensors. These first and second pairs of electrical connectors also serve to allow a charging current to be fed to the energy source. The first and/or the second electrical connector of the energy source may comprise at least one spring-loaded arm, which spring-loaded arm may have a nub-like or dome-like projection for contacting the respective electrical connector partner. Such a nub or dome effectively avoids that any remaining punching burr contacts the respective electrical connector partner. Due to the non-permanent coupling of the connector partners, accelerated motion of the device or mechanical shock may lead to motion between the electrical contact partners and thus to mechanical wear, which could become considerable in case of non-smooth connector partners. The respective electrical contact partner for the spring-loaded arm connector may be a conductive layer such as a gold-plated conductive layer. At least one of the first or second electrical connectors or of the first or second electrical connector partners may be coated with a grease to reduce corrosion and/or contamination effects, or it may be coated with a conductive grease, which may in addition improve the contact between non-permanently coupled electrical connector pairs. The first and/or the second electrical connector partner may be realized as a metal sheet clement made from a conductive metal sheet. The metal sheet element may be locked at the chassis, e.g., by means of at least one locking element such as one or more snap hooks that lock the metal sheet at the chassis. The metal sheet clement may comprise integral elements made by cutting, stamping and bending operations. These elements may comprise at least one nub-like or dome-like contact element or at least one spring-loaded contact arm. Other such elements being integral with the metal sheet element may comprise at least one connector arm for establishing an electrical connection with a conducting wire or with a printed wire on a printed circuit board, and/or one or more abutting elements for defining a position of the metal sheet element with respect to the chassis.

[0029] In embodiments in which the energy source is intended for removal along an energy source removal direction that coincides with the longitudinal extension direction of the energy source, the first electrical connector may contact the first electrical connector partner in the longitudinal extension direction of the energy source and the second electrical connector may contact the second electrical connector partner in a direction that is perpendicular to the longitudinal extension direction so that the two contacting directions are about 90 degrees apart. Specifically, the

contacting between the first electrical connector and the first electrical connector partner may then be enforced by a biasing element such as a coil spring pushing against the energy source in the longitudinal extension direction. The second electrical connector and the second electrical connector partner may then get into contact in a sliding manner in the longitudinal extension direction and due to a spring force in the direction perpendicular to the longitudinal extension direction. The sliding contact under spring pressure may then withstand accelerations and shocks during the use of the personal care device so that the electrical contact is effectively maintained even under such mechanically difficult circumstances.

[0030] In some examples, the chassis comprises a blocking structure that blocks the way for removing the energy source from the chassis along the energy source removal direction. In the assembled state, the blocking structure may be arranged between the energy source and the closure element or between the energy source and a portion of the outer housing. In such examples, the blocking structure may comprise at least one holder arm that is provided for a severance cut through a neck section of the holder arm so that after the severance cut at least a portion of the blocking structure can be bent away for clearing the way for removing the energy source from the chassis along the energy source removal direction. The blocking structure may be a charging coil holder. In an assembly step, the blocking structure may need to provide a certain stability for enabling a controlled assembly process. While the blocking structure may comprise a pivot around which a portion of the blocking structure can be pivoted away, it is not necessary to provide a dedicated pivot or hinge if after the severance cut the blocking portion of the blocking structure can be bend away to clear the way for removal of the energy source from the chassis.

[0031] The neck section of the at least one holder arm may comprise at least two in particular oppositely arranged groove-like structures for guiding a tool for performing the severance cut. As will be explained in more detail further below, the cross-sectional area of the neck section to be cut may be limited to not more than 4 mm.sup.2 and/or the material may be a thermoplastic.

[0032] The closure element may be detachable from the outer housing by means of a rotary motion. The closure element and the outer housing may be mechanically coupled by at least one pair of interacting mechanical elements such as a projection and a receptacle. The projection and/or the receptacle may have a ramp or chamfer to support the detachment of the closure element from the outer housing when the closure element is rotated against the outer housing. Specifically, the closure element and the outer housing may be locked at each other by two pairs of interacting mechanical elements. In some embodiments, the closure element may be detachable from the outer housing by squeezing the outer housing to decouple mechanically engaged interaction elements such as a projection and a receptacle. The closure element may then be detached by a tilting motion of the closure element relative to the outer housing, while the outer housing is being squeezed together. In case of two pairs of mechanically interacting elements, the squeezing and tilting may need to be repeated for a complete detachment.

[0033] In some examples the energy source may be arranged for removal from the chassis along an energy source removal direction that is about perpendicular to a longitudinal length extension direction of the chassis. This may support the removal action without prior dealing with a blocking structure. As in other examples, the respective energy source has a first electrical connector and a second electrical connector that are non-permanently coupled with a first and a second electrical connector partner, respectively, so that a current flow from and to the energy source is enabled. The first and the second electrical connector partners may be secured at the chassis and may be realized as metal sheet elements. In such an example, the first electrical connector of the energy source has a first geometry or first design and the second electrical connector has a second geometry or second design different to the first geometry or first design. The first electrical connector partner is then geometrically adapted to receive the first electrical connector having the first geometry and the second electrical connector partner is adapted to receive the second electrical connector having the second geometry. This may be sufficient for a mistake-proof alignment of the electrical connectors

of the energy source with the electrical connector partners of the chassis so that a wrong polarity of the inserted energy source is effectively avoided. The chassis may comprise a further mechanical structure such as a mechanical receiver element that also ensures that the alignment and insertion of the energy source cannot be done wrongly by a user or by untrained service personnel. The mechanical structure may be designed so that it can only cooperate with one of the geometries of the first or second electrical connectors.

[0034] FIG. **1** is a depiction of an example personal care device **1**A realized as an electric toothbrush. The personal care device **1**A comprises a handle **10**A and a head **2**A, here realized as a detachable brush head. The handle **10**A comprises an outer housing **11**A and a detachable closure element **12**A.

[0035] FIG. **2** is a depiction of the outer housing **11**A and the closure element **12**A shown in FIG. **1**. A chassis **20**A is shown in a state where it was already removed from a cavity **19**A defined by the outer housing **11**A. In the shown example, the chassis **20**A is a multi-component part comprising various elements such as a holder **30**A for a removable energy source **60**A, a printed circuit board, a motor, a drive shaft, a blocking structure **50**A such as a charging coil holder etc. The chassis **20**A has been removed from the cavity **19**A along a chassis removal direction R**1**. The removable energy source **60**A is arranged for removal from the chassis **20**A along an energy source removal direction R**2**. It can be appreciated that the blocking structure **50**A blocks the way for the removal of the removable energy source **60**A.

[0036] FIG. **3** is a depiction of a holder **30**A for holding a removable arranged energy source. The holder **30**A may be a part of a chassis such as the chassis **20**A shown in FIG. **2**. The holder **30**A may be a plastic part, specifically an injection molded plastic part. A first electrical connector partner **40**A is secured at the holder **30**A for contacting a first electrical connector of the removable energy source (see, e.g., a first electrical connector **61**A in FIG. **7**A). The details of the first electrical connector partner are discussed in the following paragraph with reference to FIG. **4**.

[0037] FIG. **4** is a magnified and isolated depiction of the first electrical connector partner **40**A shown in FIG. **3**. The first electrical connector partner **40**A is here realized as a conductive metal sheet element. The metal sheet element may be gold-plated or otherwise coated for improved corrosion properties and reduced contact resistance. The first electrical connector partner **40**A has a base metal sheet **41**A and an electrical contact area **42**A. The electrical contact area **42**A may comprise at least one nub-like or dome-like contact element **420**A that may be centrally arranged. In addition to the nub-like or dome-like contact element **420**A, the first electrical connector partner **40**A may comprise at least one spring-loaded contact arm **421**A, **422**A. In case of two spring-loaded contact arms **421**A and **422**A as in the shown example, these contact arms **421**A, **422**A may be symmetrically arranged with respect to the central nub-like or dome-like contact clement **420**A. It had been found that in case that an energy source is removably arranged in a chassis of a personal care device (i.e., where the electrical contacts are non-permanently coupled and rely on pressure and friction between the contact partners rather than a solder material or the like), a combination of one or more fixed contact element(s) and of one or more elastic contact element(s) can typically deal better with vibrations and shocks of the personal care device during use than just one single type of contact element. At least one of the at least one spring-loaded contact arms **421**A, **422**A may have a nub-like or dome-like contact projection or may—as is shown—have a line-like contact protrusion, which may be made by a stamping and/or bending operation. The first electrical connector partner **40**A may comprise at least one of the following further elements:

(a) one or more stopper arms or abutting elements or projections or edges **431**A, **432**A for providing a stopper functionality in an automated mounting process when the first electrical connector partner **40**A is secured at the chassis, e.g., at a holder of the chassis for holding the removable energy source,

(b) an electrical connector element **44**A that may comprise a cut-out **441**A for easier bending and/or for improved soldering, which electrical connector element **44**A may be used for establishing a

conductive connection with a wire of the device electronics, and
(c) at least one snap hook **45**A that in a mounting process non-detachably locks the first electrical connector partner **40**A at the chassis, where non-detachably here refers to the fact that after snapping into a receptacle or the like, the snap hook **45**A needs to be manually bent to allow removal of the first electrical connector partner **40**A. In an example as shown, all the mentioned elements of the first electrical connector partner **40**A may be made out the same single metal sheet by cutting, stamping, and bending operations.
[0038] FIG. **5** is a side view onto an example blocking structure **50**A that may be located between the removably arranged energy source and the closure element in the assembled state of the personal care device and thus, even after removal of the chassis from the outer housing, the removal of the energy source along the energy source removal direction is inhibited by the blocking structure **50**A. The blocking structure **50**A is in the shown example a holder structure holding a charging coil **541**A. In detail, the blocking structure **50**A here comprises a first portion **51**A that introduces the necessary stability of the blocking structure **50**A during the assembly process, an elastic portion **52**A that compensates tolerances, and a coil bobbin portion **53**A onto which the coil **541**A is wound. The first portion **51**A is intended for being secured at the chassis, in particular at a printed circuit board of the chassis, by means of a connector **56**A onto which also a wire **54**A is loosely wound that then bridges over to the coil bobbin portion **53**A. The blocking structure **50**A comprises at least one holder arm **58**A (here being a part of the first portion **51**A) that in turn has a neck section **59**A having at least two groove-like structures **591**A and **592**A that together shape the neck section in a way that jaws of a pliers or a wire cutter or another pliers-like tool are guided towards the thinnest portion of the neck section **59**A. As can be seen in FIG. **6**, the first portion **51**A may be ring-shaped and thus the first portion may have two oppositely arranged neck sections at two holder arms, even though the number of neck section is neither linked to the number of holder arms nor the shown embodiment. In general, the blocking structure may comprise one or two or even more holder arms and each of the holder arms may comprise one or two or even more neck sections. The neck section may also be round and then a circumferential groove may provide the function of two opposing groove-like structures. The above discussion shall not exclude that a holder arm may comprise a neck section that has only one groove-like structure.
[0039] The shown detailed example may be sensible for an existing design of a personal care device that previously comprised a blocking structure so that removal of an energy source located “behind” the blocking structure was inhibited. Removal of the energy source may not have originally be foreseen. In the context of modifying such an existing blocking structure, it was found that the smallest cross-sectional area of the neck section to be cut and the material of the holder arm might be chosen such that any user can cut through the neck section without considerable difficulties. To achieve this, the cross-sectional area of the neck section may be chosen to be not larger than 4 mm.sup.2 or not larger than 3.5 mm.sup.2 or not larger than 3 mm.sup.2 or may be chosen to be about 2.75 mm.sup.2 or even smaller. A balance should be found between the stability of the blocking structure **50**A in an assembly process which is to some extent governed by the cross-sectional area of the neck section and the case of cutting through the neck section. Therefore, the cross-sectional area should not become too small. It was further found that the mentioned cross-sectional area may go along with the material of the holder arm **58**A being a thermoplastic. While it shall not be excluded that the holder arm **58**A is made from another material such as metal, it was found that the combination of the mentioned cross-sectional area and a thermoplastic as material enables a relatively easy cutting action while providing sufficient stability to the blocking structure **50**A.
[0040] FIG. **6** is a depiction of a portion of the chassis **20**A holding the energy source **60**A in a holder **30**A. The previously discussed blocking element **50**A is shown in a state where the previously mentioned severance cuts through two holder arms (reference numeral **58**A in FIG. **5**) were performed and a blocking portion **501**A of the blocking structure **50**A is now in a bent-away

position allowing the removal of the removably arranged energy source **60**A along an energy source removal direction R**2** that is about parallel with a longitudinal axis L**1** of the chassis **20**A and also essentially coinciding with the chassis removal direction R**1** along which the chassis **20**A was removed from the cavity of the outer housing of the personal care device as discussed in a previous paragraph. The blocking structure **50**A is secured at a printed circuit board **70**A by means of the connector **56**A. In the current example, the blocking structure **50**A does not have a dedicated hinge about which the blocking portion **501**A of the blocking structure **50**A can pivot, but the wires **54**A spanning between the remaining chassis **20**A and the blocking portion **501**A of the blocking structure provides for a flexible area **55**A that allows a bending-away motion as is indicated by arrow R. As the removable energy source **60**A is only non-permanently connected with the chassis **20**A, the energy source **60**A can be removed from the chassis after the blocking portion **501**A is bent away.

[0041] FIG. **7**A is a side-view depiction of an example removable energy source **60**A that has a first electrical connector **61**A and a second electrical connector **63**A. The first electrical connector **61**A is arranged in a longitudinal direction or axial direction L, while the second electrical connector **63**A is provided in a radial direction essentially perpendicular to the longitudinal direction L.

[0042] FIG. **7**B is a detailed perpendicular view onto a portion of the energy source **60**A shown in FIG. **7**A. The example second electrical connector **63**A as shown comprises various parts discussed in the following. The second electrical connector **63**A may be made from a sheet of conductive metal. The second electrical connector **63**A has a connecting portion **631**A that may be welded or otherwise secured at the body of energy source **60**A, typically at a plus pole or minus pole of the energy source **60**A. The electrical connector **63**A then is bent by 90 degrees and continues as a portion **632**A extending along the longitudinal direction L until a bending section **633**A at which the second electrical connector **63**A is bent by somewhat less than 180 degrees. The conductive sheet metal of the second electrical connector **63**A is then split into three parallel spring-loaded arms **64**A that are intended to contact a second electrical connector partner. For reduction of mechanical interaction between the spring-loaded arms **64**A and the second electrical connector partner due to, e.g., punching burrs, each spring-loaded arm **64**A may comprise at least one nub-like or dome-like contact element **641**A.

[0043] FIG. **8** shows a cross-sectional cut through an example personal care device at a level at which an outer housing **11**A and a closure element **12**A mechanically engage with each other. As previously indicated, the closure element **12**A is here intended for detachment from the outer housing **11**A by a rotary motion against the outer housing **11**A as is indicated by arrow R**3**. The closure element **12**A comprises two oppositely arranged projections **121**A and **122**A that each comprise a ramp **1211**A and **1221**A, respectively. The projections **121**A and **122**A are received by receptacles **111**A and **112**A, respectively. The receptacle **111**A comprises a ramp **1111**A that interacts with the ramp **1211**A when the closure element **12**A is moved in direction R**3**, and the receptacle **112**A comprises a ramp **1121**A that interacts with the ramp **1221**A when the closure element **12**A is moved in direction R**3**.

[0044] FIG. **9** is a depiction of an example portion **70**A of a chassis, which portion **70**A may be a printed circuit board, at which a second electrical connector partner **71**A is provided, which second electrical connector partner **71**A may be realized as a conductive layer, e.g., as a gold-plated conductive layer.

[0045] FIG. **10** is a depiction of an example personal care device **1**B realized as an electrical toothbrush having a handle **10**B and a detachable head **2**B. The handle **10**B comprises an outer housing **11**B and a closure element **12**B provided at a top of the handle, i.e., proximal to the head **2**B.

[0046] FIG. **11** is a depiction of the outer housing **11**B of the personal care device **1**B shown in FIG. **10** with a chassis **20**B being removed from a cavity **19**B of the outer housing **11**B along a chassis removal direction R**4**. The chassis **20**B comprises a holder **30**B that holds a removable

energy source **60**B.

[0047] FIG. **12** is a longitudinal cut through a portion of the chassis **20**B shown in FIG. **11**, where the energy source **60**B is already removed from the holder **30**B along an energy source removal direction R**5** that here is essentially perpendicular to a longitudinal axis L**2** of the chassis **20**B and essentially to the chassis removal direction R**4** shown in FIG. **11**. A blocking structure **50**B is shown that due to the energy source removal direction R**5** is not causing any issues when removing the energy source **60**B.

[0048] FIG. **13** is a depiction of the holder **30**B shown in FIGS. **11** and **12** and of a first and a second electrical connector partner **410**B and **420**B, respectively, that are shown in isolation from the holder **30**B, i.e., prior to being locked at the holder **30**B. It shall be appreciated that the first and the second electrical connector partner **410**B and **420**B are intended for being secured at the holder **30**B and to thus provide electrical connector partners for a first and a second electrical connector of the energy source **60**B shown in FIGS. **11** and **12**. The first and the second electrical connector partners **410**B and **420**B may in particular be coupled, e.g., soldered, to electrical leads for enabling current flow from the removable energy source **60**B to an energy consumer of the personal care device such as a drive and/or control electronics. In the shown example, the holder **30**B comprises a mechanical structure **32**B formed by two wall elements that form a geometrical receiver that will allow only objects of a certain maximum diameter to be received between the two wall elements. As will be explained with respect to the removable energy source **60**B shown in detail in FIG. **15**, the mechanical structure **32**B thus forms a hard to overcome obstacle for a wrongly aligned energy source. Thus, the mechanical structure **32**B may form part of a mistake-proof alignment concept for the removable energy source if the removable energy source is attached to the chassis again or in case a new removable energy source is to be attached.

[0049] FIGS. **14**A and **14**B are magnified depictions of the first and the second electrical connector partners **410**B and **420**B, respectively, shown in isolation. Without going into the details of their example design as shown, it is just mentioned that the first electrical connector partner **410**B has a receiver opening **411**B having a diameter d**1** that is geometrically adapted for receiving a first electrical connector of the energy source having a first design or geometry and the second electrical connector partner **420**B has a receiver opening **421**B having a diameter d**2** geometrically adapted to a second electrical connector of the energy source having a second design or geometry being different to the first design or geometry so that d**1**≠d**2**. Thus, due to the different geometric shaping of the receiver openings **411**B, **421**B of the first and the second electrical connector partners **410**B and **420**B, respectively, a mistake-proof alignment of the energy source should be enabled, but due to the limited stability of metal sheet plates forming the first and second electrical connector partners **410**B and **420**B, the mechanical structure **32**B mentioned in the previous paragraph may be used for improved mistake-proof alignment. The first electrical connector partner **410**B may comprise a snap hook **415**B integrally formed from the metal sheet forming the first electrical connector partner **410**B for locking the first electrical connector partner **410**B at the holder **30**B (see FIG. **13**). The second electrical connector partner **410**B may comprise a snap hook **425**B integrally formed from the metal sheet forming the second electrical connector partner **410**B for locking the second electrical connector partner **410**B at the holder **30**B.

[0050] FIG. **15** is a depiction of an example removable energy source **60**B comprising a first electrical connector **61**B and a second electrical connector **62**B. In the shown embodiment, the first electrical connector is an essentially cylindrical contact element having a diameter d**1** and the second electrical connector **62**B is an essentially cylindrical contact element having a diameter d**2**, where d**1**≠d**2**.

[0051] The dimensions and values disclosed herein are not to be understood as being strictly limited to the exact numerical values recited. Instead, unless otherwise specified, each such dimension is intended to mean both the recited value and a functionally equivalent range

surrounding that value. For example, a dimension disclosed as “40 mm” is intended to mean “about 40 mm.”

Claims

1. A personal care device having an energy source arranged for being removable, the personal care device comprising: an outer housing having a detachable closure element at one end, the detachable closure element enabling access to a cavity of the outer housing after detachment; a chassis disposed in the cavity of the outer housing, the chassis holding the energy source; the chassis comprising a blocking structure positioned between the energy source and the closure element along an energy source removal direction; the energy source having a first electrical connector non-permanently coupled with a first electrical connector partner and a second electrical connector non-permanently coupled with a second electrical connector partner, the first electrical connector partner and the second electrical connector partner being secured at the chassis; the chassis being arranged for removal from the cavity of the outer housing along a chassis removal direction when the closure element is detached; and the blocking structure comprising at least one holder arm with a neck section provided for a severance cut so that the blocking structure can be bent away after the severance cut to allow removing the energy source from the chassis.
2. The personal care device in accordance with claim 1, wherein the blocking structure is a charging coil holder.
3. The personal care device in accordance with claim 1, wherein the neck section comprises at least two groove-like structures for guiding a tool for performing the severance cut.
4. The personal care device in accordance with claim 1, wherein the first electrical connector partner is a metal sheet element that is secured at the chassis.
5. The personal care device in accordance with claim 4, wherein the metal sheet element has a metal snap hook locking the metal sheet element at the chassis.
6. The personal care device in accordance with claim 4, wherein the metal sheet element has at least one spring-loaded contact arm and at least one nub-like or dome-like contact structure.
7. The personal care device in accordance with claim 1, wherein the second electrical connector is realized as at least one spring-loaded arm.
8. The personal care device in accordance with claim 7, wherein the at least one spring-loaded arm contacts the second electrical connector partner in a direction perpendicular to the energy source removal direction.
9. The personal care device in accordance with claim 8, wherein the at least one spring-loaded arm has at least one nub-like contact structure being in contact with the second electrical connector partner.
10. The personal care device in accordance with claim 8, wherein the second electrical connector partner is a contact surface such as a gold-plated conductive layer.
11. The personal care device in accordance with claim 1, wherein the first electrical connector or the second electrical connector is coated with a grease.
12. The personal care device in accordance with claim 1, wherein the first electrical connector is contacting the first electrical contact partner in a longitudinal extension direction of the energy source and the second electrical connector is contacting the second electrical contact partner in a direction perpendicular to the longitudinal extension direction so that the two contacting directions are about 90 degrees apart.
13. The personal care device in accordance with claim 1, wherein the closure element is arranged for detachment from the outer housing by a rotary motion with respect to the outer housing and the closure element and the outer housing are locked at each other by at least one engaged projection and receptacle pair.
14. A personal care device having an energy source arranged for being removable, the personal care

device comprising: an outer housing having a detachable closure element at one end, the detachable closure element enabling access to a cavity of the outer housing after detachment; a chassis disposed in the cavity of the outer housing, the chassis holding the energy source; the energy source having a first electrical connector non-permanently coupled with a first electrical connector partner and a second electrical connector non-permanently coupled with a second electrical connector partner, the first electrical connector partner and the second electrical connector partner being secured at the chassis; the chassis being arranged for removal from the cavity of the outer housing when the closure element is detached, and the energy source being arranged for removal from the chassis in an energy source removal direction perpendicular to a chassis removal direction along which the chassis can be removed from the cavity of the outer housing; the first electrical connector having a first geometry and the second electrical connector having a second geometry being different to the first geometry and the first electrical connector partner being adapted for the geometry of the first electrical connector and the second electrical connector partner being adapted for the geometry of the second electrical connector so that the energy source has only one correct insertion alignment providing a mistake-proof insertion.

15. The personal care device in accordance with claim 14, wherein the first electrical connector is an essentially cylindrical structure having a first diameter and the second electrical connector is an essentially cylindrical structure having a second diameter different to the first diameter.

16. The personal care device in accordance with claim 14, wherein the chassis comprises at least one mechanical receiver element cooperating only with one of the first and second electrical connectors.

17. The personal care device in accordance with claim 14, wherein the first electrical connector partner is a metal sheet element that is secured at the chassis by a non-detachable snap connector and the second electrical connector partners is a metal sheet element that is secured at the chassis by a non-detachable snap connector.

18. The personal care device in accordance with claim 14, where the personal care device is an electric toothbrush.