



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
02.10.2019 Bulletin 2019/40

(51) Int Cl.:
B26B 19/38 (2006.01)

(21) Application number: **18164823.9**

(22) Date of filing: **29.03.2018**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(71) Applicant: **Braun GmbH**
61476 Kronberg im Taunus (DE)

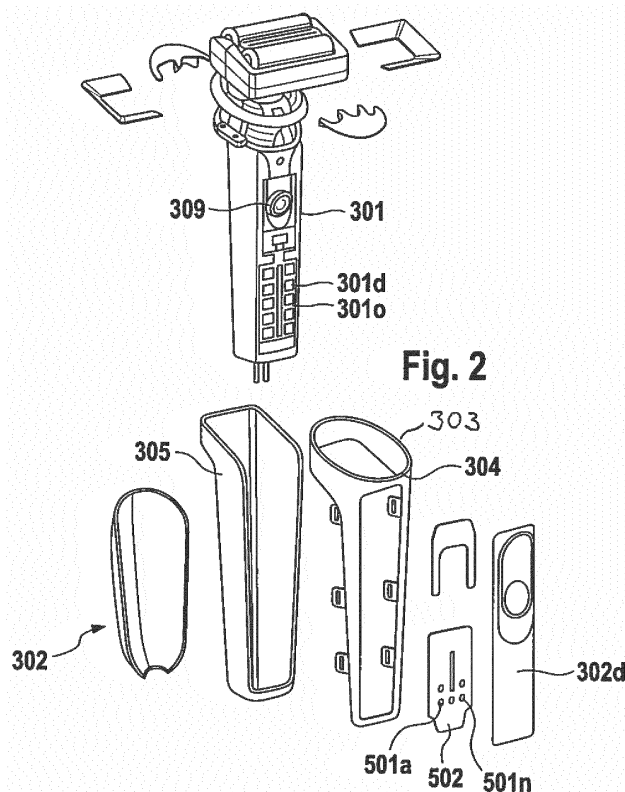
(72) Inventor: **Erndt, Andreas**
61476 Kronberg (DE)

(74) Representative: **P&G Patent Germany**
Procter & Gamble Service GmbH
Sulzbacher Straße 40
65824 Schwalbach am Taunus (DE)

(54) **PERSONAL CARE DEVICE SUCH AS ELECTRIC SHAVER**

(57) The present invention relates to a personal care device, in particular an electric shaver, comprising a housing (300) with a working head (3) attached thereto, said housing including an inner housing (301) and an outer housing (302), and a display (500) including a light source (503) accommodated in the inner housing to emit light through transparent portions of said inner and outer housings, said display further including a display foil

(502) having portions of different transparency and/or different colors forming display symbols, said display foil being sandwiched between said transparent portions of the inner and outer housings. More particularly, the display foil may be glued to both the inner and outer housing by means of an adhesive on each of opposite sides of the display foil.



Description

FIELD OF THE INVENTION

[0001] The present invention relates to a personal care device, in particular an electric shaver, comprising a housing with a working head attached thereto, said housing including an inner housing and an outer housing, and a display including a light source accommodated in the inner housing to emit light through transparent portions of said inner and outer housings, said display further including a display foil having portions of different transparency and/or different colors forming display symbols, said display foil being sandwiched between said transparent portions of the inner and outer housings. The present invention further relates to a method of manufacturing such a personal care device.

BACKGROUND OF THE INVENTION

[0002] Electric shavers and other hair removal devices such as epilators usually have one or more cutter elements driven by an electric drive unit in an oscillating manner where the cutter elements reciprocate under a shear foil, wherein such cutter elements or undercutters may have an elongated shape and may reciprocate along their longitudinal axis. Other types of electric shavers use rotatory cutter elements which may be driven in an oscillating or a continuous manner. Said electric drive unit may include an electric motor or a magnetic-type linear motor, wherein the drive unit may include a drive train having elements such as an elongated drive transmitter for transmitting the driving motion of the motor to the cutter element, wherein said motor may be received within the handle portion of the shaver.

[0003] On the other hand, when the motor is accommodated within the shaver head, no such drive train extending from the housing into the shaver head is necessary. Nevertheless, usually an electric connection from the power source accommodated in the housing extends into the shaver head to supply power from said electric power source to the motor. Such power source may be an electric power storage such as a battery or an accumulator.

[0004] The housing accommodating the electric motor and/or electric power source often includes an elongated base element closed by a cover element to allow for mounting and accommodating the electronic components inside the housing. As the housing should nevertheless form a sealed container for protecting the electric components from liquids and moisture, a seal is provided between the base element and the cover element, wherein such seal may include a sealing ring extending between surfaces of the base element and the cover element facing each other.

[0005] Such sealing of the housing is also necessary so as to protect other electronic components from liquids and moisture. For example, personal care devices often

include a display device for displaying various information to a user. Such display may include symbols indicating a battery's charging status, a cleaning status, wear and tear necessitating, for example, replacement of the tool head, a level of an application liquid reservoir or other types of information such as treatment instructions, speed modes, user modes or styling modes.

[0006] Such display devices may include at least one light source such as an LED to emit light from the interior of the housing through a transparent portion of the housing, wherein such light may be guided through a display foil provided with more and less transparent portions and/or portions of different colors to form the aforementioned symbols which are illuminated by the light guided through said display foil. While the light source and supplying and controlling elements connected thereto such as an electronic circuit board are received inside the housing to protect them against moisture, said display foil is sometimes positioned outside the sealed housing container to provide for a more brilliant illumination of the displaying symbols richer in contrast.

[0007] More particularly, said display foil may be positioned outside an inner housing which is sealed against moisture or liquids, but inside an outer housing encompassing or surrounding said inner housing so that the aforementioned display foil is sandwiched between the inner and outer housings. Such two-shell or multiple-shell structure of the housing is sometimes desired so as to hide the functional structure of the inner housing and to provide for good handling, aesthetic appearance and modular configuration of different types of devices. Each of the inner and outer housings may be individually adapted to different functions. For example, the inner housing may form a functional platform for accommodating electronic components protected against moisture and positioning drivetrain elements and supporting the working head, whereas the outer housing may fulfill other needs such as forming an ergonomic handle with an organic shape and an anti-slippery surface, or an attractive outer appearance.

[0008] Such outer housing, however, is sometimes not sealed against moisture or liquids or foam or gel which therefore may get contact to the display foil arranged between the outer and inner housings. Such moisture getting contact to the display foil may impair visibility of the display symbols or, even worse, may harm the function of the display foil due to, for example, dissolving the borders between transparent and opaque portions.

[0009] Furthermore, when positioning the display foil between inner and outer housing portions, it is sometimes difficult to exactly align the symbols of the display foil with the light source accommodated in the interior of the inner housing, as manufacturing tolerances may cause misalignment of the display foil. Even when there are only small misalignments, illumination of the symbols may be severely impaired due to light diffusion or stray light or shadowing. As there are usually a plurality of symbols positioned rather close to each other, the light source

es are also arranged in a sort of rather dense matrix so that even small misalignments may cause light emitted from a light source associated with a first symbol to stray and scatter onto a second symbol.

[0010] A personal care device of the aforementioned type is shown, for example, by US 2009/0025229 A1 which discloses a drive unit for the cutter elements of an electric shaver, wherein the drive unit includes transmitter pins extending from the shaver housing towards the shaver head. A similar device is known from US 7,841,090 B2.

[0011] Further electric shavers are known from, for example, US 3,748,371 B, FR 1391957 A, GB 811,207 B and US 5,704,126 B.

SUMMARY OF THE INVENTION

[0012] It is an objective underlying the present invention to provide for an improved personal care device such as an electric shaver avoiding at least one of the disadvantages of the prior art and/or further developing the existing solutions.

[0013] A more particular objective underlying the invention is to provide for cost-sensitive, easy manufacturing of personal care devices such as electric shavers having a brilliant display for displaying information and sufficiently sealed against liquids.

[0014] A further objective underlying the invention is to provide for an improved shaver having a sealed container housing for accommodating electric components such as an electric motor and/or an electric power source, and a display rich in contrast and providing for good visibility.

[0015] More particularly, an objective underlying the present invention is to combine an easily visible display with sealing of the personal care device's housing and protection of the display against moisture even when there are tolerances in shape and/or dimensions of the housing elements to be connected and/or variations in the mounting forces pressing the housing elements against each other due to tolerances and/or mistakes in the assembling process.

[0016] To achieve at least one of the aforementioned objectives, it is suggested to provide for sealing the display foil to both the inner and outer housing elements to protect the display foil against liquids and moisture. More particularly, the display foil may be glued to both the inner and outer housing by means of an adhesive on each of opposite sides of the display foil. Due to such adhesion of the display foil to the outer side of the inner housing and the inner side of the outer housing, water or other liquids and moisture or foam or gel are prevented from creeping onto the display foil surface, thereby preventing visibility from being impaired or the display foil from becoming defective.

[0017] So as to compensate for tolerances in the distance of the inner surface of the outer housing from the outer surface of the inner housing and/or compensate

for movements of the inner and outer housings relative to each other due to deformation due to gripping forces and/or bending of the housing, an adhesive foam such as PE foam or PU foam may be used as adhesive for glueing the display foil to the inner or outer housing.

[0018] The display foil may be provided with the symbols to be illuminated by means of, for example, laser treatment of the display foil, after having attached the display foil to the inner housing. Applying the symbols to the foil after having fixed the foil to the inner housing helps in avoiding misalignment of the symbols relative to the inner housing and components received therein such as the light source.

[0019] According to a still further aspect, the inner housing may be provide with opaque shading fences on the interior side of the inner housing for restricting light emitted by a light source associated with a transparent housing portion aligned with a display symbol to be transmitted only to said display symbol and prevent other symbols from being illuminated by stray light or scattered light originating from such light source.

[0020] These and other advantages become more apparent from the following description giving reference to the drawings and possible examples.

BRIEF DESCRIPTION OF THE DRAWINGS

[0021]

Fig. 1: a perspective view of an electric shaver with a shaver connected to a handle by means of a support structure,

Fig. 2: a schematic explosion view of the housing of the electric shaver showing the shell-like structure of the housing including an outer housing and an inner housing, and a display foil to be arranged therebetween,

Fig. 3: a perspective, explosion view of the inner housing of Fig. 2, wherein an electronic core component including an LED array of a display is to be inserted into an elongated, cup-shaped base element of the inner housing,

Fig. 4: a cross-sectional view of the electric shaver's handle showing the arrangement of the display foil between the inner and outer housings and the arrangement of the light source and the shading fences inside the inner housing,

Fig. 5: a schematic cross-sectional view of the display foil and the adhesive layers fixing the display foil to the inner and outer housings, wherein according to a first aspect two transparent adhesive layers fully covering the opposite surfaces of the display foil are bonding the display foil to the inner and outer housings,

Fig. 6: a schematic cross-sectional view of the display foil and the adhesive layer similar to Fig. 5, wherein a bottom side of the display foil is bonded to the inner housing by means of a transparent adhesive layer fully covering the display foil and the top side of the display foil is bonded to the outer housing by means of an adhesive layer having a window leaving open the display area of the display foil,

Fig. 7: a schematic cross-sectional view of the display foil and the adhesive layer similar to Fig. 5, wherein a top side of the display foil is bonded to the outer housing by means of a transparent adhesive layer fully covering the display foil and the bottom side of the display foil is bonded to the inner housing by means of an adhesive layer having a window leaving open the display area of the display foil,

Fig. 8: a schematic cross-sectional view of the display foil and the adhesive layer similar to Fig. 5, wherein a bottom side of the display foil is bonded to the inner housing by means of a transparent adhesive layer fully covering the display foil and the top side of the display foil is bonded to the outer housing by means of an adhesive foam layer having a window leaving open the display area of the display foil,

Fig. 9: a schematic cross-sectional view of the display foil and the adhesive layer similar to Fig. 5, wherein a top side of the display foil is bonded to the outer housing by means of a transparent adhesive layer fully covering the display foil and the bottom side of the display foil is bonded to the inner housing by means of an adhesive foam layer having a window leaving open the display area of the display foil,

DETAILED DESCRIPTION OF THE INVENTION

[0022] According to an aspect, to achieve at least one of the aforementioned objectives, it is suggested to seal the display foil, which is arranged between the inner and outer housings, to the inner surface of the outer housing as well to the outer surface of the inner housing. More particularly, the display foil is glued to both the inner and outer housings by means of an adhesive on each of the opposite major surfaces of the display foil so that the outer housing is glued to the inner housing via said display foil. Due to such gluing of both surfaces of the display foil to the inner and outer housings, water or other liquids and moisture are prevented from creeping onto the displaying surface of the display foil what prevents visibility of the display symbols from being impaired and the display foil from becoming defective.

[0023] More particularly, so as to prevent water or

moisture from creeping onto the displaying symbols, said adhesive may form at least a closed sealing loop surrounding the area of the display foil in which the display symbols are arranged, wherein such closed sealing loop may run along the outer edges of the display foil. Basically, such closed sealing loop formed by the adhesive may be provided on each of opposite sides of the display foil so central areas on both sides of the display foil may be left open. However, in the alternative, at least one of the major surfaces of the display foil may be fully covered by adhesive and fully glued to the respective housing element so that the display foil, at least on one side, is in full contact with the housing.

[0024] More particularly, on one side of the display foil, the adhesive may form a transparent adhesive layer covering at least a major portion of the display foil including the display area in which the display symbols are arranged, whereas on the opposite other side of the display foil the adhesive may form an adhesive layer having a window leaving open or leaving uncovered the display symbols. In such window of the adhesive layer, the display foil is not covered by adhesive and may be spaced apart from the transparent housing portion covering the display foil.

[0025] Glueing at least one side of the display foil substantially completely to the housing, i.e. the complete surface area of said at least one side or at least a major portion of the surface area of said side is covered by adhesive and glued to said housing, helps in maintaining the desired shape of the display foil and prevents the display foil from corrugating or undulating or wrinkling or other undesired deformations.

[0026] Both sides of the display foil may be substantially completely glued to the inner and outer housings, wherein in such case a transparent adhesive is used to glue the display foil to the inner and outer housings so that light may shine through the transparent adhesive layers, in particular in the area of the display symbols.

[0027] When one of the adhesive layers is provided with a window so that basically a central portion of the display unit is not glued to the corresponding housing element, such windowed adhesive layer may be provided on a top surface of the display unit to fix the display foil to the outer housing. In the alternative, such windowed adhesive layer may be provided on a bottom side of the display foil to connect the display foil to the inner housing.

[0028] Such adhesive layer having a window portion leaving open the display foil's area in which the display symbols are arranged, may consist of or include an opaque adhesive material. Use of such opaque adhesive material forming a window frame surrounding the display area of the display foil may prevent scattered light from illuminating other portions than the display area and thus, may improve visibility of the illuminated symbols.

[0029] According to a further aspect, the adhesive for glueing the display foil to the inner and/or outer housing may include an adhesive foam and/or be made from a foamy material. For example, a polyurethane (PU) or a

polyethylene (PE) foam may be used to fixedly attach the display unit to the inner housing or to the outer housing. Adhesive foam may be advantageous so as to compensate for tolerances in the distance of the inner surface of the outer housing from the outer surface of the inner housing and/or to compensate for movements of the inner and outer housings relative to each other which may occur, for example, due to bending of the housing and/or gripping the housing with excessive forces and/or for avoiding the generation of bubbles between two glue layers. Advantageously, the adhesive foam may be elastic and/or deformable to allow for such compensation. Moreover, such adhesive foam may easily compensate for uneven portions of the housings' surface and to provide for a smooth surface holding the display foil.

[0030] In particular, the aforementioned adhesive layer having a window leaving open the display foil's area in which the display symbols are provided, may be formed from such adhesive foam.

[0031] In order to avoid excessive forces onto the adhesive bonding of the display foil or even loosening or detaching the display foil from the inner and/or outer housing, it may be advantageous to provide for a multipiece structure of the outer housing. More particularly, the outer housing may be composed of a plurality of housing parts, wherein an outer housing display part to which the display foil is attached, may form a substantially plate-like insert received in a window of another outer housing part which helps in avoiding transmission of forces applied to said other housing part to said outer housing display part. In other words, the outer housing display part may form a window pane to be inserted into the window frame formed by said other housing part. More particularly, said outer housing display part forming the aforementioned insert may be inserted into the window of the other housing part from an inner side of the outer housing so that the outer housing display part may stick to the display foil even when the other housing part having said window is moved away from the display foil. More particularly, the other outer housing part having said window may, with an edge portion of the window, overlay the outer housing display part from an outside thereof.

[0032] So as to allow for easy manufacturing, but nevertheless receive precise alignment of the display symbols with the light sources received in the interior of the inner housing, the display foil may be provided with the display symbols after having been attached to the inner housing. More particularly, when manufacturing and/or assembling the personal care device, a plain display foil not yet having the display symbols may be glued onto the outer surface of the inner housing. After having attached the display foil onto the inner housing by means of glueing, a marking treatment may be applied to the display foil so as to generate the display symbols desired. More particularly, a laser treatment process may be used so as to provide the display foil attached to the inner housing with the desired symbols.

[0033] The display foil may include a laser-active layer.

For example, a transparent foil may be used having a laser-active layer becoming opaque when applying laser light thereon. In the alternative, the laser-active layer may be originally opaque, for example black, wherein the laser-active layer may be configured to become transparent in the portions subject to the laser beam. By activation by laser it is further possible to apply the laser process after the shaver is finally ready manufactured and just before packaging the shaver may be tailored to the specific shaver type by applying the type specific display foil activation process (if e.g. shaver types are merely different by the symbols shown on the laser display). By this process the inventors of finished goods is reduced.

[0034] Other treatment processes may be used to mark the display foil with the desired symbols, for example applying radiation onto the foil via a mask.

[0035] Provision of the display symbols after having attached the display foil to the inner housing is not only advantageous in terms of exact alignment irrespective of tolerances in positioning the foil onto the housing, but also allows for easy logistics avoiding storage of different display foils preconfigured for different models of the personal care device, thus reducing the number of different parts needed, and making delivery of the parts needed for assembling an embodiment just in time easier.

[0036] After having created the symbols on the display foil, the outer housing may be glued to the display foil. Thus, the manufacturing process may include the following three steps executed one after the other with optional other intermediate treatment steps therebetween: glueing a plain display foil onto the inner housing, marking the display foil with the symbols to be displayed and then glueing the outer housing onto the marked display foil. Said optional intermediate steps may include, for example, a heat application step for expediting hardening of the adhesive, or a cooling step after laser marking the display foil.

[0037] In order to help in illuminating a symbol of the display foil brightly and exactly without illumination of neighboring regions of the display foil, the inner housing may be formed to include transparent portions and opaque portions. More particularly, the inner housing may include a transparent portion aligned with and positioned below a display symbol of the display foil, and a non-transparent portion surrounding said transparent portion, said non-transparent portion may have a ring-shape and/or may form a shadowing fence preventing light going through the transparent portion from spreading into other portions neighboring the display symbol.

[0038] More particularly, the inner housing may be formed as a two-component or multiple-component part comprising portions of different materials. For example, the inner housing may be a molded plastic part made from two different plastic components one of which is transparent and another one is opaque.

[0039] When the display foil includes a plurality of display symbols which may be arranged in a regular pattern such as a matrix of symbols, the inner housing may have

a plurality of transparent portions aligned with the position of the display symbols, wherein each of said transparent housing portions may be surrounded, at least in part, by non-transparent housing portions. Said non-transparent housing portions separating the transparent housing portions from each other, may form a net-like or grid-like, opaque structure separating the transparent portions of the inner housing aligned with the display symbols from each other. For example, the transparent portions of the inner housing may be formed from a transparent hard-plastic material component, whereas the non-transparent, grid-like structure may be formed from an opaque soft-material plastic component.

[0040] In addition or in the alternative to such wall structure of the inner housing including transparent and non-transparent portions, a shadowing fence structure also may be provided between the inner surface of the inner housing and the light source. More particularly, such shadowing fence structure on the inner side of the inner housing may include at least one non-transparent sleeve surrounding the at least one light source and extending from the light source to the inner surface of the inner housing, wherein a longitudinal axis of such sleeve may extend substantially perpendicular to the inner housing and/or to the display foil and/or substantially parallel to the main axis of emission of the light source.

[0041] When there are a plurality of light sources associated with a plurality of display symbols, a plurality of such sleeve-like shadowing fences may be provided so as to form light pipes directing light from each light source to the display symbol associated therewith and to prevent such light from spreading towards another display symbol. Again, when the display symbols and the light sources associated therewith are arranged in a regular pattern such as a matrix of light sources, the sleeve-like shadowing fences may form a grid-like or net-like structure of opaque material having light channels formed by recesses in the material and going from a light source to the respective display symbol, more particularly the transparent portion of the inner housing associated with such display symbol.

[0042] The light sources may be arranged on a common circuit board for supplying electric energy to the light sources and/or controlling the light sources. The sleeve-like shadow fences forming light pipes may extend between such circuit board and the inner housing, wherein the shadowing fence structure may be attached to the circuit board and/or to the inner housing in a fixedly manner, for example by means of glueing or by means of press-fitting contact.

[0043] In order to compensate for an uneven surface of the aforementioned circuit board and/or of the inner housing surface, said shadowing fence structure may be formed by a foamy material allowing for full contact of the surface of the circuit board and/or the inner housing irrespective of uneven sections thereof. More particularly, the shadowing fence structure may be formed by a sponge material such as cellular rubber or sponge rubber

that may self-adapt its contour to the contact surface.

[0044] The inner housing may form a sealed, in particular water-proof container in which the motor and/or batteries or accumulators or other power sources and/or an electronic control unit for controlling the motor and the light sources of the display may be received and protected against liquids and moisture, wherein said container may have a barrel structure and being formed by an elongated pot or cup having a closed bottom and an open top side, wherein the motor, an electronic control unit and batteries may be completely received within such cup element of the inner housing which, at its open top side, may be closed by means of a cover element which may form the front face of the barrel-like container forming the inner housing.

[0045] Thus, the barrel-like container forming the inner housing may have a two-piece structure comprising only two pieces, i.e. the aforementioned cup element and the cover element. Such two-piece structure of the inner housing considerably reduces sealing efforts necessary to make the container waterproof. In particular, it may be sufficient to use only one ring-shaped seal to seal the interface between the cup element and the cover element, wherein such interface may have a circular configuration although other contours such as oval or elliptical contours would be possible.

[0046] Said cup element may include the transparent portion(s) aligned with the display foil.

[0047] The aforementioned cup-shaped base element may have an elongated configuration extending substantially over the entire length of the inner housing and may have a length corresponding to at least 80% or 90% of the inner housing and/or of the handle, whereas the cover element may have a length of smaller than 20% or smaller than 10% of the inner housing's length and/or the handle's length. Such cover element may have a disk-like or plate like configuration, wherein it may have a slightly dome-shaped or convex contour.

[0048] The connector for connection to the shaver head's support structure may be provided on the aforementioned cover element.

[0049] The cover element and the cup element of the inner housing may be rigidly connected to each other, wherein various known types of connection techniques such as form-fitting, screwing, welding, glueing and/or snap-fitting may be used.

[0050] So as to hold the light source arrangement of the display and/or the motor and/or the electronic control unit and/or the batteries in position within the inner housing, a support frame to which the aforementioned components are attached, may be inserted into the cup element and may be held there in place, wherein for example a slideable guide element such as a guiding groove and/or guiding projections may be provided. Such support frame may be formed by or include a circuit board bearing the light source(s) and/or forming part of the electronic control unit.

[0051] So as to help in sealing the inner housing, the

inner housing may have only one opening which may be an opening in the cover element through which the shaft protrudes. Optionally, there may be a second opening in an end portion opposite to the cover element which second opening may be provided for a charging connection. However, such second opening may be avoided by means of integrating the charging connectors into the inner housing, for example by means of molding charging pins to be an integral part of the inner housing.

[0052] So as to allow communication with the control unit inside the inner housing, the inner housing and/or outer housing may include a soft material portion allowing to be deformed so as to activate switches positioned inside the inner housing.

So as to allow access to the aforementioned soft material portion associated with switching means of the inner housing, the outer housing also may have soft material portions and/or a recess or opening through which the soft material portion of the inner housing can be deformed.

[0053] The outer housing may have a two-piece or three-piece or multiple-piece shell structure comprising a plurality of shell elements that can be connected with each other and cover different portions of the inner housing. In particular, the outer housing may comprise two shell elements extending on opposite sides of the inner housing and connectable to each other. Such shell elements may have a substantially - roughly speaking - flute-like or chute-like contour so that the two shell elements together may surround the inner housing substantially completely.

[0054] In addition to such shell elements, the outer housing may further include a ring element to be connected with at least one of the aforementioned shell elements. Such ring element may help in forming a rigid, strong outer housing structure, wherein such ring element may be positioned at an end portion of the housing facing the shaver head. More particularly, such ring element may surround the shaft and may have an inner diameter which is significantly smaller than the maximum diameter of the inner housing.

[0055] When considering the handle in its entirety, the handle may have an elongated shape the cross-section of which may substantially continuously increase from a bottom face of the handle to a top face of the handle opposite to said bottom face of the handle. In other words, the cross-section of the handle may continuously increase towards the shaver head. The cross-sectional shape may vary, wherein such cross-sectional shape may be substantially rounded and/or circular and/or elliptical and/or oval. "Substantially continuously" does not exclude some portions such as the display portion or an operating key portion where the cross-section does not increase. Nevertheless, when considering the larger proportions, the handle's cross-section may increase from a bottom end portion to a top end portion.

[0056] In addition, a drive transmitter may include a shaft or shaft-like elongated drive element extending

from the handle into the interior of the shaver head.

[0057] So as to transform the rotatory oscillation of such shaft as mentioned before into a linear oscillation of at least one cutter element, a crank arm may be attached to the shaft, wherein such crank arm may be positioned within the shaver head and/or may support at least one drive pin for driving the cutter element. For example, such drive pin may extend substantially parallel to the shaft and may be fixedly attached to the crank arm to extend eccentric with regard to the shaft axis. When the crank arm, in its neutral position, extends substantially perpendicular to the desired linear oscillation of the cutter element, such drive pin is moved along a curved path tangential to the desired cutter element oscillation and thus, executes a nearly linear oscillation.

[0058] These and other features become more apparent from the examples shown in the drawings. As can be seen from Fig. 1, shaver 1 may have a shaver housing 300 forming a handle 2 for holding the shaver, which handle may have different shapes such as - roughly speaking - a substantially cylindrical shape or box shape or bone shape allowing for ergonomically grabbing or holding the shaver, wherein such shaver handle 2 has a longitudinal axis 20 due to the elongated shape of the handle, cf. Fig. 1.

[0059] More particularly, the handle 2 may have a cross-sectional shape which is rounded or circular or oval or elliptical, wherein mixtures of those shapes are possible. Irrespective of the cross-sectional shape, the cross-section may continuously increase from one end of the handle to the other one thereof.

[0060] On one end of the handle 2, a shaver head 3 is attached to the handle 2, wherein the shaver head 3 may be slewably supported about a swiveling axis 7 and about a tilting axis 11 which swiveling and tilting axes 7 and 11 may extend substantially perpendicular to each other and perpendicular to the aforementioned longitudinal handle axis 20.

[0061] When considering an oblong main axis 40 of the shaver head 3, the swivel axis 7 may extend parallel to such main axis 40, whereas the tilting axis 11 may extend perpendicular to such main axis 40. Such main axis 40 may be considered to extend in parallel to the larger side surfaces of the shaver head 3 and/or in parallel with a longitudinal axis of the elongated cutter elements 4 and/or in parallel with a cutter oscillation axis 8 and/or substantially perpendicular to the longitudinal handle axis 20.

[0062] The shaver head 3 may include a pair of elongated cutter units 100 each comprising an elongated cutter element 4 that can be driven in a reciprocating manner along reciprocating axis 8 which may extend parallel to the aforementioned main axis 40. Said cutter elements 4 may cooperate with and reciprocate under shear foils 5 covering said cutter elements 4.

[0063] As can be seen from Figures 1 to 3, the shaver head 3 is supported onto the handle 2 by means of a support structure 30.

[0064] In addition to said support structure 30, an elongated drive transmitter may extend from the handle 2 into the shaver head 3 so as to connect the cutter element 4 to a motor 93 which may be accommodated in the interior of the handle 2. Such elongated drive transmitter 9 may include a shaft 90 which may be driven to rotate in a reciprocating manner, i.e. to rotate back and forth by a certain degree. A crank element may be rotatorily fixed to said shaft 90 and accommodated inside the shaver head 3. Such crank element may rigidly support a drive pin for each of said cutter elements 4. Said crank element, in a neutral position of the shaft 90 may extend transverse to the longitudinal axis of the elongated cutter element 4 so that the drive pin moves back and forth along the longitudinal axis of the cutter element 4. More particularly, such drive pin executes a movement along a segment of a circle. However, as the rotational oscillation has a limited amplitude and the circular segment is tangential to the longitudinal axis of the cutter element 4, such movement may be considered to approximate a linear movement along the cutter element's longitudinal axis.

[0065] As can be seen from Fig. 3, the housing 300 forming the handle 2 may have a two-shell structure comprising an inner housing 301 and an outer housing 302 (including parts 305, 304, 302d) surrounding said inner housing 301.

[0066] The inner housing 301 accommodates the aforementioned motor 93 and furthermore, an electrical storage such as batteries or an accumulator, and an electronic control unit, cf. Fig. 3, wherein the inner housing 301 may form a water-tight container protecting such components from liquids and moisture.

[0067] More particularly, the inner housing 301 may have an elongated barrel-like structure including a cup-shaped or pot-like base element 306 having a closed bottom and an open top face, wherein such base element may extend substantially over the entire length of the handle 2, cf. Fig. 2 and 3.

[0068] The base element 306 is closed, at its open top side, by a cover element 307 which may have a plate-like or slightly dome-like shape and, when closing the base element 306, forms a front face side of the inner housing 301 facing the shaver head 3.

[0069] The aforementioned cover element 307 includes an opening through which the shaft 90 penetrates the housing, wherein the cover element 307 is sealed, by means of appropriate seals, against said shaft 90 and against the cover element 307 so that the inner housing 301 forms a waterproof container.

[0070] As can be seen from Fig. 3, charging connections such as charging pins 310 may protrude from the bottom side of the cover element 307 so as to allow charging of the batteries inside the inner housing 301.

[0071] The inner housing 301 may include at least one soft material portion 309 which can be associated with an electronic switching means inside the inner housing 301.

[0072] As can be seen from Fig. 3, the outer housing

302 may have a shell structure including a pair of elongated shell elements 304 and 305 which together may surround the inner housing 301 substantially entirely. The shell elements 304 and 305 may extend substantially over the entire length of the inner housing 301 and/or the handle 2.

[0073] Said shell elements 304 and 305 may be positioned on opposite sides of the inner housing 301 and may be connected to each other so that they together form the gripping surface of the substantially cone-shaped or cylindrical handle 2.

[0074] In addition, the outer housing 302 may include a ring element 303 forming, at least in part, a top side surface of the outer housing 302 facing the shaver head 3, wherein said ring element 303 may have an inner diameter substantially smaller than the maximum outer diameter of the inner housing 301. Said ring element 303 is connected to at least one of the shell elements 304 and 305 and may cover a ring-shaped portion of the cover element 307 of the inner housing 301.

[0075] Furthermore, there is a display 500 for displaying various information useful to a user of the device, wherein such display 500 may be arranged at the housing 300 forming the handle 2. Such display 500 may include a plurality of display symbols 501a-n to indicate such information such as a loading status of the device's battery, a cleaning status, last shaving time or other information as mentioned before.

[0076] Said display 500 includes a display foil 502 which may include transparent and non-transparent portions forming said symbols or portions of different colors forming such symbols 501a-n, wherein a light source 503 such as an LED may emit light to illuminate the symbols of the display foil 502.

[0077] As can be seen from Figures 3 to 9, said display foil 502 may be positioned between the inner housing 301 and the outer housing 302, wherein said inner and outer housings 301, 302 may include transparent portions allowing light emitted from the light source 503, which may be accommodated inside the inner housing 301, to be transmitted through the inner housing 301, the display foil 502 and the outer housing 302.

[0078] More particularly, the outer housing 302 may include a transparent outer housing display part 302d which may be a part of the aforementioned shell structure and one of the shell elements thereof. Said outer housing display part 302d may have a size comparable to the size of the display foil 502 and/or may cover substantially the entire display foil 502.

[0079] As can be seen from Figure 3, said outer housing display part 302d may form an insert that can be inserted into a window portion of a further outer housing part that can be formed by one of the aforementioned shell elements 304. Advantageously, the shell element 304, with the edge of its window portion forming a sort of window frame, may overlay the outside of said outer housing display part 302 at an edge portion thereof. In other words, the outer housing display part 302d can be

inserted into the window portion of shell element 304 from an interior side thereof. Thus, forces urging the outer housing 302 away from display foil 502 are not transmitted to the outer housing display part 302d and/or may not damage the bonding of the display foil 502 to the inner and outer housings as it will be described later.

[0080] The inner housing 301 also may have a transparent inner housing display part 301d which may form an integral part of the aforementioned base element or cup element 306. More particularly, the inner housing 301 may have a plurality of transparent portions in the region facing the display foil 502. Such plurality of transparent portions 301d may be aligned with the display symbols 501a-n so that the respective display symbol is positioned directly on the top surface of a corresponding transparent portion 301d in the center thereof.

[0081] Corresponding to a matrix-like pattern of the display symbols 501a-n, said transparent portions 301d of the inner housing 301 also may be arranged in a matrix-like pattern.

[0082] To avoid light scattering to different display symbols, said transparent portions 301d of the inner housing 301 may be separated from each other by non-transparent, opaque inner housing portions 301o. When the transparent display portions 301d are arranged in a matrix-like pattern, the opaque housing portions 301o may form a grid-like or net-like structure forming a shadowing fence structure.

[0083] The inner housing 301 may be formed as a two-components or multiple-components molded plastic part, wherein, for example, the transparent inner housing display portions 301d may be formed from a transparent hard plastic, whereas the grid-like shadowing fence structure formed by the aforementioned opaque housing portions 301o may be formed from an opaque soft plastic material.

[0084] As can be seen from Figures 4 to 9, the light sources 503, which also may be arranged in a matrix-like pattern corresponding to the pattern of the display symbols 501a-n, can be supported on a circuit board 504 which may include electric lines for supplying electric power to the light sources 503 and electronic circuit components for controlling said light sources 503.

[0085] As can be seen from Figure 3, said circuit board 504 including the light sources 503 may be preassembled with the motor 93 and the battery compartment to form a preassembled mounting structure that can be inserted into the inner housing 301.

[0086] So as to avoid light scattering and spreading in the area between the circuit board 504 and the inner housing 301, a light shadowing fence structure 505 may be provided between the circuit board 504 and the inner surface of the inner housing 301. Such fence structure 505 may include a sleeve for each light source 503, which sleeve surrounds the associated light source 503 and may extend from the circuit board 504 to the inner surface of the inner housing 301. When there are a plurality of light sources 503, a plurality of sleeve-like shadowing

fences may be provided as fence structure 505 which fence structure 505 may have a matrix-like or grid-like or net-like structure providing for a plurality of light pipes or light channels each going from a light source 503 to an associated display symbol 501a-n.

[0087] Such inner shadowing fence structure 505 may be made from an elastic and/or spongy material such as rubber sponge and may be in full contact with the surfaces of the circuit board 504 and the inner housing 301. For example, the fence structure 505 may be fixedly attached by means of, for example, glueing or press-fitting contact, to the circuit board 504 and/or to the inner housing 301.

[0088] As can be seen from Figures 5 to 9, the aforementioned display foil 502 is glued to the outer surface of the inner housing 301 as well as to the inner surface of the outer housing 302 by means of an adhesive layer 506 and 507 on each side of the display foil 502. 520 in Fig. 5 to 9 refers to the black laser active layer and 521 refers to the white PET basis foil.

[0089] Advantageously, at least on one side of the display foil 502, a continuous adhesive layer 506, 507 is provided to fully cover the display foil 502, wherein such continuous adhesive layer may be made from a transparent adhesive to allow light going therethrough. By means of such continuous, full-size transparent adhesive layer, the display foil 502 or at least a major portion thereof is in full contact with the corresponding inner or outer housing surface, thereby preventing the display foil 502 from corrugating or wrinkling or other undesired deformations.

[0090] As can be seen from Figure 5, such full-size adhesive layer 506 and 507 can be provided on both, opposite sides of the display foil 502.

[0091] In the alternative, only one side of the display foil 502 may be provided with such continuous full-size transparent adhesive layer, whereas the opposite side of the display foil 502 may be glued to the corresponding housing part by means of a frame-like adhesive layer having a window leaving open the central portion of the display foil 502. The advantage of such window is per one side to minimize or avoid the generation of bubbles because the glue layer is not properly fixed on the housing, per other side improve the light transmission.

[0092] As can be seen from Figure 6, the bottom side of the display foil 502 may be glued to the inner housing 301 by means of a transparent adhesive layer 506 fully covering the display foil 502, whereas the top side of the display foil 502 can be glued to the outer housing 302 by means of a frame-like adhesive layer 507 having a central window 507w leaving open the central portion of the display foil 502.

[0093] In the alternative, as shown by Figure 7, the bottom side of the display foil 301 by means of said frame-like adhesive layer 506 having a central window 506w, whereas the top side of the display foil 502 may be glued to the outer housing 302 by means of a continuous full-size adhesive layer 507 fully covering the display foil 502.

[0094] Said frame-like adhesive layer having a central window may be formed from a non-transparent, opaque adhesive.

[0095] As can be seen from Figures 8 and 9, such frame-like adhesive layer having a central window also may be formed from an adhesive foam such as a PU foam or a PE foam so as to compensate for tolerances in the distance of the display foil 502 to the inner housing 301 or the outer housing 302. Such adhesive foam layer may have a multi-layered structure, wherein the foaming material may form a central or inner layer with sticky, adhesive layers provided on opposite sides and forming the surfaces of the adhesive foam layer, cf. Figures 8 and 9.

[0096] As can be seen from Figures 8 and 9, the adhesive foam layer may be provided on the top side of the display foil 502 to glue it to the outer housing 302, or may be provided on the bottom side of the display foil 502 to glue it to the inner housing 301. The other side of the display foil 502 of these two examples of Figures 8 and 9 may be glued to the other housing part by means of a continuous, substantially full-size transparent adhesive layer.

[0097] As illustrated by Figures 5 to 9, the display foil 502 may include a laser-active layer allowing the display symbols 501a-n to be created in a laser treatment step, wherein laser light is applied to the display foil 502.

[0098] Advantageously, such laser treatment can be made, after the display foil 502 has been glued to the inner housing 301. After having applied the laser markings onto the display foil 502 to form the display symbols 501, the outer housing 302, more particularly the outer housing display part 302d may be glued onto the top surface of the display foil 502. As mentioned above alternatively the laser treatment may be applied at the end of the shaver assembly process.

[0099] In a further manufacturing step, the other shell elements 304 and 305 of the outer housing 302 may be assembled to form the outer housing 302.

[0100] As can be seen from Figures 2 and 3, the pre-assembled electronic core of the shaver including the circuit board 504 with the light sources 503 supported thereon and optionally the motor 93 and the battery compartment may be inserted into the inner housing 301 before glueing the display foil 502 onto the outer surface of the inner housing 301, wherein the inner housing 301 may be completely closed and/or sealed before glueing the display foil 502 onto the inner housing 301. In the alternative, the display foil 502 may be glued onto the inner housing 301 and/or the laser markings thereof may be effected, before said electronic core including the circuit board 504 is inserted into the inner housing 301.

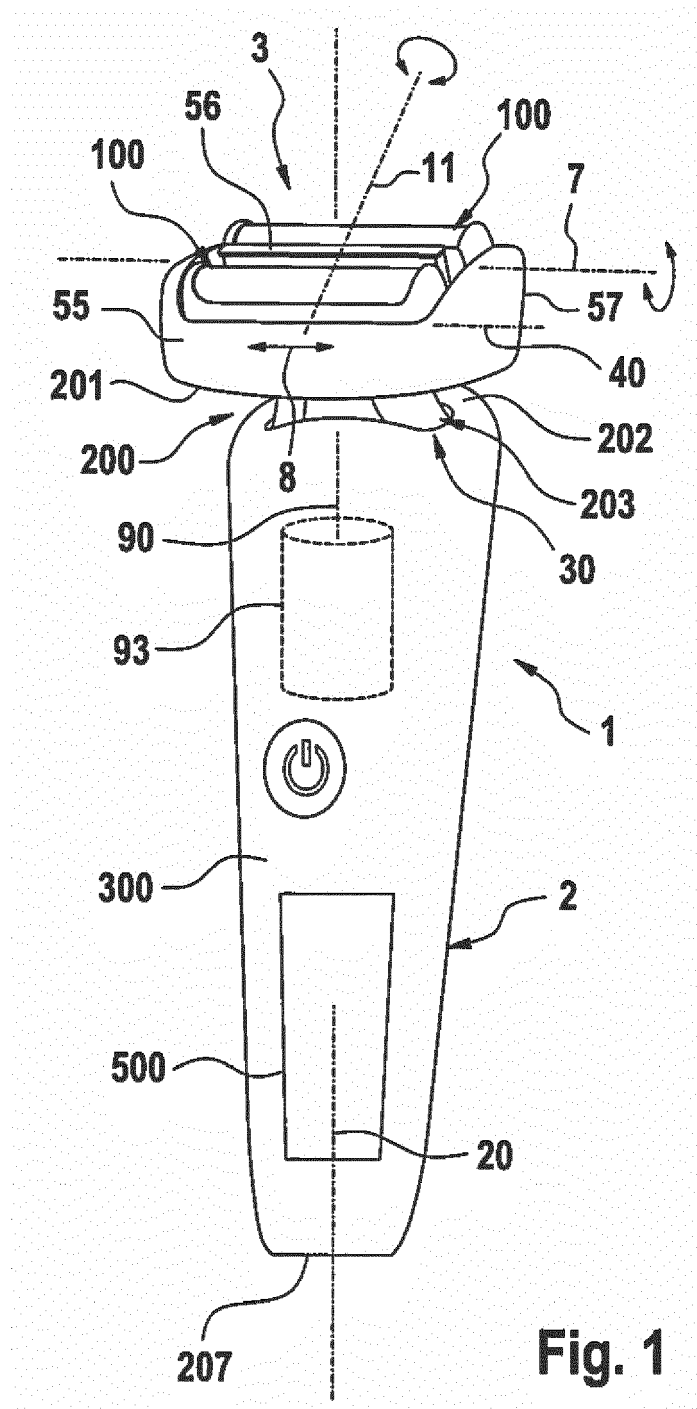
[0101] The dimensions and values disclosed herein are not to be understood as being strictly limited to the exact numerical values recited. Instead, unless otherwise specified, each such dimension is intended to mean both the recited value and a functionally equivalent range surrounding that value. For example, a dimension dis-

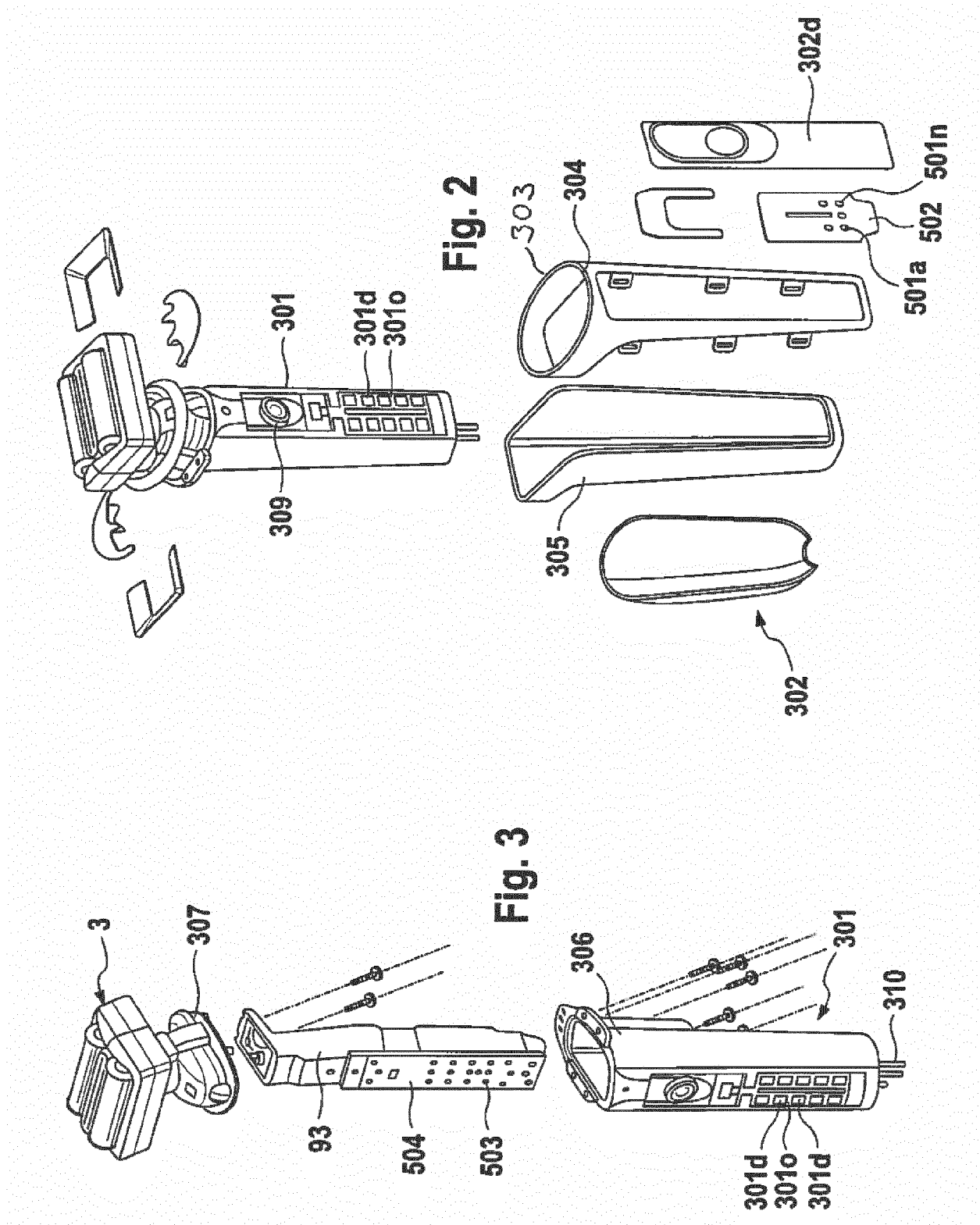
closed as "40 mm" is intended to mean "about 40 mm."

Claims

1. A personal care device, in particular an electric shaver, comprising a housing (300) with a working head (3) attached thereto, said housing (300) including an inner housing (301) and an outer housing (302), and a display (500) including a light source (503) accommodated in the inner housing (301) to emit light through transparent portions (301d, 302d) of said inner and outer housing (301, 302), said display (500) further including a display foil (502) having portions of different transparency and/or different colors forming display symbols (501), said display foil (502) being sandwiched between said transparent portions of the inner and outer housings (301, 302), **characterized in that** said display foil (502) is glued to both the inner and outer housings (301, 302) by means of an adhesive (508) on each of opposite sides of the display foil (502).
2. Personal care device according to the preceding claim, wherein said adhesive (508) forms at least a closed sealing loop surrounding the display symbols (501) on each of said opposite sides to seal the display foil (502) against the inner and outer housings (301, 302) to prevent liquid or moisture from contacting the display foil (502) inside said adhesive sealing loop.
3. Personal care device according to any one of the preceding claims, wherein on one side of said display foil (502), said adhesive (508) forms a transparent adhesive layer (506, 507) covering at least a major portion of the display foil (502) including the display symbols (501) thereof, whereas on the opposite other side of said display foil (502), the adhesive (508) forms an adhesive layer (506, 507) having a window (506w, 507w) leaving open the display symbols (501) and/or a central portion of said display foil (502).
4. Personal care device according to any one of the preceding claims, wherein the adhesive (508) on both sides of the display foil (502) is a transparent adhesive.
5. Personal care device according to claim 3, wherein the adhesive layer (506, 507) having said window (506w, 507w) is made from a non-transparent adhesive.
6. Personal care device according to the preamble of claim 1 or any one of the preceding claims, wherein at least one side of said display foil (502) is glued to the housing (300) by means of an adhesive foam.

7. Personal care device according to the preceding claim in combination with claim 3, wherein the adhesive layer (506, 507) having the window (506w, 507w) includes an adhesive foam layer and/or an adhesive polyurethane foam layer and/or adhesive polyethylene foam layer and/or having provided the window in the inner housing side. 5
8. Personal care device according to any one of the preceding claims, wherein the outer housing (302) is composed of a plurality of housing parts, wherein an outer housing display part (302) to which the display foil (502) is glued, forms a substantially plate-like, transparent insert received in a window frame portion of another housing part (304) of the outer housing (302). 10 15
9. Personal care device according to the preceding claim, wherein said further outer housing part (304), with an edge portion of its window, overlays an outer surface of said outer housing display part (302d) at an edge portion thereof. 20
10. Personal care device according to the preamble of claim 1 or any one of the preceding claims, wherein the inner housing (301) is a multiple component plastic mold part made from a transparent hard plastic material component forming the at least one transparent inner housing display portion (301d) aligned with the display foil (502) and an opaque soft or hard plastic material portion (301o) surrounding said inner housing display portion (301d). 25 30
11. Personal care device according to any one of the preceding claims, wherein the inner housing (301) includes a grid-like shadowing fence structure made of opaque material (301o), said shadowing fence structure separating a plurality of transparent housing portions (301d) aligned with the display symbols (501) of the display foil (502) from each other, said shadowing fence structure preventing light to be transmitted through one of said plurality of transparent housing portions (301d) to one of the display symbols (501) from spreading and scattering towards one of the other display symbols (501). 35 40 45
12. Personal care device according to any one of the preceding claims, wherein said at least one light source (503) is surrounded by a sleeve-like light pipe (509) extending from said light source (503) to the inner surface of the inner housing (301), said light pipe (509) having a substantially straight longitudinal axis substantially parallel to the main emission direction of the light source (503) and substantially perpendicular to the display foil (502). 50 55
13. Personal care device according to the preceding claim, wherein said light pipe (509) is made from a sponge material or from rubber sponge and is contacting the inner surface of the inner housing (301) as well as a surface of a circuit board (504) supporting said at least one light source (503).
14. Personal care device according to one of the two preceding claims, wherein a plurality of light sources (503) are arranged in a pattern corresponding to a pattern of the display symbols (501), wherein a plurality of light pipes (509) is provided to restrict light emitted by each of said plurality of light sources (503) to one of said plurality of display symbols (501), wherein said plurality of light pipes (509) is formed by a grid-like fence structure made of opaque material.
15. Method of manufacturing a personal care device according to any one of the preceding claims, comprising the following steps:
- fixedly attaching a plain display foil (502) to the inner housing (301),
 - after having attached said plain display foil (502), marking said display foil (502) with display symbols (501) by means of marking treatment.
16. Method according to claim 15, wherein said marking treatment includes applying a laser beam onto said display foil (502).
17. Method according to claim 15 or 16, wherein said marking treatment is applied after assembly of the shaver housing with all display parts mounted thereon and/or a laser beam activation of the display foil is applied through both the outer and the inner housing.





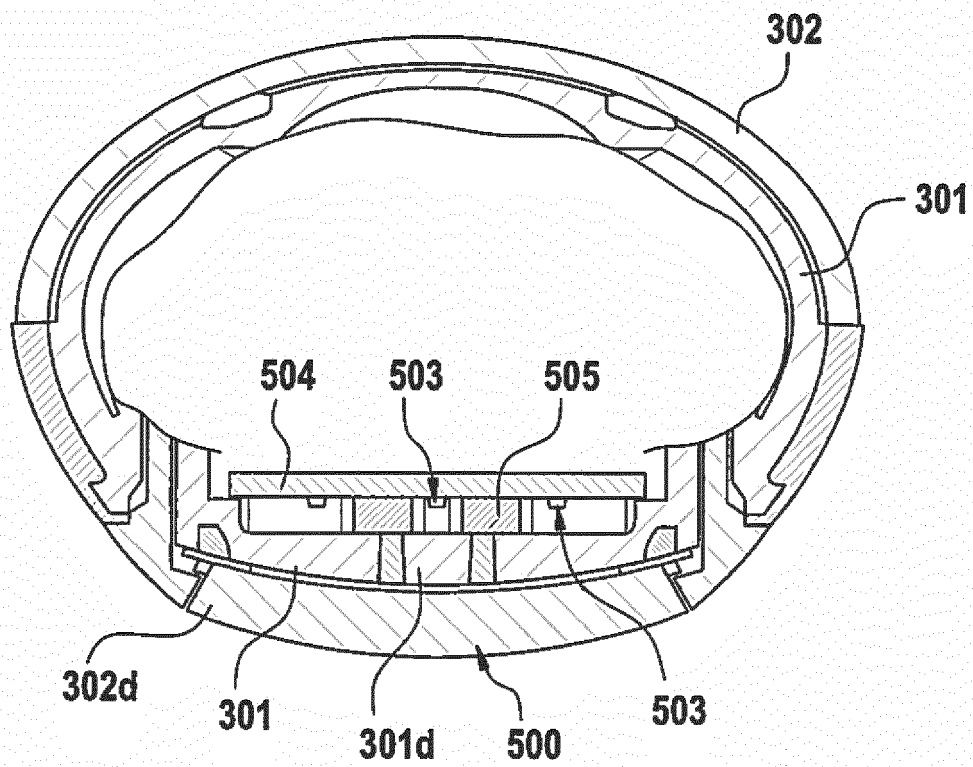


Fig. 4

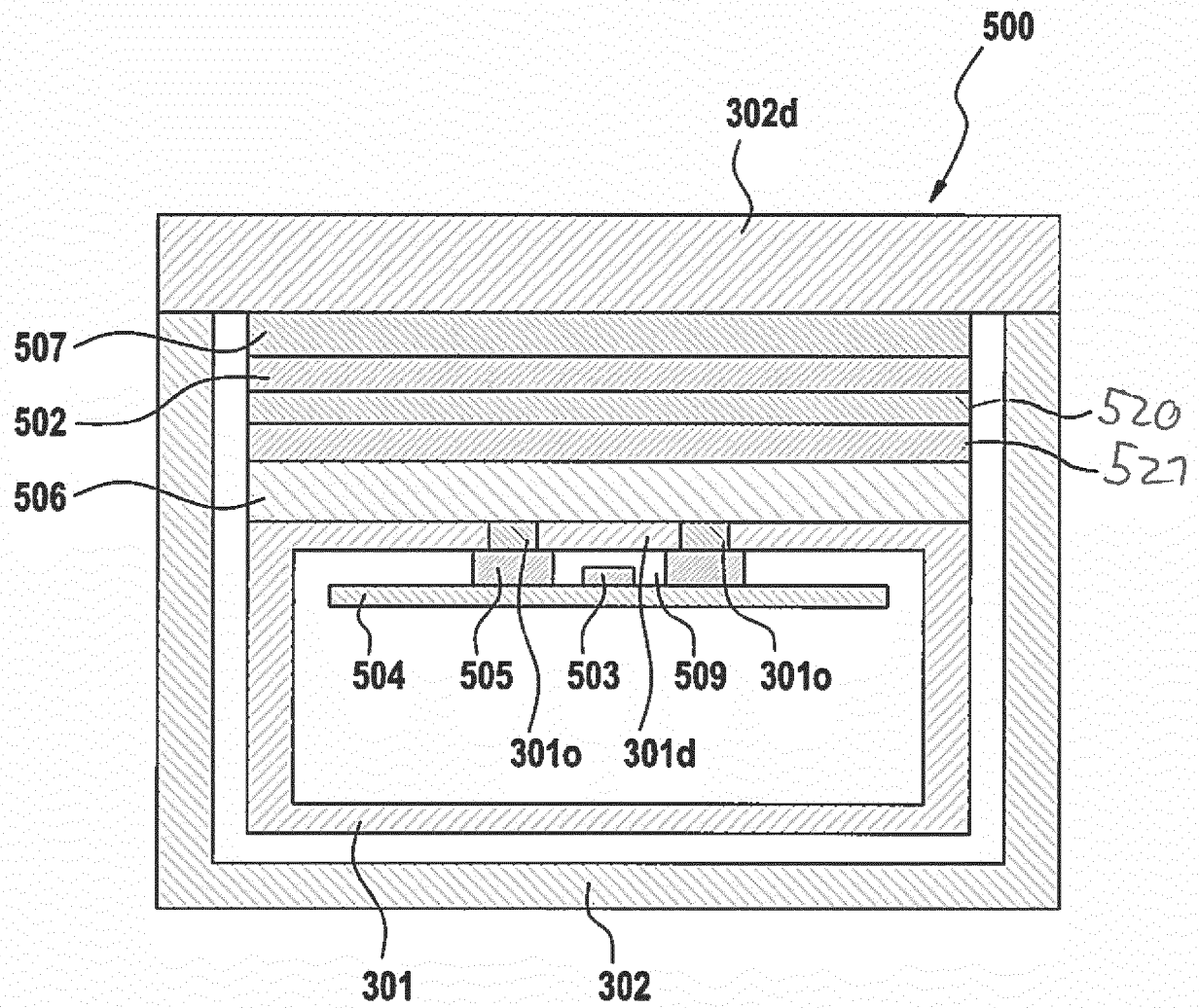
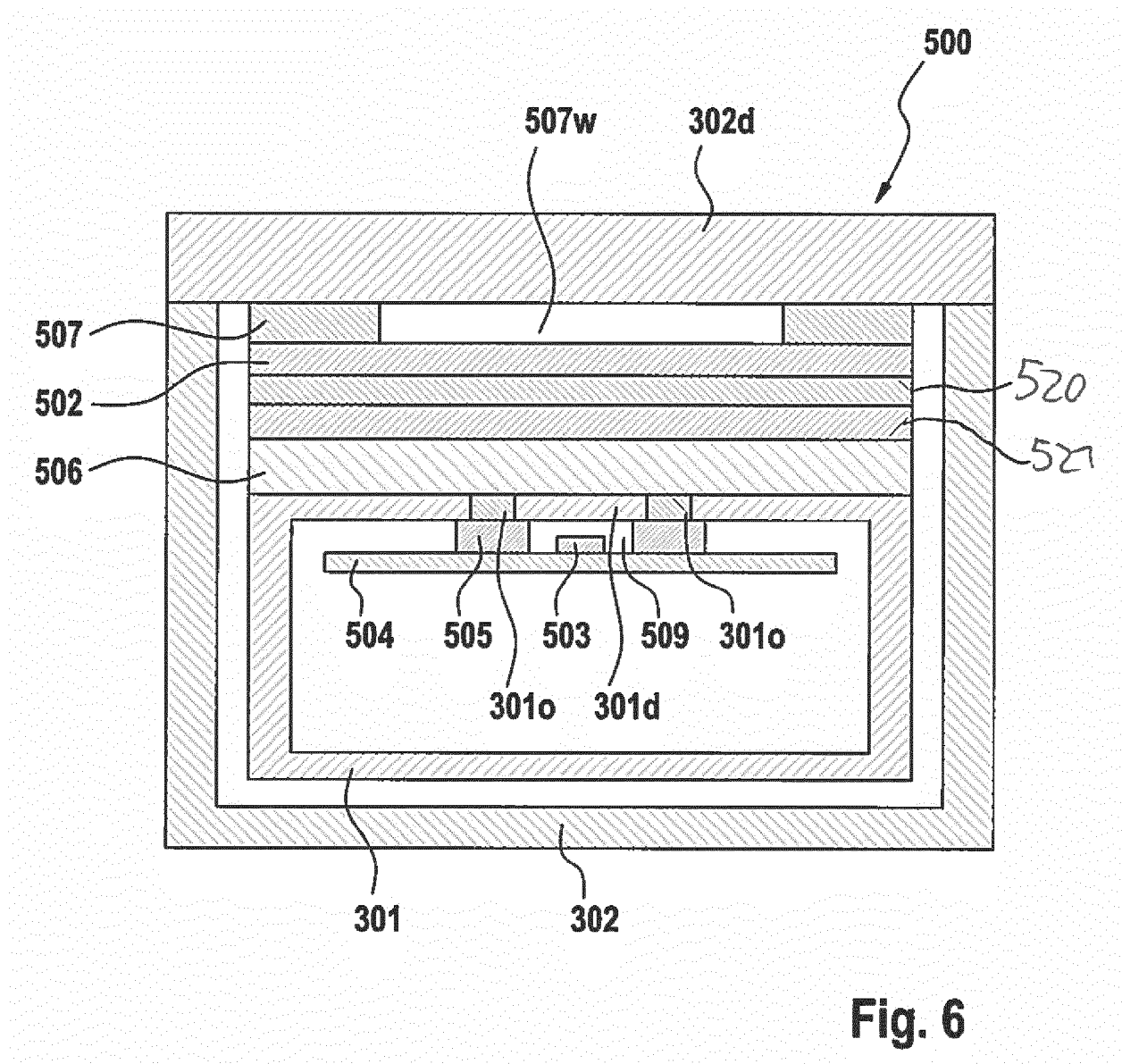


Fig. 5



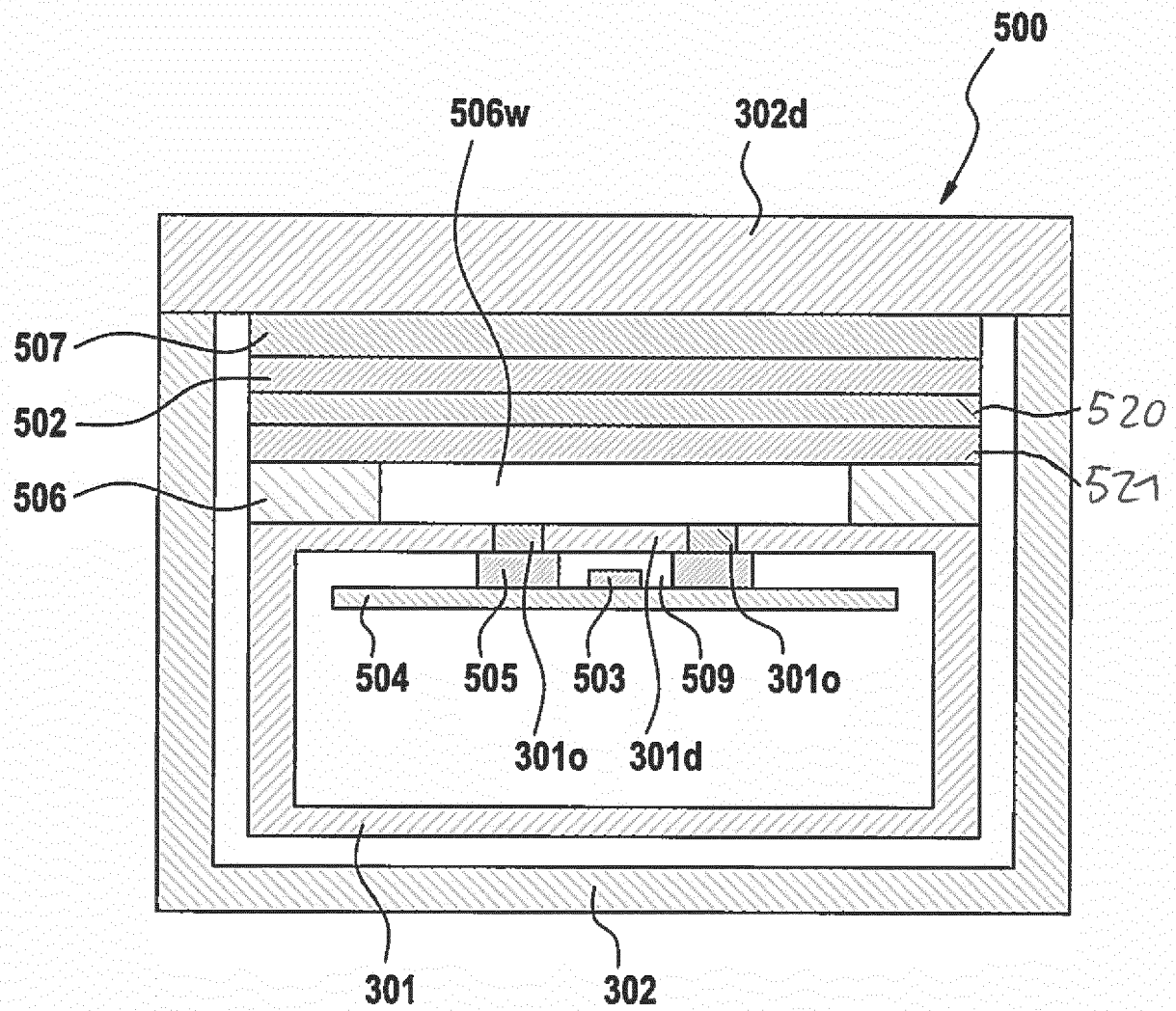


Fig. 7

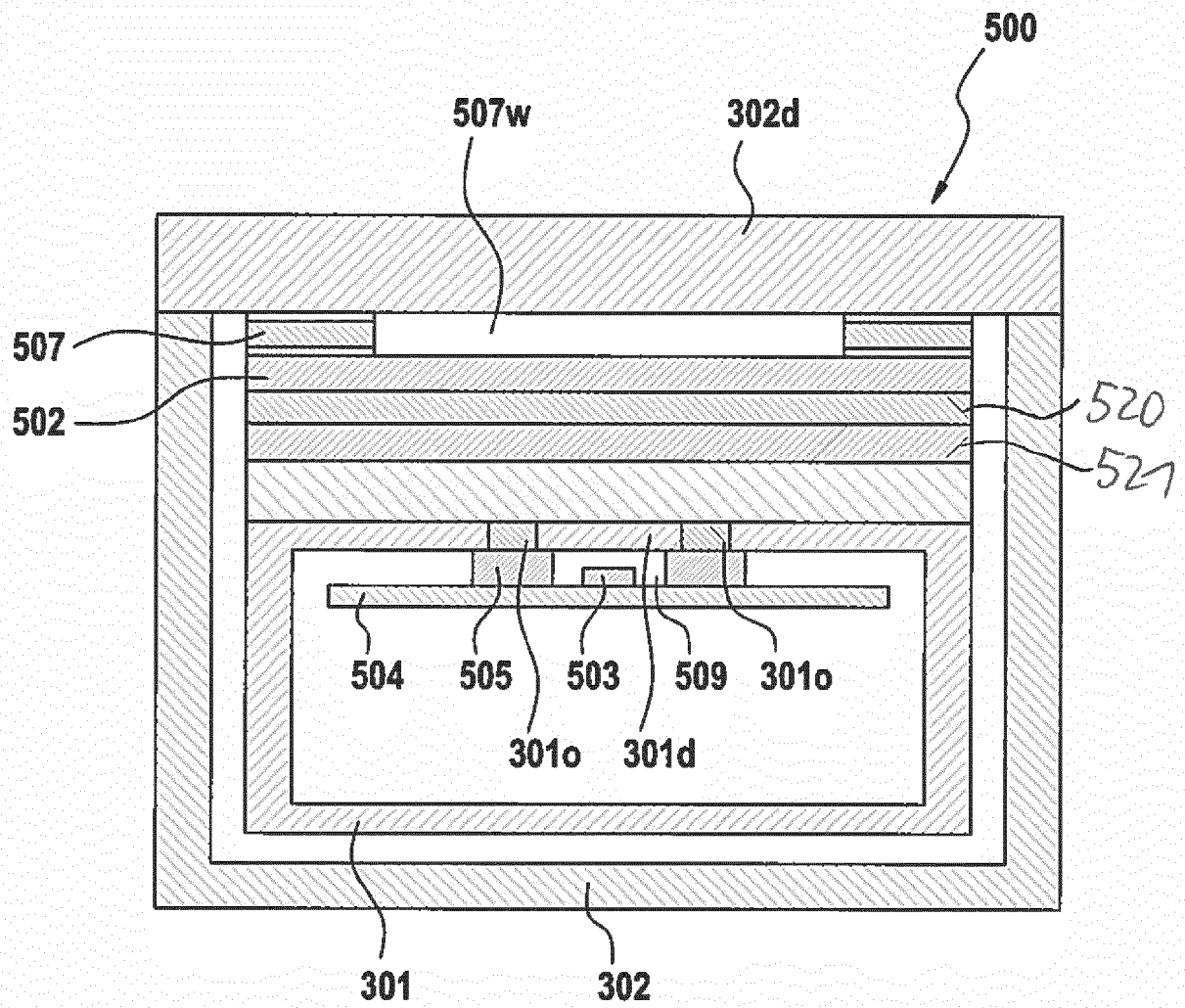


Fig. 8

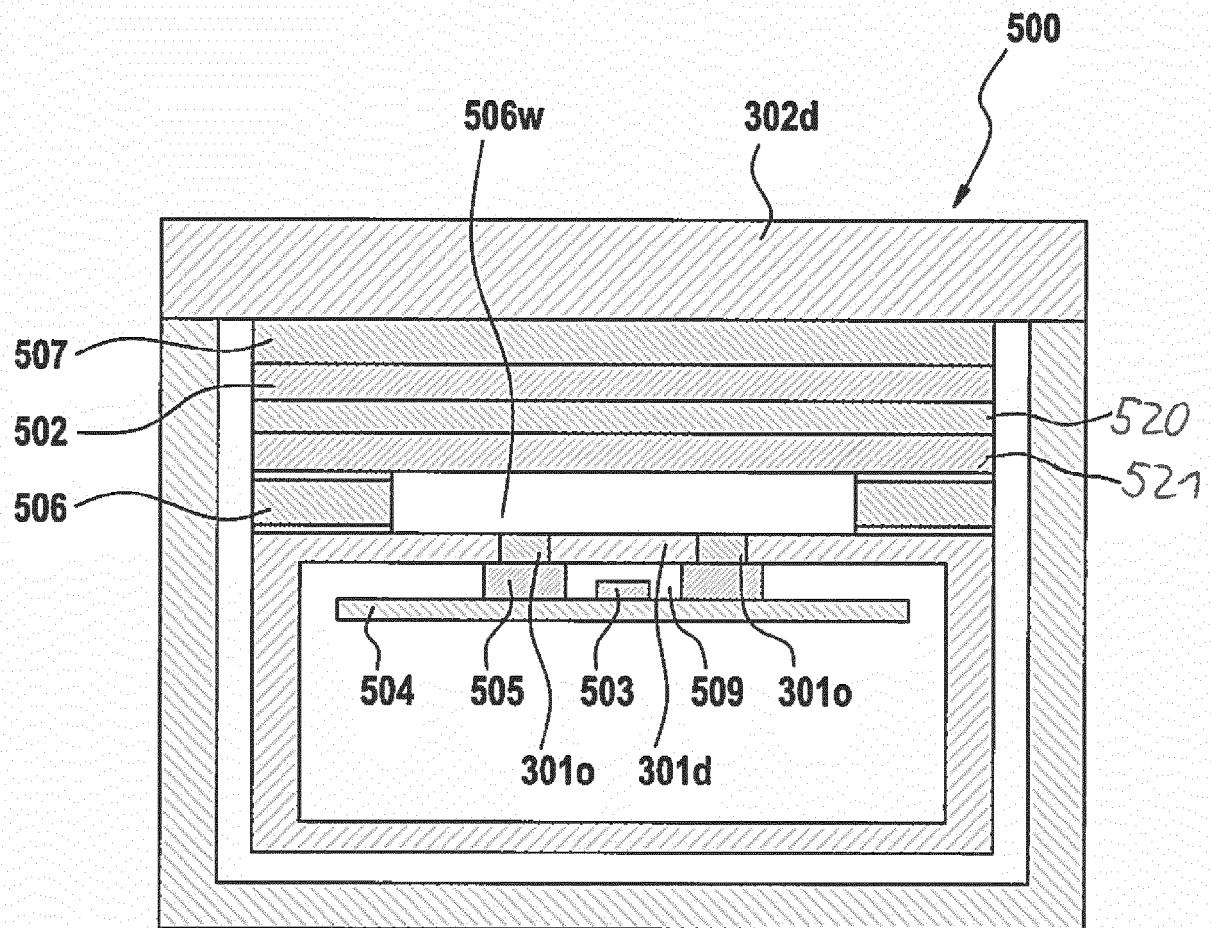


Fig. 9



EUROPEAN SEARCH REPORT

Application Number
EP 18 16 4823

5

10

15

20

25

30

35

40

45

50

55

1

EPO FORM 1503 03.82 (P04C01)

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	WO 2005/051615 A1 (KONINKL PHILIPS ELECTRONICS NV [NL]; BARON SINT [NL]; KRIKKEN PIETER N) 9 June 2005 (2005-06-09) * page 3, line 5 - page 6, line 27; figures 1-9 *	1-17	INV. B26B19/38
A	WO 03/056971 A1 (AMERICAN DESIGN GROUP [US]; RUBEN DAVID A [US]) 17 July 2003 (2003-07-17) * paragraph [0014] - paragraph [0038]; figures 1-9 *	1-17	
A	EP 1 045 754 A1 (KONINKL PHILIPS ELECTRONICS NV [NL]) 25 October 2000 (2000-10-25) * paragraph [0012] - paragraph [0016]; figures 1-4 *	1-17	
A	EP 3 215 322 A1 (KONINKLIJKE PHILIPS NV [NL]) 13 September 2017 (2017-09-13) * paragraph [0031] - paragraph [0051]; figures 1-5 *	1-17	TECHNICAL FIELDS SEARCHED (IPC)
A	EP 3 166 760 A1 (KONINKLIJKE PHILIPS NV [NL]) 17 May 2017 (2017-05-17) * paragraph [0038] - paragraph [0056]; figures 1-8 *	1-17	B26B
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 4 October 2018	Examiner Klintebäck, Daniel
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 18 16 4823

5

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

04-10-2018

10

15

20

25

30

35

40

45

50

55

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
WO 2005051615	A1	09-06-2005	AT 387292 T	15-03-2008
			CN 1886238 A	27-12-2006
			DE 602004012153 T2	19-02-2009
			EP 1697093 A1	06-09-2006
			JP 2007514469 A	07-06-2007
			US 2007107230 A1	17-05-2007
			WO 2005051615 A1	09-06-2005

WO 03056971	A1	17-07-2003	AU 2003209161 A1	24-07-2003
			US 2005011533 A1	20-01-2005
			WO 03056971 A1	17-07-2003

EP 1045754	A1	25-10-2000	CN 1287529 A	14-03-2001
			DE 69905693 D1	10-04-2003
			DE 69905693 T2	18-12-2003
			EP 1045754 A1	25-10-2000
			JP 2002528202 A	03-09-2002
			US 6305083 B1	23-10-2001
			WO 0024565 A1	04-05-2000

EP 3215322	A1	13-09-2017	BR 112017009181 A2	30-01-2018
			CN 107107352 A	29-08-2017
			EP 3215322 A1	13-09-2017
			JP 6222793 B2	01-11-2017
			JP 2017532155 A	02-11-2017
			US 2017341245 A1	30-11-2017
			WO 2016071144 A1	12-05-2016

EP 3166760	A1	17-05-2017	BR 112017000133 A2	09-01-2018
			CN 105269603 A	27-01-2016
			CN 204976697 U	20-01-2016
			EP 3166760 A1	17-05-2017
			JP 6298574 B2	20-03-2018
			JP 2017519594 A	20-07-2017
			RU 2662759 C1	30-07-2018
			US 2017129113 A1	11-05-2017
			WO 2016005142 A1	14-01-2016

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- US 20090025229 A1 [0010]
- US 7841090 B2 [0010]
- US 3748371 B [0011]
- FR 1391957 A [0011]
- GB 811207 B [0011]
- US 5704126 B [0011]