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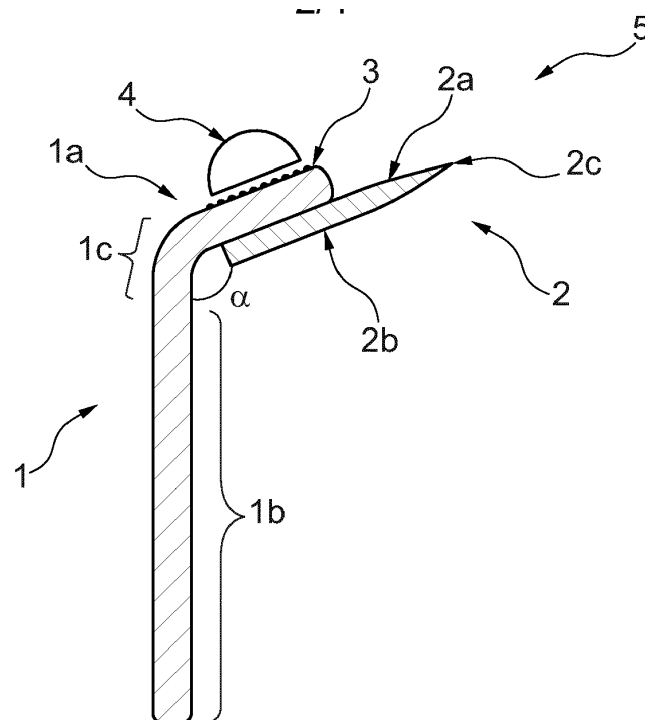
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(54) BLADE ASSEMBLY WITH LASER MARKED AREA

(57) The present disclosure relates to a blade assembly (5) comprising at least one blade support (1), the at least one blade support (1) having a flat portion (1a) and a base portion (1b), the flat portion (1a) of the at least one blade support (1) comprising an upper surface (1a') and a lower surface (1a''); at least one blade (2) having a cutting edge portion, the blade (2) being in contact with

the flat portion (1a) of the at least one blade support (1); a laser marked area (3) on the at least one blade (2) and/or on the at least one blade support (1); and a protruding element (4) attached to the laser marked area (3), wherein the protruding element (4) comprises a water-insoluble component. The present disclosure further relates to a razor cartridge, a razor and a kit of parts.

**Fig. 3**

Description

Technical Field:

[0001] The following disclosure relates to a blade assembly comprising a blade, a blade support in contact with the blade, a laser marked area on the blade and/or on the blade support; and a protruding element attached to the laser marked area.

Technical Background

[0002] Razors (shaving devices or shavers) generally comprise a head unit having one or more blades retained therein, each of the one or more blades comprising a cutting edge. The one or more blades are aligned in parallel when retained in the razor head. In order to obtain an improved shaving performance, the cutting edges of the blades are usually located very close to one another. The distance between the parallel cutting edges of adjacent blades is commonly known as the inter-blade span (IBS). Said span can control the degree to which skin will bulge between the cutting members. A smaller inter-blade span decreases the space for the flow of water and shaving debris through the cutting members (rinsability). A large inter-blade span (IBS) can improve rinsability, but also increases skin bulging between adjacent cutting members, which in turn causes undesirable skin irritation nicks, and/or cuts. There have been prior attempts to correct problems associated with decreasing undesirable skin irritations and improved rinsability during shaving, including:

- metallic spacers formed above the surface of the blade, defining a skin engaging cap portion;
- metallic guard elements deposited on the blade body or over the blade edge;
- ink objects, printed on the razor blade, which act as skin guards. The ink objects form a continuous strip in a cone-like shape or spaced apart segments extending along the length of the visible surface of the blade.
- non-cutting elements disposed anywhere between the guard and the cap, thereby forming rinse-through gaps before and after the non-cutting elements.

[0003] A solution proposed to overcome the above issue consists in placing skin guard elements (or protruding elements) on the razor blades so as to maintain a good rinsability and improve skin stretching to prevent skin bulging. In addition, in case said skin guard element comprises a water-soluble component, it can also help hydrate and protect the skin of the user during shaving, while providing glide and comfort.

[0004] However, as blades and blade supports are made of stainless steel, it is challenging to bind the skin guard element to the stainless steel material. In particular it is difficult to bind a skin guard element in a strong and/or

5 durable manner during the full life-time of the razor. Indeed, such material (stainless steel) provides poor chemical interaction (bonding) with many adhesive types, which make the adhesion of the stainless steel with the skin guard element very difficult.

[0005] In addition, it is important for the skin guard element to remain attached to the razor blade for the entire use life of the razor. Adhesion promoters (such as primers and conversion coatings) have been used to promote the adhesion of skin guard elements on stainless steel. Nevertheless, such option requires a separate coating process (to coat the stainless steel material with the adhesion promoter) which increases the costs and the complexity of the process.

10 [0006] Document WO 2018/118560 A1 relates to razor blades comprising laser produced markings to illustrate a visual effect such as text, design and/or graphics on the blades.

[0007] Therefore, there is still a need for providing a durable razor having improved shaving performance in terms of comfort and safety while maintaining a good rinsability, that is produced in a simple and cost-effective manner.

Summary of the Invention:

[0008] It is a first object of the present disclosure to provide a blade assembly comprising:

- at least one blade support, the at least one blade support having a flat portion and a base portion, the flat portion of the at least one blade support comprising an upper surface and a lower surface;
- at least one blade having a cutting edge portion, the blade being in contact with the flat portion of the at least one blade support;
- a laser marked area on the at least one blade and/or on the at least one blade support; and
- a protruding element attached to the laser marked area, wherein the protruding element comprises a water-insoluble component.

[0009] According to some embodiments, the blade is attached to the lower surface of the flat portion of the blade support.

[0010] According to some embodiments, the laser marked area is located on the at least one blade support, more specifically on at least part of the flat portion of the at least one blade support, and in particular on at least part of the upper surface of the flat portion of at least one blade support.

[0011] According to some embodiments, the protruding element is located on the blade support, more specifically on at least part of the flat portion of the at least one blade support, and in particular on at least part of the upper surface of the flat portion of at least one blade support.

[0012] According to some embodiments, the protrud-

ing element is further located on the blade.

[0013] According to some embodiments, the laser marked area comprises a textured surface, more specifically a textured surface comprising a micropattern, in particular a micropattern being formed by a plurality of grooves.

[0014] According to some embodiments, the laser marked area is in the form of a continuous mark, more specifically a continuous mark along the length of the at least one blade or on the at least one blade support, in particular a continuous mark along the length of the upper surface of the flat portion of the at least one blade support.

[0015] According to some embodiments, the laser marked area is in the form of two or more discontinuous marks, more specifically the discontinuous marks are spaced apart along the length of the at least one blade or of the flat portion of the at least one blade support, in particular along the length of the upper surface of the flat portion of the at least one blade support.

[0016] According to some embodiments, each discontinuous mark has a length from 0.2 to 20 mm, and more specifically from 0.5 to 2 mm.

[0017] According to some embodiments, each discontinuous mark has a width from one another from 0.1 to 1.5 mm, and more specifically from 0.2 to 0.7 mm.

[0018] According to some embodiments, wherein the discontinuous marks have the same width.

[0019] According to some embodiments, the distance between neighboring discontinuous marks is equal to or lower than the width of the discontinuous marks, and in particular equal to the width of the discontinuous marks.

[0020] According to some embodiments, at least two of the discontinuous marks have a different width.

[0021] According to some embodiments, the distance between two neighboring discontinuous marks is from 0.2 to 20 mm, and more specifically from 0.5 to 2 mm.

[0022] According to some embodiments, the protruding element has a width, and wherein the laser marked area has a width, and the width of the protruding element is equal to or higher than the width of the laser marked area.

[0023] According to some embodiments, the protruding element has a width from 0.02 to 1.0 mm, and more specifically from 0.10 to 1.0 mm.

[0024] According to some embodiments, the protruding element has a length from 10 to 40 mm, and more specifically from 30 to 36 mm.

[0025] According to some embodiments, the protruding element has the form of a continuous strip.

[0026] According to some embodiments, the protruding element has the form of a discontinuous strip, more specifically the discontinuous strip comprises two or more intermittent protruding parts, and in particular each intermittent protruding part has a length from 0.2 to 20 mm, and more specifically from 0.5 to 2 mm.

[0027] According to some embodiments, the water-insoluble component is chosen from polystyrene, styrene co-polymers such as high-impact polystyrene, polyethy-

lene, polypropylene, polyacetal, acrylonitrile-butadiene-styrene copolymer, ethylene vinyl acetal copolymer, polylactic acid, polycarbonate, maleic anhydride ethylene co-polymer blends, polyether-containing block copolymers, blends and copolymers, and thermoplastic elastomer compounds, more specifically thermoplastic poly-urethanes, silicone polymers, and mixtures thereof.

[0028] According to some embodiments, the protruding element further comprises a water-soluble component, more specifically a water-soluble component chosen from polyethylene oxide, polyethylene glycol, polyvinyl pyrrolidone, polyacrylamide, polyhydroxymethacrylate, polyvinyl imidazoline, polyvinyl alcohol, polyhydroxymethacrylate, silicone polymers, blends and copolymers of the above.

[0029] According to some embodiments, the blade assembly further comprises an adhesive, more specifically an adhesive layer.

[0030] According to some embodiments, the adhesive is located between the protruding element and the laser marked area.

[0031] According to some embodiments, the adhesive is chosen from a hot melt type adhesive, a cyanoacrylate adhesive, a polyvinyl acetate adhesive, a pressure-sensitive adhesive, an epoxy adhesive, an acrylic adhesive, an acrylate adhesive, a methacrylate ester adhesive, a polyurethane adhesive, a thermally rearranged adhesive, a silicone adhesive and combinations thereof.

[0032] It is a second object of the present disclosure to provide a razor cartridge comprising:

- the blade assembly described above, and
- a housing,

wherein the at least one blade and/or at least one blade support is partially exposed through an opening of the housing.

[0033] It is a third object of the present disclosure to provide a razor comprising:

- a razor handle, and
- the razor cartridge described above.

[0034] According to some embodiments, the razor cartridge is either releasably attached to the razor handle via a pivotable or non-pivotable connection, integrally formed with the razor handle via a non-pivotable connection, or integrally formed with the razor handle via a pivotable connection.

[0035] It is a fourth object of the present disclosure to provide a kit of parts comprising:

- a razor handle, and
- a razor cartridge holder comprising at least two razor cartridges (as described above).

[0036] The present disclosure makes it possible to address the need mentioned above. In particular, the

disclosure provides a durable razor having improved shaving performance in terms of comfort and safety while maintaining a good rinsability, and that is produced in a simple and cost-effective manner.

[0037] This is achieved by providing a razor that comprises a laser marked area on at least one of the blade and the blade support and more particularly on the surface of the blade or the blade support (called "*upper surface*") which faces towards the skin of the user during shaving, and a protruding element on top of the laser marked area. More specifically, the laser marked area which is formed on the stainless steel of the blade and/or of the blade support, allows to modify the surface of the stainless steel and makes it less inert by increasing its surface energy, in other words more prone to create a strong bond with a material such as a protruding element and/or an adhesive. Such modification of the surface of the stainless steel may include mechanical anchoring which renders the surface of the stainless steel rougher (with regards to the surface prior to the laser marking). Additionally or alternatively, such modification may include the creation of an oxide layer due to the heat of the surface deriving from the laser beam. Such layer makes it possible to increase the surface energy of the surface of the stainless steel and promote the adhesion of a protruding element and/or of an adhesive on the laser-marked area. Consequently, the presence of the laser marked area facilitates the adhesion of the protruding element (either directly or indirectly via an adhesive present between the protruding element and the laser marked area) and reinforces the attachment/fixation of the protruding element on the stainless steel so that the razor can have a longer use life and so that the improved shaving performance can last longer. Finally, given that the laser marked area can be formed in different stages of the fabrication process of the razor (for example on the support blade raw material, or during the assembly of the blade assembly, or directly on the final product) it renders the process more flexible, easier and cheaper. The fact that the protruding element of the present disclosure comprises at least a water-insoluble compound, allows for said protruding element not to be worn during use (for example in comparison with a protruding element consisting of a water-soluble compound) and thus prolongs the use life of the razor and also the effects provided by the razor (skin bulging for example). Advantageously, when the protruding element is a lubricating element, in other words when the protruding element further comprises a water-soluble compound, the razor according to the present disclosure, in addition to the above, further provides hydration and lubricity of the skin thus a better glide.

Brief Description of the Drawings:

[0038]

Figure 1 illustrates a cross-sectional view of a blade

assembly according to an embodiment of the first aspect.

Figure 2 illustrates a perspective view of a blade assembly according to an embodiment of the first aspect.

Figure 3 illustrates a cross-sectional view of a blade assembly according to an embodiment of the first aspect.

Figure 4 illustrates a cross-sectional view of a blade assembly according to an embodiment of the first aspect.

Figure 5 illustrates a front view of a blade assembly according to an embodiment of the first aspect.

Figure 6 illustrates a front view of a blade assembly according to an embodiment of the first aspect.

Figure 7 illustrates a cross-sectional view of a blade assembly according to an embodiment of the first aspect.

Figure 8 illustrates a perspective view of a razor according to an embodiment of the third aspect.

Detailed Description:

[0039] The invention will now be described in more detail without limitation in the following description.

[0040] According to a first aspect, the disclosure relates to a blade assembly comprising:

- at least one blade having a cutting edge portion;
- at least one blade support in contact with the at least one blade, the at least one blade support having a flat portion and a base portion, the flat portion of the at least one blade support comprising an upper surface and a lower surface;
- a laser marked area on the at least one blade and/or on the at least one blade support; and
- a protruding element attached to the laser marked area, wherein the protruding element comprises at least a water-insoluble component.

[0041] The first aspect is described by making reference to **Figures 1 to 6**. More specifically, the blade assembly 5 comprises at least one blade support 1 and at least one blade 2 in contact with the blade support 1. According to some embodiments, the blade assembly 5 may comprise two or more blade supports 1 and/or two or more blades 2, for example two, or three, or four, or five blade supports 1 and/or two, or three, or four, or five blades 2.

[0042] The blade support 1 has a flat portion 1a and a base portion 1b. The flat portion 1a may extend at an

angle α relative to the base portion 1b, i.e. the flat portion 1a may form a first plane and the base portion 1b may form a second plane, and the two planes together may form an angle α (such angle being illustrated in **Figure 1**), in other words the flat portion 1a may extend at an angle α with respect to the base portion 1b. Thus, the blade support 1 may further comprise a bent portion 1c which is intermediate to the flat portion 1a and the base portion 1b. Therefore, the (intermediate) bent portion 1c may be located between the flat portion 1a and the base portion 1b of the blade support 1.

[0043] According to some embodiments, the flat portion 1a, the base portion 1b and the bent portion 1c may be integrally formed, i.e. formed as a single piece.

[0044] In addition, the flat portion 1a of the blade support 1 has an upper surface 1a' and a lower surface 1a" opposite the upper surface 1a' (as illustrated in **Figure 1**). By "upper surface" is meant the surface that in use faces towards the shaving surface (skin). Thus, by "lower surface" is meant the surface that faces at the opposite direction of the shaving surface.

[0045] Furthermore, the blade support 1, and in particular the flat portion 1a of the blade support 1, may have a length L1 and a width W1 as illustrated in **Figure 2**. By "length" is meant the greater of the dimensions, notably of the three dimensions, of the flat portion 1a of the blade support 1 (the other two being the width and the height). By "width" is meant the dimension of the flat portion 1a that is perpendicular to the length L1 of the flat portion 1a and parallel to a plane formed by the upper surface 1a' of the flat portion 1a of the blade support 1.

[0046] According to some embodiments, the blade support 1 is made of austenitic stainless steel. Austenitic stainless steel is one of the five classes of stainless steel depending on the crystalline structure (along with ferritic, martensitic, duplex and precipitation hardened). Its primary crystalline structure is austenite.

[0047] According to some embodiments, the austenitic stainless steel may comprise the following components (by weight relative to the total weight of the stainless steel composition):

- Carbon: in particular from 0 to 0.15 %,
- Chromium: in particular from 15 to 21 %,
- Manganese: in particular from 0 to 16 %,
- Nickel: in particular from 1 to 26 %,
- Copper, Aluminum, Molybdenum: in particular from 0 to 2 %
- Iron: in particular balance

[0048] Austenitic stainless steel can be identified by several methods known in the art such as Chemical Etching and Optical Microscopy, Chemical Etching and X-ray Diffraction Analysis (XRD), and Scanning Electron Microscopy with Electron Backscatter Diffraction (EBSD).

[0049] The blade 2 of the blade assembly 5 has a cutting edge portion. Said cutting edge portion may com-

prise an upper surface 2a and a lower surface 2b. The same definitions of the upper and lower surface as explained above, also apply in the case of the blade 2. The blade 2, and in particular the cutting edge portion, may further comprise a tip 2c. Accordingly, in some embodiments, the cross-section of the cutting edge portion may have a substantially symmetrical tapering geometry terminating in a blade tip 2c. The cross-section may have a central longitudinal axis originating from the blade tip 2c, and the cutting edge portion may have a thickness of between 1.5 μm and 2.4 μm measured at a distance of 5 μm along the central longitudinal axis from the blade tip. In some embodiments, the blade's edge portion has a thickness of between about 4.6 μm and about 6.8 μm , in particular about 4.62 to about 6.74 μm , measured at a distance of about 20 μm along the central longitudinal axis from the blade tip. In some embodiments, the blade's edge portion has a thickness of between about 10.3 μm and 14.4 μm , in particular about 10.32 to about 14.35 μm , measured at a distance of about 50 μm along the central longitudinal axis from the blade tip. In some embodiments, the blade's edge portion has a thickness of between about 19.8 μm and 27.6 μm , in particular about 19.82 to about 27.52 μm , measured at a distance of about 100 μm along the central longitudinal axis from the blade tip.

[0050] According to some embodiments, the blade 2, and in particular the cutting edge portion of the blade 2, may have a thickness from 0.01 to 0.20 mm and in particular from 0.04 to 0.12 mm.

[0051] The blade 2 is in contact with the blade support 1, in other words the blade 2 is attached to the blade support 1. Such attachment can for example be carried out by laser welding. In some embodiments, the blade 2 is attached to the flat portion 1a of the blade support 1. More specifically, in some embodiments, the blade 2 is attached to the lower surface 1a" of the flat portion 1a of the blade support 1. Thus, in this case, the upper surface 2a of the blade 2 is in contact with the lower surface 1a" of the blade support 1. Such embodiment is illustrated for example in **Figures 1 to 3**.

[0052] In other embodiments (as illustrated in the **Figure 4**), the blade 2 is attached to the upper surface 1a' of the flat portion 1a of the blade support 1. In this case, the lower surface 2b of the blade 2 is in contact with the upper surface 1a' of the flat portion 1a of the blade support 1.

[0053] According to some embodiments, the blade 2 is made of martensitic stainless steel. Martensitic stainless steel is a type of stainless steel alloy that has a martensite crystal structure.

[0054] According to some embodiments, the martensitic stainless steel may comprise mainly iron and from 0.62 to 0.75 % of carbon by weight relative to the total weight of the stainless steel composition. In particular, the martensitic stainless steel may comprise the following components (by weight relative to the total weight of the stainless steel composition):

- Carbon: in particular from 0.62 to 0.75 %,
- Chromium: in particular from 12.7 to 13.7 %,
- Manganese: in particular from 0.45 to 0.75 %,
- Silicon: in particular from 0.20 to 0.50 %,
- Iron: in particular balance

[0055] In particular, such an alloy has no more than traces of other components, and notably no more than traces of Molybdenum.

[0056] Martensitic stainless steel can be identified by several methods known in the art such as Chemical Etching and Optical Microscopy, Chemical Etching and X-ray Diffraction Analysis (XRD), and Scanning Electron Microscopy with Electron Backscatter Diffraction (EBSD).

[0057] According to some embodiments, the blade 2 may have a coating on its upper surface 2a and/or its lower surface 2b. Said coating may be a phosphate-based coating (or else a phosphate conversion coating). The presence of this coating allows to improve the corrosion resistance of the blade 2.

[0058] The blade assembly 5 according to the first aspect further comprises a laser marked area 3.

[0059] By "laser" is meant the acronym that stands for Light Amplification by the Stimulated Emission of Radiation. By raising the energy level of atoms to an excited state, these atoms release light as they fall back to their original energy, or ground state, thereby producing a laser. Once this beam of light is created, it is amplified in some way to produce a focal point. As the atoms begin to move, they create a weak light, and as more and more energy is added, the light waves become even more concentrated. Unlike with other types of light (such as a flashlight), the light rays of lasers all have the same wavelength and are coherent, which is what makes it such a powerful concentration of energy.

[0060] By "laser marked area" is meant a marking or a marked area that is induced by a laser beam. Said laser beam affects this area by creating surface oxidation, or etching-roughening, or engraving, or structuring or any combination of the above.

[0061] In the case of oxidation, an oxide layer is created on the surface of a marking target (area/surface), when the laser beam is applied to said target/surface in a way that heat is transferred to the (metallic) surface, without engraving or ablating the material of the surface. This oxide layer allows to create a chemical bond with the protruding element (or the adhesive if present, such elements being described below), so as to enhance the adhesion of the protruding element (or of the adhesive) on the blade 2 or blade support 1. Such oxide layer may have a different color from the initial (unmarked) surface.

[0062] In the case of etching-roughening, the laser beam is applied to a marking target (area/surface) at the focal point. As a result, material from the (metallic) surface is slightly removed-ablated to create an uneven/roughened surface comprising irregular micro-

structures (micropatterns in the form of recesses). Such microstructures may have a depth and/or a length and/or width equal to or lower than 20 μm .

[0063] In the case of engraving, the laser beam irradiates the focal point and engraves (etches) the surface of a marking target (area/surface). By increasing the laser irradiation count or the laser power, the depth of the engraving may be increased. The created laser-marked surface may comprise (irregular) microstructures (micropatterns in the form of recesses) of depth and/or a length and/or width equal to or lower than 50 μm . In other words, the depth (or else the distance of the lowest part of the recess from the surface of the material to be engraved) and/or a length and/or width of the recess may be equal to or lower than 50 μm .

[0064] In the case of structuring, a fast (nanosecond, picosecond, femtosecond) pulsed laser beam is used to create symmetrical (even/regular/organized) structures in the nano to micro scale. In particular, such structures (micropatterns in the form of recesses) may have a depth and/or a length and/or width from 50 nm to 50 μm .

[0065] It is believed that the surface texturing (etching or engraving or structuring) makes it possible to increase the surface area of the laser marked area, which allows to promote adhesion on the laser marked area. In addition, the microstructures (micropatterns in the form of recesses) create mechanical anchoring that further improves adhesion (to the protruding element or the adhesive).

[0066] In some embodiments, the oxidation alone or the surface texturing (etching or engraving or structuring) alone or their combination may also promote the adhesion on the laser marked area.

[0067] In other words, the above processes allow to alter the surface of a material so as to create a textured surface comprising micropatterns. This means that the laser marked area (and thus the textured surface) comprises a plurality of grooves (recesses from the surface of the material), notably micro-grooves, that macroscopically (to the naked eye) form a textured surface. For example, the micropatterns may comprise combinations of regular shapes such as cylindrical or polygonal shapes, or of random combinations of irregular random shapes. The plurality of grooves may have a depth with regards to the plane of the surface of the material of at least 5 nm, more specifically of at least 10 nm, and more specifically of at least 25 nm. In particular, the height of a groove may be from 5 to 100000 nm, and more specifically from 10 to 50000 nm. Additionally, the spacing (distance) between the different grooves may be from 10 to 10000 nm, more specifically from 50 to 5000 nm and even more specifically from 100 to 1000 nm.

[0068] According to some (preferred) embodiments, and as illustrated in **Figures 2 and 3**, and more specifically when the blade 2 is attached to the lower surface 1a" of the flat portion 1a of the blade support 1, the laser marked area 3 is located on the blade support 1. More specifically, in this case, the laser marked area 3 is

located on the flat portion 1a of the blade support 1, and in particular on at least part of the upper surface 1a' of the flat portion 1a of the blade support 1. This is an advantageous and preferred embodiment due to the fact that the blade support 1 is commonly made of austenitic stainless steel while the blade 2 is commonly made of martensitic stainless steel. More particularly, austenitic stainless steel is known to be more inert than martensitic stainless steel (in other words austenitic stainless steel has a lower surface energy than martensitic stainless steel) thus, it is more challenging to promote adhesion on an austenitic stainless steel than on a martensitic stainless steel.

[0069] According to other embodiments, as illustrated in the **Figure 4**, and more specifically when the blade 2 is attached to the upper surface 1a' of the flat portion 1a of the blade support 1, the laser marked area 3 is located on the blade 2, and more specifically on at least part of the upper surface 2a of the blade 2.

[0070] Again according to other embodiments (not illustrated in the figures), the laser marked area 3 may be located on the blade 2 and the flat portion 1a of the blade support 1. In this case, either the blade 2 is attached to the lower surface 1a" of the flat portion 1a of the blade support 1, or the blade 2 is attached to the upper surface 1a' of the flat portion 1a of the blade support 1. This embodiment is advantageous in case the protruding element 4 (that will be described below) is located both on the blade 2 and the flat portion 1a of the blade support 1 (thus in this case the protruding element can be attached to both the blade 2 and the flat portion 1a of the blade support 1 via the laser marked area 3).

[0071] According to some embodiments, the laser marked area 3 is in the form of a continuous mark 3a. Such embodiment is for example illustrated in **Figure 2** and in **Figure 5**. By "*continuous mark*" is meant a laser marked area 3 or a marking (such as a textured surface) that has the form of a wide line/strip and that extends longitudinally along the blade 2 and/or the flat portion 1a of the blade support 1. More specifically, said continuous mark 3a (also called continuous strip line) may be located on the upper surface 1a' of the flat portion of the blade support 1 and/or on the upper surface 2a of the blade 2. Even more specifically, said continuous mark 3a may be located along the length of the upper surface 2a of the blade 2 and/or of the upper surface 1a' of the flat portion 1a of the blade support 1. In particular, the continuous mark 3a may be located along the length of the upper surface 1a of the blade support 1. According to some embodiments, such continuous mark 3a is linear or essentially linear on the blade 2 and/or on the flat portion 1a of the blade support 1, and in particular on the upper surface 2a of the blade 2 and/or the upper surface 1a' of the flat portion 1a of the blade support 1.

[0072] According to some embodiments, the continuous mark 3a may have a width W1 (as illustrated in **Figure 5**) which can be equal to or less than the width of the blade support 1 (notably the flat portion 1a) and/or the blade 2 on which the laser marked area 3 is located.

Thus, the width W1 of the continuous mark 3a may be from 0.1 to 1.5 mm, and more specifically from 0.2 to 0.7 mm.

[0073] According to some embodiments, the continuous mark 3a may have a length L1 (as illustrated in **Figure 5**) which can be equal to or less than the length of the blade support 1 (notably the flat portion 1a) and/or the blade 2 on which the laser marked area 3 is located. Thus, the length L1 of the continuous mark 3a may be from 10 to 40 mm, and more specifically from 30 to 36 mm.

[0074] According to other (alternative) embodiments, the laser marked area 3 is in the form of two or more discontinuous marks 3b as illustrated in **Figure 6**. By "*discontinuous marks*" is meant a plurality of intermittent (neighboring) laser marks 3b that form the final laser marked area 3, each laser mark 3b comprising a textured surface comprising micropatterns (as defined and detailed above). In other words, the laser marked area 3 has the form of a discontinuous (intermittent) line comprising the discontinuous marks 3b. In some embodiments, the discontinuous marks 3b are spaced apart along the length of the blade 2 and/or of the flat portion 1a of the blade support 1. In particular, the discontinuous marks 3b are spaced apart along the length of the upper surface 1a' of the flat portion 1a of the blade support 1, and/or along the length of the upper surface 2a of the blade 2, and in particular along the length of the upper surface 1a' of the flat portion 1a of the blade support 1.

[0075] According to some embodiments, the discontinuous marks 3b may have a width W2 (as illustrated in **Figure 6**) which can be equal to or less than the width of the blade support 1 and/or of the blade 2 on which the laser marked area 3 is located. Thus, the width W2 of each discontinuous mark may be from 0.1 to 1.5 mm, and more specifically from 0.2 to 0.7 mm.

[0076] According to some embodiments, each discontinuous mark 3b may have a length L2 (as illustrated in **Figure 5**) from 0.2 to 20 mm, and more specifically from 0.5 to 2 mm.

[0077] According to some advantageous embodiments, the different discontinuous marks 3b may have the same size/dimensions. In particular, all the discontinuous marks 3b of the laser marked area 3 may have the same length L2 and/or width W2, more specifically the same length and width on the blade 2 or the blade support 1. Alternatively, the size of at least two discontinuous marks 3b of the laser marked area 3 may differ from each other, for example the length and/or the width of each discontinuous mark 3b may be different.

[0078] Furthermore, as disclosed above, the discontinuous marks 3b may be spaced apart from one another. In this case, the distance D2 between two neighboring discontinuous marks 3b may be from 0.2 to 20 mm, and more specifically from 0.5 to 2 mm. This distance may be the same or different between two neighboring discontinuous marks 3b, in particular the distance may be the same between two neighboring discontinuous marks 3b.

According to some embodiments, and in case all the discontinuous marks 3b of the laser marked area 3 have the same width, the distance between neighboring discontinuous marks 3b may be equal to or lower than the width of the discontinuous marks 3b, and in particular equal to the width of the discontinuous marks 3b.

[0079] The blade assembly 5 according to the first aspect further comprises a protruding element 4 (as illustrated in **Figures 3 and 4**). The protruding element 4 acts as a functional spacer (therefore reducing skin being entrapped between the blades) and improves skin stretching to prevent skin bulging. This protruding element 4 comprises at least one water-insoluble component. Such water non-soluble component allows for said protruding element 4 not to be worn during use (for example in comparison to a protruding element consisting of a water-soluble compound) and thus prolongs the use life of the razor. According to some embodiments, the water-insoluble component may be a water-insoluble polymer. Said polymer may be chosen from polystyrene, styrene co-polymers such as high impact polystyrene (HIPS), polyethylene, polypropylene, polyacetal, acrylonitrile-butadiene-styrene copolymer, ethylene vinyl acetal copolymer, polylactic acid, polycarbonate, maleic anhydride ethylene co-polymer blends, polyether-containing block copolymers, blends and copolymers, and thermoplastic elastomer compounds, more specifically thermoplastic poly-urethanes, silicone polymers, and mixtures thereof. In particular, the water-insoluble polymer may be chosen from polystyrene, styrene copolymers and mixtures thereof.

[0080] According to some embodiments, the protruding element 4 may consist, or may essentially consist of the water-insoluble component.

[0081] According to other embodiments, the protruding element 4 may comprise other components in addition to the water-insoluble component.

[0082] Consequently, the water-insoluble component may be present in the protruding element 4 at an amount from 0.1 to 100 %, more specifically, from 5 to 100 % and even more specifically from 10 to 100 % by weight, relative to the total weight of the protruding element 4.

[0083] In addition to the water-insoluble component, the protruding element 4 may further comprise a water-soluble component. Such water-soluble component allows to provide lubrication and reduce friction on the skin. In this case, the protruding element 4 is a lubricating element. The water-soluble component may be a water-soluble polymer, in particular chosen from polyethylene oxide and/or polyethylene glycol, polyvinyl pyrrolidone, polyacrylamide, polyhydroxymethacrylate, polyvinyl imidazoline, polyvinyl alcohol, polyhydromethylmethacrylate, silicone polymers, blends and copolymers of the above. In particular, the water-soluble polymer may be chosen from polyethylene oxide and/or polyethylene glycol.

[0084] When present, the water-soluble component may be present in the protruding element 4 at an amount

from 0.1 to 99.9 %, more specifically, from 1 to 95 % and even more specifically from 1 to 90 % by weight, relative to the total weight of the protruding element 4.

[0085] Additionally, the protruding element 4 may further comprise other additional components chosen from plasticizers, such as low molecular weight polyethylene glycols, water-swellaible release enhancing agents, such as cross-linked polyacrylics and/or maleic anhydride compounds, additional lubricants, compatibilizers, surfactants, and/or skin care agents selected in the group consisting of vitamins, botanical extracts, salts, humectants, fragrances, essential oils, silicon oils, organic oils, waxes, antioxidants, exfoliants, depilatory agents, surfactants, hair and skin conditioning agents, anti-bacterial agents, anti-microbial, anti-irritants, antiseptics, biocides, preservatives, skin cooling and soothing agents, moisturizing and hydrating agents, skin protectants, colorants, film formers, processing thickening agents from the list of silica, fume silica, TiO₂ particles, and combinations thereof.

[0086] When present, the additional components may be present in the protruding element 4 at an amount from 0.01 to 30 %, more specifically, from 0.1 to 20 % and even more specifically from 1 to 15 % by weight, relative to the total weight of the protruding element 4.

[0087] According to some embodiments, the protruding element 4 may be extruded or micro-extruded, notably in the form of a continuous strip line. Alternatively, the protruding element 4 may be injected, or micro-injected, or 3D printed through material extrusion and/or other 3D manufacturing techniques in individual items to be further assembled on the blade 2 or the blade support 1. According to preferred embodiments, the protruding element 4 has the form of a strip. As will be explained below, the protruding element 4 may have the form of a continuous or discontinuous (intermittent) strip.

[0088] The shape of the protruding element 4 is not limiting. Thus, the cross-section of the incorporated protruding element 4 may be of any suitable shape, for example, circular, semi-circular, semi-oval, triangular, rectangular, rectangular with chamfered top edges (i.e. with cut-away corners), trapezoidal, lemniscate, asymmetrical or any combination thereof. Advantageously, the protruding element 4 may have a semi-circular, semi-oval or rectangular with chamfered top edges cross section.

[0089] The protruding element 4 may have a height from 0.01 to 0.5 mm, and more specifically from 0.05 to 0.5 mm. By "height" is meant the (perpendicular) distance of the higher point of the protruding element 4 to a plane formed by the laser-marked area (thus either the surface of the blade 2 or of the flat portion 1a of the blade support 1).

[0090] Furthermore, the protruding element 4 may have a width from 0.02 to 1.0 mm, and more specifically from 0.10 to 1.0 mm.

[0091] According to some embodiments, notably when the protruding element 4 has the form of a continuous strip, the protruding element 4 may have a length which

can be equal to or less than the length of the blade support 1 (notably the flat portion 1a) and/or of the blade 2 on which the laser marked area 3 is located. Thus, the length of the protruding element 4 may be from 10 to 40 mm, and more specifically from 30 to 36 mm.

[0092] According to other embodiments, notably when the protruding element 4 has the form of a discontinuous strip, the protruding element 4 may comprise two or more intermittent protruding parts that form the final discontinuous protruding element 4. In other words, these (two or more) protruding parts are distanced from one another to form a discontinuous protruding element 4. According to some embodiments, these protruding parts have all the same length. According to other embodiments, at least two of the protruding parts have a different length from one another. The length of each protruding part may be from 0.2 to 20 mm, and more specifically from 0.5 to 2 mm. Additionally, the different protruding parts may be spaced apart from one another. In this case, the distance between two neighboring protruding parts may be from 0.2 to 20 mm, and more specifically from 0.5 to 2 mm. This distance may be the same or different between two neighboring protruding parts, in particular the distance may be the same between two neighboring protruding parts.

[0093] The protruding element 4 is (directly or indirectly) attached to the laser marked area 3. For example, the protruding element 4, in particular in form of a continuous or discontinuous strip, can be attached either to the continuous mark 3a or to the discontinuous marks 3b forming the laser marked area 3.

[0094] According to some embodiments, the protruding element 4 may be located at least on either one of the blade 2 or the flat portion 1a of the blade support 1.

[0095] According to some embodiments, the protruding element 4 may be located on both the blade 2 and the flat portion 1a of the blade support 1. In this case, at least part of the protruding element 4 is in contact with the laser marked area 3. This means that at least one of the blade 2 and the flat portion 1a of the blade support 1 has a laser marked area 3, and that the protruding element 4 being in located both on the blade 2 and the flat portion 1a of the blade support 1, is in contact at least with the laser marked area 3 of the blade 2 or of the flat portion 1a of the blade support 1. Preferably, in this case, the laser marker area is present on the flat portion 1a of the blade support 1. Alternatively, both the blade 2 and the flat portion 1a of the blade support 1 have a laser marked area 3, and the protruding element 4 being located both on the blade 2 and the flat portion 1a of the blade support 1, is in contact with both the laser marked area 3 of the blade 2 and the laser marked area 3 of the flat portion 1a of the blade support 1.

[0096] Therefore, according to some embodiments, the blade 2 may be attached to the upper surface 1a' of the flat portion 1a of the blade support 1 (thus the lower surface 2b of the blade 2 is in contact with the upper surface 1a' of the flat portion 1a of the blade support 1)

and the protruding element 4 may be located on both the upper surface 1a' of the flat portion 1a of at least one blade support 1 and the upper surface 2a of the blade 2. Such embodiment is illustrated in **Figure 7**. In this case, the laser marked area 3 (not illustrated in the figures) may be present in either one or both of the upper surface 1a' of the flat portion 1a of at least one blade support 1 and the upper surface 2a of the blade 2.

[0097] According to other embodiments (not illustrated in the figures), the blade 2 may be attached to the lower surface 1a" of the flat portion 1a of blade support 1 and the protruding element 4 may be located on both the upper surface 1a' of the flat portion 1a of at least one blade support 1 and the upper surface 2a of the blade 2. In this case, the laser marked area 3 may be present in either one or both of the upper surface 1a' of the flat portion 1a of at least one blade support 1 and the upper surface 2a of the blade 2.

[0098] According to some embodiments, notably when the protruding element 4 is located on the flat portion 1a of the blade support 1, or on the blade 2 and the flat portion 1a of the blade support 1, the protruding element 4 does not go beyond the flat portion 1a of the support, in other words the protruding element 4 is not located on does not come to contact with) the bent portion 1c and/or the base portion 1b of the blade support 1. This allows to improve the rinsability as the protruding element 4 is not in contact with the base portion 1b and the bent portion 1c of the blade support 1, and therefore fluidity is increased between the different blade supports 1.

[0099] The protruding element 4 can be attached to the laser marked area 3 by adhesion with any type of adhesive (see below), polymer welding, press-fit, snap-fit, hot embossing, insert molding, 3D printing methods, or any similar method.

[0100] According to some embodiments, said attachment can be direct. In other words, the protruding element 4 can be in direct contact with the laser marked area 3 (i.e. without any intermediate layers between the protruding element 4 and the laser marked area 3).

[0101] According to other preferred embodiments, said attachment is indirect. In this case, the protruding element 4 is attached to the surface comprising the laser marked area 3 via an adhesive, notably an adhesive layer (not illustrated in the figures). Such adhesive can be chosen from a hot melt type adhesive, a cyanoacrylate adhesive, a polyvinyl acetate adhesive, a pressure-sensitive adhesive, an epoxy adhesive, an acrylic adhesive, an acrylate adhesive, a methacrylate ester adhesive, a polyurethane adhesive, a thermally rearranged adhesive, a silicone adhesive and combinations thereof.

[0102] According to some embodiments, the thickness of the adhesive layer may be from 0.001 to 0.2 mm, and in particular from 0.01 to 0.1 mm.

[0103] Additionally or alternatively, the blade assembly 5 may further comprise an adhesion promoter (such as a primer or a conversion coating). Such adhesion promoter may be in the form of a layer (not illustrated in the figures).

Said layer allows to further promote the adhesion of the protruding element 4 and/or of the adhesive (when present) on the laser marked area 3. The adhesion promoter can be chosen from phosphate-based promoters, silicate-based promoters, silane-based promoters, zirconate-based promoters, titanate-based promoters, polyurethane-based promoters and mixtures thereof.

[0104] According to some embodiments, the thickness of the adhesion promoter layer may be from 0.1 nm to 3 μm , and in particular from 1 nm to 0.5 μm .

[0105] When present, the adhesion promoter layer can be in contact with the laser marked area 3 and/or with the protruding element 4 and/or with the adhesive layer (when present). More specifically, the blade assembly 5 may comprise one, or more than one adhesion promoter layers, in particular one or two adhesion promoter layers. In case the blade assembly 5 comprises one adhesion promoter layer, said layer may be in contact with the laser marked area 3 and the protruding element 4 (in other words, the adhesion promoter layer may be located between the laser marked area 3 and the protruding element 4), or between the laser marked area 3 and the adhesive layer (when present), or between the adhesive layer and the protruding element 4. In case the blade assembly 5 comprises two adhesion promoter layers, a first adhesion promoter layer may be in contact with the laser marked area 3 and the protruding element 4 (in other words, the adhesion promoter layer is located between the laser marked area 3 and the protruding element 4), and the second adhesion promoter layer may be between the laser marked area 3 and the adhesive layer (when present), or between the adhesive layer and the protruding element 4.

[0106] According to some embodiments, the blade assembly 5 may comprise at least two blades 2, more specifically at least three blades 2 and in particular at least four blades 2. In addition, the blade assembly 5 may comprise at least two blade supports 1, more specifically at least three blade supports 1 and in particular at least four blade supports 1. Advantageously, the number of blades 2 equals the number of blade supports 1.

[0107] When the blade assembly 5 comprises a plurality of blades 2 and blade supports 1, not all blades and blade supports 1 need to comprise the laser marked area 3 and the protruding element 4. For example, in case a blade assembly 5 comprises three blades 2 and/or blade supports 1, only one blade 2 and/or blade support 1, in particular only one blade support 1, may comprise the laser marked area 3 and the protruding element 4 and the two other blades 2 or blade supports 1 may not comprise (be devoid of) the laser marked area 3 and the protruding element 4. In other words, in this case only one laser marked area 3 and one protruding element 4 is present in the blade assembly 5. Alternatively, two blades 2 and/or blade supports 1 of the three blades 2 and blade supports 1 may comprise the laser marked area 3 and the protruding element 4 or all three blades 2 and/or blade supports 1 may comprise the laser marked area 3 and the protruding

element 4.

[0108] According to a second aspect, the present disclosure relates to a razor cartridge 6 as illustrated in **Figure 8**. Said razor cartridge 6 comprises the blade assembly 5 described above and a housing. The housing may have a substantially rectangular shape. Alternatively, the housing may have any suitable shape such as ovoid or circular without deviating from the scope of the present disclosure. The blade(s) 2 and/or blade support(s) 1 may be partially exposed through an opening of the housing. The blade(s) 2 and blade support(s) 1 may be mounted within the housing and secured with clips.

[0109] The housing may comprise a front part, and a rear part. As used herein, the terms "*front/forward*", "*back/rear*", and derivatives thereof may refer to an orientation or direction of the housing with respect to the shaving direction. By "*front part*" is meant the part of the housing that, during shaving, comes to contact with the skin of the user prior to the blade 2. By "*rear part*" is meant the part of the housing that during shaving, comes to contact with the skin of the user after the blade. The housing may further comprise a cap, notably located at the rear part of the housing. Said cap may comprise one or more lubrication members. The housing may further comprise one or more guard structures, notably located at the front part of the housing. Thus, the one or more guard structures may be positioned in front of the blades and may be joined to or integral with the cartridge housing.

[0110] According to a third aspect, this present disclosure relates to a razor 7 comprising the razor cartridge 6 described above and a razor handle 8. The handle 8 can extend in a handle direction between a proximal end and a distal end. The razor cartridge 6 can be coupled with the distal end of the handle 8.

[0111] According to some embodiments, the razor cartridge 6 can be releasably attached to the razor handle 8 via a pivotable or non-pivotable connection. Such releasably attachment can be carried out for example by a lock and release mechanism.

[0112] According to other embodiments, the razor cartridge 6 can be integrally formed with the razor handle 8, such that the razor cartridge 6 is not configured to be removably coupled with or selectively separated from the handle 8. In this case, the connection between the razor cartridge 6 and the handle 8 may be a pivotable connection or a non-pivotable connection.

[0113] The handle 8 may be any suitable shape to allow a user to securely grip the handle 8. It is foreseen that the handle 8 may include one continuous curve or include one straight portion or several curved and/or straight portions extending along an entirety of or a substantial portion of the handle 8 without deviating from the scope of the present inventive concept.

[0114] According to a fourth aspect, the present disclosure relates to a kit of parts comprising a razor handle 8 (as described above) and a razor cartridge holder. The razor cartridge holder comprises at least two razor car-

tridges 6 as described above.

[0115] The above blade assembly 5 may be manufactured by the method disclosed below. In more detail, the method for manufacturing the blade assembly 5 disclosed above, comprises the below steps that can be carried out in different orders without affecting the final product:

- step of producing the laser marked area 3;
- step of applying/attaching the protruding element 4;
- step of applying the adhesive (optional);
- step of applying the adhesion promoter layer (optional);
- step of assembling the blade assembly 5.

[0116] The step of producing a laser marked area 3 may be carried out on at least one blade 2 and/or (preferably or) on at least one blade support 1 or on a flat piece of material which is a precursor of the blade support 1. The laser marked area 3 may be produced with a laser beam (as explained above). In other words, the laser marked area 3 can be formed by contacting the blade 2 and/or the blade support 1 or the precursor of the blade support 1 (more specifically contacting the upper surface 1a' of the flat portion 1a of the blade support 1 or the upper surface 2a of the blade 2) with a laser beam. The laser marked area 3 may be produced with the apparatus KEYENCE MD-X1020.

[0117] The laser marking to provide the laser marked area 3 may be produced with a laser scanning apparatus. Such laser scanning apparatus may comprise a laser source which may produce a pulsed or a continuous wave, with a laser beam wavelength of infrared or green, or UV. The laser beam produced by the laser source may be transmitted via an output fiber that is connected to a laser head. A collimator collimates the laser beam produced by the laser to produce a collimated laser beam, and a lens focuses the collimated laser beam to produce a focused laser beam. The collimator may optionally be part of a larger apparatus, such as a scan system that comprises one or more actuators and/or mirrors for directing and moving the collimated laser beam. The lens may comprise a single-element lens or a multi-element lens. In some embodiments, the lens may comprise an F-theta lens, and in one particular example, the lens may comprise a telecentric F-theta lens. In other examples, the lens may comprise a diffractive optical element or a holographic optical element. A mirror is coupled to an actuator such that the mirror is translatable and/or rotatable to direct the focused laser beam to a workpiece (blade or support) and generate a laser marking area. The actuator may comprise, for example, an apparatus similar to a mirror galvanometer-mirror, which changes the angle and/or position of the focused laser beam with respect to the workpiece. In some embodiments, the galvanometer-mirror scanner may comprise a 2- or 3-axis scanner. In addition, the laser scanning apparatus may comprise two or more actuators to allow movement

of the mirrors about two or more different axes. The laser scanning apparatus may further comprise an imaging system that is positioned to monitor one or more parameters of the workpiece, and laser marking area. The laser scanning apparatus may also belong in the category of the polygon scanners. One or more nozzles coupled to a gas supply may direct a shield gas such as helium, argon, or nitrogen to the laser marking area. In addition, a pre-objective scanner, or a post-objective scanner may also be used, in which the lens is located before the mirror(s) and is coupled to a servo or other actuator. The workpiece may be mounted to a moving stage or may be fixed relative to laser head with the laser beam being directed at the laser marking area. The laser head and/or stage may optionally comprise one or more respective actuators that allow movement of the laser head and/or stage and workpiece relative to each other in the X, Y, and/or Z directions to advance the laser beam along the razor blade. The laser scanning apparatus may be configured such that laser scanning for laser marking proceeds in any desired direction or pattern.

[0118] Thus, the step of producing a laser marked area 3 on the blade support 1 (or on the flat piece of material which will then be formed in the blade support 1) and/or on the blade 2 can be carried out before, during or after the process of assembling (putting together) the blade assembly 5, or even after the process of assembling (putting together) the blade assembly 5 inside the razor cartridge 6. By "*process of assembling the blade assembly*" is meant the process of assembling all the elements comprised in the blade assembly 5 according to the present disclosure i.e. the blade 2, the blade support 1, the protruding element 4 and optionally the adhesive and the adhesion promoter (which can be assembled in different orders). By "*process of assembling the blade assembly inside the razor cartridge*" is meant the process wherein the blade assembly 5 according to the present disclosure is put together/assembled in the razor cartridge 6 with the rest of the elements comprised in the razor cartridge 6 (such as the housing and the clips described above).

[0119] In case the blade assembly 5 comprises an adhesive, the step of applying such adhesive may be carried out after the step of producing the laser marked area 3. Additionally or alternatively, the step of applying the adhesive can be carried out before or after the process of assembling (putting together) the blade assembly 5, or after the process of assembling (putting together) blade assembly 5 inside the razor cartridge 6. In any case, such step may be carried out prior to the step of attaching the protruding element 4.

[0120] Furthermore, in case the blade assembly 5 comprises an adhesion promoter, the step of applying the adhesion promoter may be carried out prior to the step of applying the adhesive. In any case, such step may be carried out prior to the step of attaching the protruding element 4.

[0121] Finally, the step of applying/attaching the pro-

truding element 4 may be carried out after the step of producing a laser marked area 3. If an adhesive (and optionally an adhesion promoter) is present in the blade assembly 5, the step of applying/attaching the protruding element 4 may be carried out after the step of applying the adhesive (and optionally an adhesion promoter). Additionally or alternatively, the protruding element 4 may be applied before or after the process of assembling (putting together) the blade assembly 5, or even after the process of assembling (putting together) blade assembly 5 inside the razor cartridge 6.

Examples:

Example 1 (according to the invention):

[0122] Fifteen razor cartridges each one comprising a blade assembly comprising four blades and four blade supports wherein each blade is attached to the lower surface of the flat portion of a blade support were prepared, and an intermittent laser marked area was formed on the upper surface of each one of the blade supports. The laser marking was carried out with the Laser scanner KEYENCE MD-X1020 in such way so as to obtain an intermittent laser marked area with the following features: 1 mm of marking length / 1 mm of spacing (distance) / 0.5 mm of marking width and a total marking area length of 34 mm. On top of said laser marked area, a protruding element comprising a styrene polymer and polyethylene oxide in the form of a continuous strip was extruded and attached on the blade support comprising the laser marked area.

[0123] The shaving cartridges were then used to prepare fifteen razors and the razors were tested in a panel comprising 15 users. The results illustrate that only 8 % of the (total) initial number of protruding elements were detached from the blade supports after the 8th shave. By "detached" is meant that at least 20 % of the length of the protruding element is detached from the blade support of the blade assembly.

Example 2 (comparative example):

[0124] Fifteen razor cartridges each one comprising a blade assembly comprising four blades and four blade supports wherein each blade is attached to the lower surface of the flat portion of a blade support were prepared. A protruding element comprising a styrene polymer and polyethylene oxide in the form of a continuous strip was extruded and attached on the blade support in the same way and conditions as in Example 1.

[0125] The razor cartridges were then used to prepare fifteen razors and the razors were tested in a panel comprising 15 users. The results illustrate that more than 50 % of the (total) initial number of protruding elements were detached from the razor during the 1st shave.

[0126] Based on the above, it is illustrated that the presence of a laser marked area allows to promote the

adhesion of the protruding element so as to prolong the use life of the razor.

Embodiments:

[0127] Although the present invention is defined in the attached claims, it should be understood that the present invention can also (alternatively) be defined in accordance with the following embodiments:

1. A blade assembly (5) comprising:

- at least one blade support (1), the at least one blade support (1) having a flat portion (1a) and a base portion (1b), the flat portion (1a) of the at least one blade support (1) comprising an upper surface (1a') and a lower surface (1a");
- at least one blade (2) having a cutting edge portion, the blade (2) being in contact with the flat portion (1a) of the at least one blade support (1);
- a laser marked area (3) on the at least one blade (2) and/or on the at least one blade support (1); and
- a protruding element (4) attached to the laser marked area (3), wherein the protruding element (4) comprises a water-insoluble component.

2. The blade assembly 5 according to embodiment 1, wherein the at least one blade (2) is attached to the lower surface (1a") of the flat portion (1a) of the blade support (1).

3. The blade assembly (5) according to embodiment 1 or embodiment 2, wherein the laser marked area (3) is located on the at least one blade support (1), more specifically on at least part of the flat portion (1a) of the at least one blade support (1), and in particular on at least part of the upper surface (1a') of the flat portion (1a) of at least one blade support (1).

4. The blade assembly 5 according to embodiment 2, wherein the protruding element (4) is located on the blade support (1), more specifically on at least part of the flat portion (1a) of the at least one blade support (1), and in particular on at least part of the upper surface (1a') of the flat portion (1a) of at least one blade support (1).

5. The blade assembly 5 according to embodiment 4, wherein the protruding element (4) is further located on the blade (2).

6. The blade assembly (5) according to any one of embodiments 1 to 5, wherein the laser marked area (3) comprises a textured surface, more specifically a textured surface comprising a micropattern, in particular a micropattern being formed by a plurality of

grooves.

7. The blade assembly (5) according to any one of embodiments 1 to 6, wherein the laser marked area (3) is in the form of a continuous mark (3a), more specifically a continuous mark (3a) along the length of the at least one blade (2) or on the at least one blade support (1), in particular a continuous mark (3a) along the length of the upper surface (1a') of the flat portion (1a) of the at least one blade support (1). 5 10

8. The blade assembly (5) according to any one of embodiments 1 to 6, wherein the laser marked area (3) is in the form of two or more discontinuous marks (3b), more specifically the discontinuous marks (3b) are spaced apart along the length of the at least one blade (2) or of the flat portion (1a) of the at least one blade support (1), in particular along the length of the upper surface (1a') of the flat portion (1a) of the at least one blade support (1). 15 20

9. The blade assembly (5) according to embodiment 8, wherein each discontinuous mark (3b) has a length from 0.2 to 20 mm, and more specifically from 0.5 to 2 mm. 25

10. The blade assembly (5) according to embodiments 8 or 9, wherein each discontinuous mark (3b) has a width from one another from 0.1 to 1.5 mm, and more specifically from 0.2 to 0.7 mm. 30

11. The blade assembly (5) according to any one of embodiments 8 to 10, wherein the discontinuous marks (3b) have the same width. 35

12. The blade assembly (5) according to embodiment 11, wherein the distance between neighboring discontinuous marks (3b) is equal to or lower than the width of the discontinuous marks (3b), and in particular equal to the width of the discontinuous marks (3b). 40

13. The blade assembly (5) according to any one of embodiments 8 to 10, wherein at least two of the discontinuous marks (3b) have a different width. 45

14. The blade assembly (5) according to any one of embodiments 8 to 13, wherein the distance between two neighboring discontinuous marks (3b) is from 0.2 to 20 mm, and more specifically from 0.5 to 2 mm. 50

15. The blade assembly (5) according to any one of embodiments 1 to 14, wherein the protruding element (4) has a width, and wherein the laser marked area (3) has a width, and wherein the width of the protruding element (4) is equal to or higher than the width of the laser marked area (3). 55

16. The blade assembly (5) according to any one of embodiments 1 to 15, wherein the protruding element (4) has a width from 0.02 to 1.0 mm, and more specifically from 0.10 to 1.0 mm.

17. The blade assembly (5) according to any one of embodiments 1 to 16, wherein the protruding element (4) has a length from 10 to 40 mm, and more specifically from 30 to 36 mm.

18. The blade assembly (5) according to any one of embodiments 1 to 17, wherein the protruding element (4) has the form of a continuous strip.

19. The blade assembly (5) according to any one of embodiments 1 to 17, wherein the protruding element (4) has the form of a discontinuous strip, more specifically wherein the discontinuous strip comprises two or more intermittent protruding parts, and in particular wherein each intermittent protruding part has a length from 0.2 to 20 mm, and more specifically from 0.5 to 2 mm.

20. The blade assembly (5) according to any one of embodiments 1 to 19, wherein the water-insoluble component is chosen from polystyrene, styrene copolymers, polyethylene, polypropylene, polyacetal, acrylonitrile-butadiene-styrene copolymer, ethylene vinyl acetal copolymer, polylactic acid, polycarbonate, maleic anhydride ethylene co-polymer blends, polyether-containing block copolymers, blends and copolymers, and thermoplastic elastomer compounds, more specifically thermoplastic poly-urethanes, silicone polymers, and mixtures thereof.

21. The blade assembly (5) according to any one of embodiments 1 to 20 wherein the protruding element (4) further comprises a water-soluble component, more specifically a water-soluble component chosen from polyethylene oxide, polyethylene glycol, polyvinyl pyrrolidone, polyacrylamide, polyhydroxymethacrylate, polyvinyl imidazoline, polyvinyl alcohol, polyhydromethymethacrylate, silicone polymers, blends and copolymers of the above.

22. The blade assembly (5) according to any one of embodiments 1 to 21, further comprising an adhesive, more specifically an adhesive layer.

23. The blade assembly (5) according to embodiment 22, wherein the adhesive is located between the protruding element (4) and the laser marked area (3).

24. The blade assembly (5) according to claims 22 or 23, wherein the adhesive is chosen from a hot melt type adhesive, a cyanoacrylate adhesive, a polyvinyl acetate adhesive, a pressure-sensitive adhesive, an

epoxy adhesive, an acrylic adhesive, an acrylate adhesive, a methacrylate ester adhesive, a polyurethane adhesive, a thermally rearranged adhesive, a silicone adhesive and combinations thereof.

25. A razor cartridge (6) comprising:

- the blade assembly (5) according to any one of embodiments 1 to 24, and
- a housing,

wherein the at least one blade (2) and/or at least one blade support (1) is partially exposed through an opening of the housing.

26. A razor comprising (7):

- a razor handle (8), and
- the razor cartridge (6) according to embodiment 25.

27. The razor (7) according to embodiment 26, wherein the razor cartridge (6) is either releasably attached to the razor handle (8) via a pivotable or non-pivotable connection, integrally formed with the razor handle (8) via a non-pivotable connection, or integrally formed with the razor handle (8) via a pivotable connection.

28. A kit of parts comprising:

- a razor handle (8), and
- a razor cartridge holder comprising at least two razor cartridges (6) according to embodiment 25.

Claims

1. A blade assembly (5) comprising:

- at least one blade support (1), the at least one blade support (1) having a flat portion (1a) and a base portion (1b), the flat portion (1a) of the at least one blade support (1) comprising an upper surface (1a') and a lower surface (1a'');
- at least one blade (2) having a cutting edge portion, the blade (2) being in contact with the flat portion (1a) of the at least one blade support (1);
- a laser marked area (3) on the at least one blade (2) and/or on the at least one blade support (1); and
- a protruding element (4) attached to the laser marked area (3), wherein the protruding element (4) comprises a water-insoluble component.

2. The blade assembly 5 according to claim 1, wherein the at least one blade (2) is attached to the lower

surface (1a'') of the flat portion (1a) of the blade support (1).

3. The blade assembly (5) according to claim 1 or claim 2, wherein the laser marked area (3) is located on the at least one blade support (1), more specifically on at least part of the flat portion (1a) of the at least one blade support (1), and in particular on at least part of the upper surface (1a') of the flat portion (1a) of at least one blade support (1).

4. The blade assembly 5 according to claim 2, wherein the protruding element (4) is located on the blade support (1), more specifically on at least part of the flat portion (1a) of the at least one blade support (1), and in particular on at least part of the upper surface (1a') of the flat portion (1a) of at least one blade support (1), and optionally wherein the protruding element (4) is further located on the blade (2).

5. The blade assembly (5) according to any one of claims 1 to 4, wherein the laser marked area (3) comprises a textured surface, more specifically a textured surface comprising a micropattern, in particular a micropattern being formed by a plurality of grooves.

6. The blade assembly (5) according to any one of claims 1 to 5, wherein the laser marked area (3) is in the form of a continuous mark (3a), more specifically a continuous mark (3a) along the length of the at least one blade (2) or on the at least one blade support (1), in particular a continuous mark (3a) along the length of the upper surface (1a') of the flat portion (1a) of the at least one blade support (1).

7. The blade assembly (5) according to any one of claims 1 to 5, wherein the laser marked area (3) is in the form of two or more discontinuous marks (3b), more specifically the discontinuous marks (3b) are spaced apart along the length of the at least one blade (2) or of the flat portion (1a) of the at least one blade support (1), in particular along the length of the upper surface (1a') of the flat portion (1a) of the at least one blade support (1).

8. The blade assembly (5) according to claim 7, wherein the discontinuous marks (3b) have the same width, and more specifically wherein the distance between neighboring discontinuous marks (3b) is equal to or lower than the width of the discontinuous marks (3b), and in particular equal to the width of the discontinuous marks (3b).

9. The blade assembly (5) according to any one of claims 1 to 8, wherein the protruding element (4) has a width, and wherein the laser marked area (3) has a width, and wherein the width of the protruding

element (4) is equal to or higher than the width of the laser marked area (3).

10. The blade assembly (5) according to any one of claims 1 to 9, wherein the water-insoluble component is chosen from polystyrene, styrene co-polymers, polyethylene, polypropylene, polyacetal, acrylonitrile-butadiene-styrene copolymer, ethylene vinyl acetal copolymer, polylactic acid, polycarbonate, maleic anhydride ethylene co-polymer blends, polyether-containing block copolymers, blends and copolymers, and thermoplastic elastomer compounds, more specifically thermoplastic poly-urethanes, silicone polymers, and mixtures thereof. 5
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11. The blade assembly (5) according to any one of claims 1 to 10 wherein the protruding element (4) further comprises a water-soluble component, more specifically a water-soluble component chosen from polyethylene oxide, polyethylene glycol, polyvinyl pyrrolidone, polyacrylamide, polyhydroxymethacrylate, polyvinyl imidazoline, polyvinyl alcohol, polyhydromethymethacrylate, silicone polymers, blends and copolymers of the above. 15
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12. The blade assembly (5) according to any one of claims 1 to 11, further comprising an adhesive, more specifically an adhesive layer, and in particular the adhesive is located between the protruding element (4) and the laser marked area (3). 30
13. A razor cartridge (6) comprising:
 - the blade assembly (5) according to any one of claims 1 to 12, and 35
 - a housing,

wherein the at least one blade (2) and/or at least one blade support (1) is partially exposed through an opening of the housing. 40
14. A razor comprising (7):
 - a razor handle (8), and
 - the razor cartridge (6) according to claim 13, 45

more specifically wherein the razor cartridge (6) is either releasably attached to the razor handle (8) via a pivotable or non-pivotable connection, integrally formed with the razor handle (8) via a non-pivotable connection, or integrally formed with the razor handle (8) via a pivotable connection, 50
15. A kit of parts comprising: 55
 - a razor handle (8), and
 - a razor cartridge holder comprising at least two razor cartridges (6) according to claim 13.

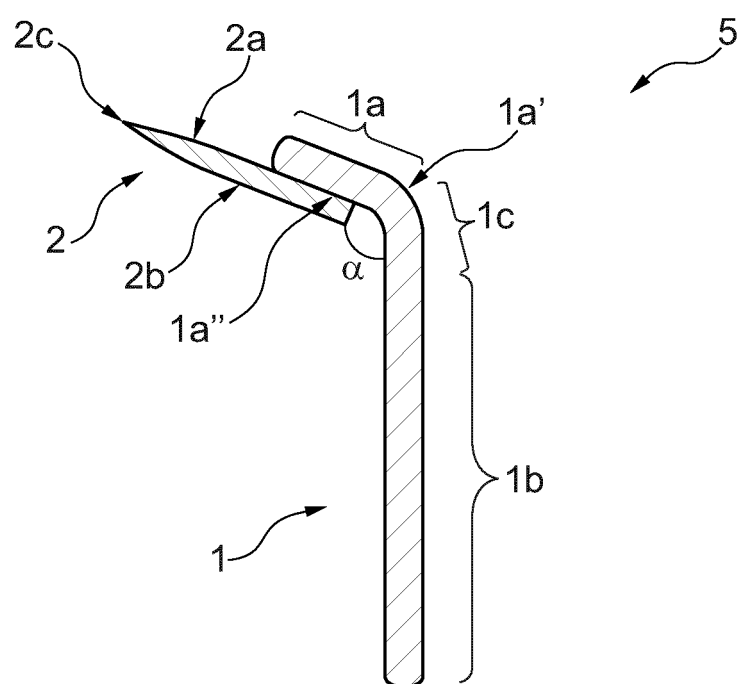


Fig. 1

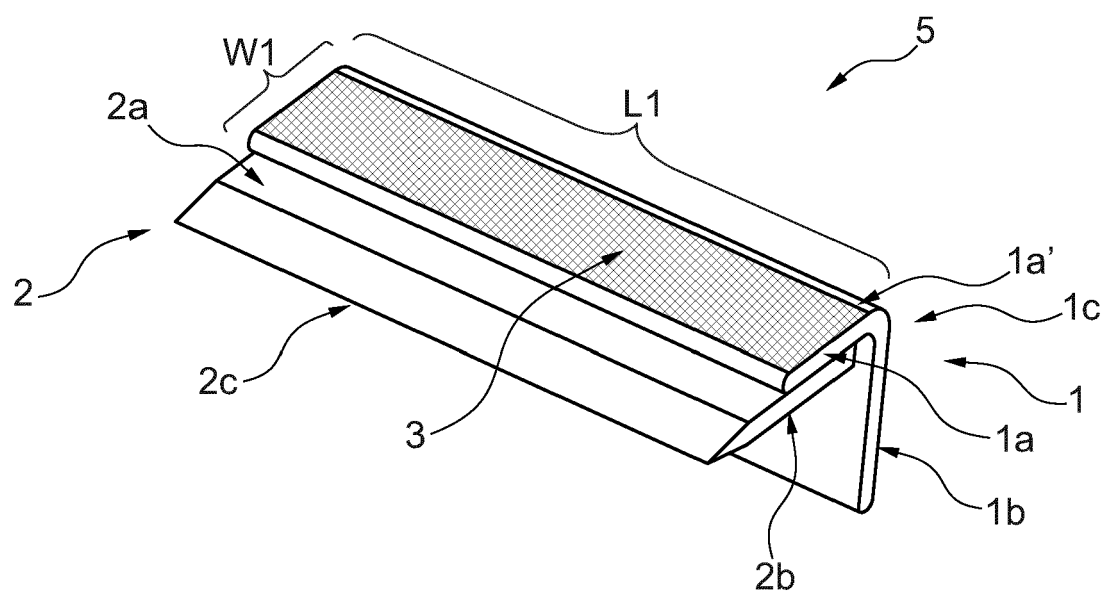


Fig. 2

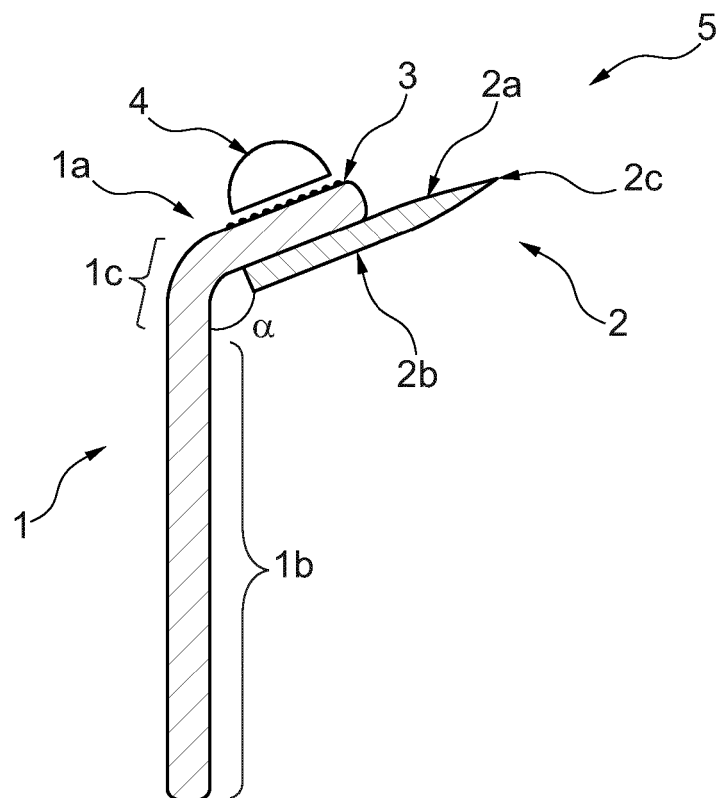


Fig. 3

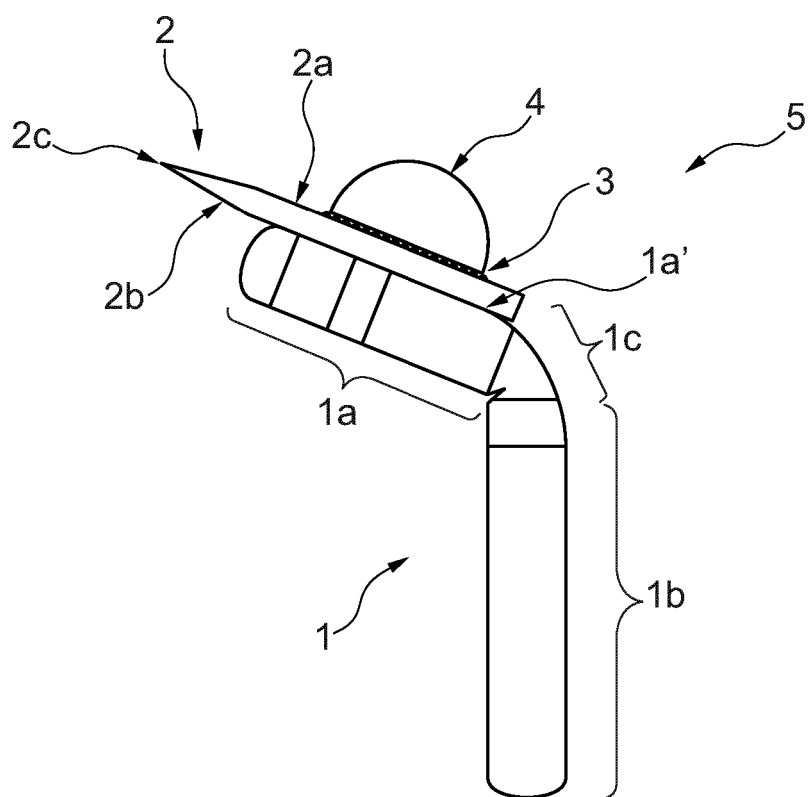
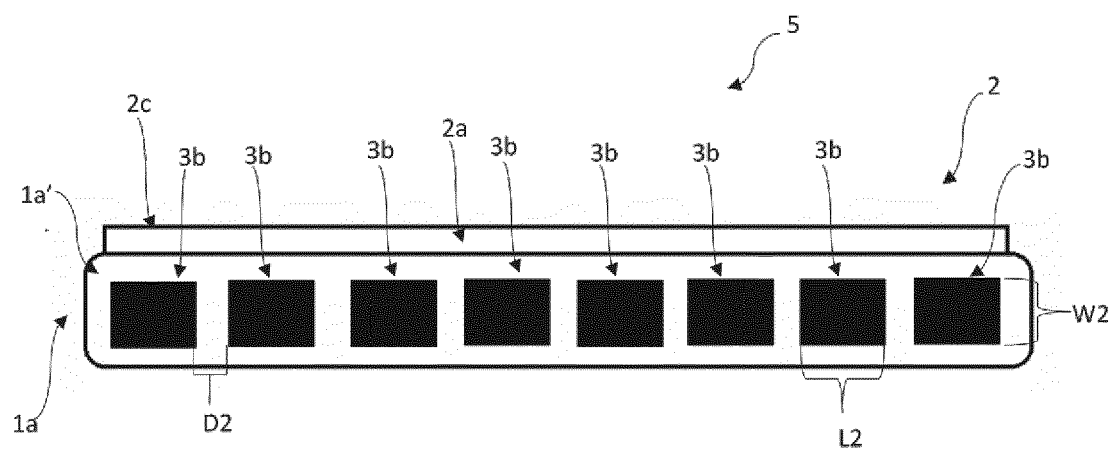
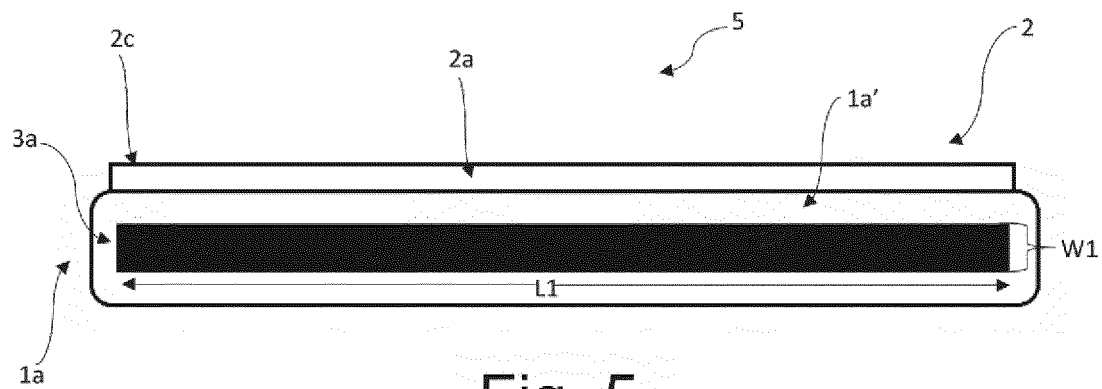
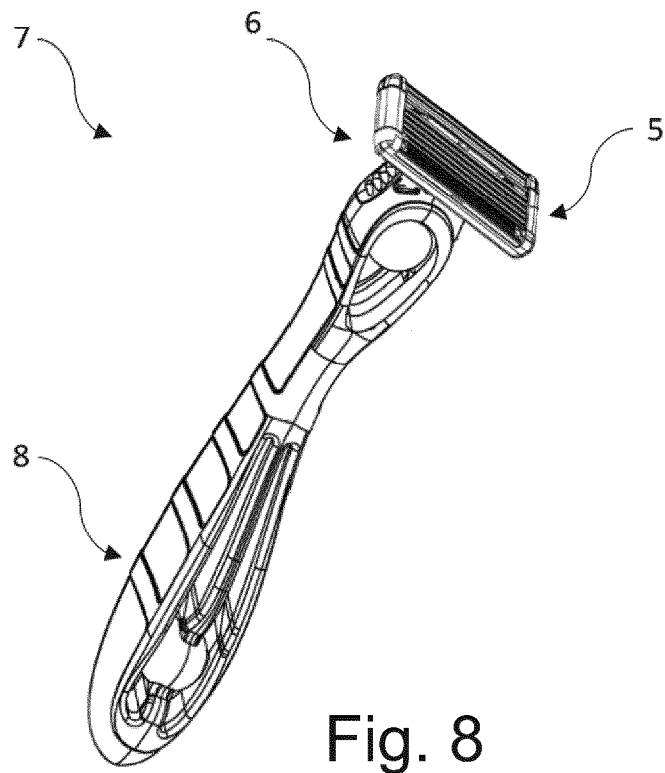
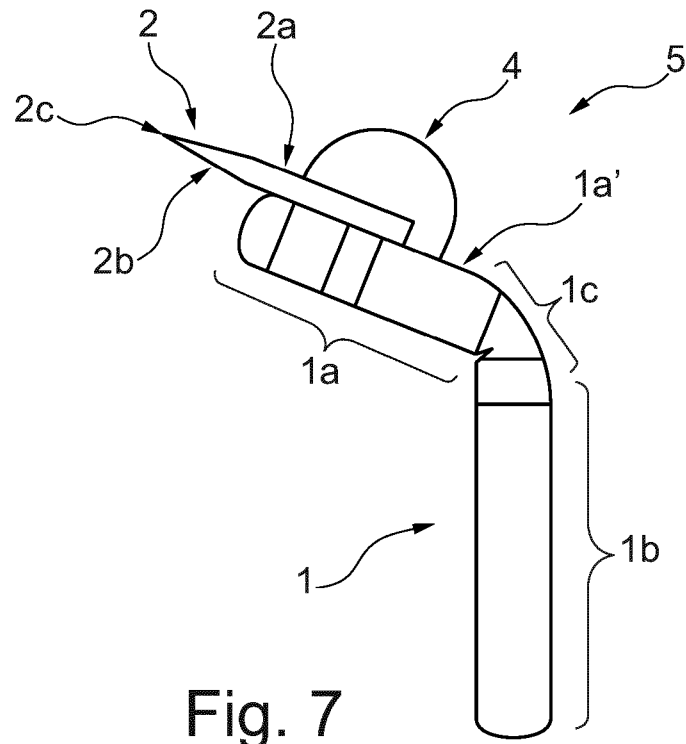


Fig. 4







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Application Number

EP 23 21 4784

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			B26B
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 18 April 2024	Examiner Schouten, Adri
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