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(54) **RAZOR BLADE TECHNOLOGY**

RASIERKLINGENTECHNOLOGIE

TECHNOLOGIE DE LAME DE RASOIR

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(56) References cited:
WO-A2-97/10083
US-A- 3 754 329
US-A- 5 416 974
US-A- 5 560 105
US-A1- 2003 121 158
US-A1- 2005 198 830
US-A1- 2006 242 844
US-A1- 2006 277 759
US-A1- 2006 277 759

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Description

Background

1. Technical Field

[0001] The present disclosure relates to razor blades for razor cartridges in general and, more particularly, to a method of manufacturing a razor blade. 2. Background

[0002] Many modem safety razors include a disposable razor cartridge adapted to be selectively connected to a reusable handle by connecting structure therebetween. The cartridge includes a housing having at least one razor blade with a cutting edge disposed therein. Other modern safety razors include a razor cartridge permanently connected to the handle that can be disposed of as a single unit.

[0003] In U.S. -B-7,681,314, the desirability of providing a razor blade assembly including an inter-blade guard joined to a razor blade is disclosed. The provision of an inter-blade guard permits adjacent cutting edges to be spaced sufficiently far apart in their razor cartridge to allow adequate rinsing of debris from the space between adjacent blades and any respective support structure while the inter-blade guard provides a skin engaging / skin supporting surface between adjacent cutting edges to control skin bulge and provide improved shaving comfort and reduction of nicks and cuts. The inter-blade guard is mounted on the razor blade in a position generally visible to a user during normal use and handling of the safety razor.

[0004] A razor cartridge including a razor blade having a bent portion can have certain advantages and there have been many proposals to provide a razor cartridge with such a razor blade. However, such razor cartridges have not been successfully commercialized or at least not manufactured on a scale that is significant in a mass market such as that of razor cartridges. Many manufacturers emulate a bent razor blade by mounting a generally planar razor blade on a bent support made from a material both thicker and softer than a typical hardened razor blade. U.S. -A-4,586,255 discloses a typical construction of a blade mounted on a support. The supoprt is mounted on the opposed side of the razor blade to the blade guard as disclosed in US-B-7,681,314 and is at least partially hidden from view by a user during normal use and handling of the safety razor.

[0005] Modem safety razors are normally used and can be stored by a user in a more or less wet or humid environment. In normal use, the razor blades of a razor cartridge are brought into contact with mildly corrosive substances, such as the constituents of sweat, soap, and shaving aids such as shaving foam or gel. Also the nature and composition of tap water (which is generally used for shaving) can vary from city to city. In view of these ambient conditions, martensitic stainless steels have become widely used as a corrosion-resisting material for making razor blades having a high level of cutting quality.

[0006] The inter-blade guard on the other hand is preferably manufactured from a fully annealed low-carbon stainless steel such as grade AISI 301 / DIN 1.4310. This material is chosen for several reasons including ease of forming its desired profile, such as those disclosed in US-B-7,681,314. For convenience of assembly, the inter-blade guard can be joined by welding, e.g. laser spot welding, to its respective razor blade.

[0007] Small compositional differences can thus exist between the razor blade and its inter-blade guard assembled thereto. In use, moisture and other constituents can be trapped and retained between the razor blade and its inter-blade guard. This can act as an electrolyte and thus the razor blade, inter-blade guard and moisture therebetween can comprise an electrochemical cell that can result in localized electrochemical corrosion of the razor blade. As the inter-blade guard is mounted on the razor blade in a position visible to a user any such corrosion can also be visible to a user and can be at least considered unsightly and may cause real or perceived premature failure of the razor blade and thus razor cartridge having such a razor blade assembly. Moreover, many modem safety razor cartridges can have an extended useful life compared to earlier razor cartridges. Improved coatings on cutting edges (e.g. hard carbon) can increase the useful life of the cutting edge and improvements in the composition or construction of so-called lubricating strips can extend the life of the lubricating strip. A modern safety razor cartridge having an extended life has more opportunity to suffer corrosion during its life than an earlier razor cartridge.

Summary:

[0008] The present disclosure has for its objective to eliminate, or at least substantially alleviate the limitations of the prior art razor blade assemblies.

[0009] The present disclosure in one aspect is directed to a method of manufacturing a razor blade assembly for a razor cartridge, comprising the steps of providing an elongated strip of stainless steel of a first composition, the strip including a front edge and a first side, processing the strip to effect a martenstic transformation to harden the strip, and providing a cutting edge extending along the front edge of the elongated strip. The strip is cut into lengthwise extending portions to provide discrete razor blades having a length suitable for use in a razor cartridge housing. A chromium oxide layer is formed on the first side of the razor blade by a thermal oxidation process. An inter-blade guard is permanently joined to the first side of the razor blade. The razor blade and the inter-blade guard comprise stainless steels of different compositions and the layer of chromium oxide prevents or delays the onset of user-visible electrochemical corrosion of the first side of the razor blade. The razor blade assembly is assembled to a housing to provide a razor cartridge. A predetermined array of closely spaced droplets of a liquid adapted to inhibit corrosion of the razor

blade can be applied to a portion of the first side of the razor blade; a portion of a skin engaging surface of the inter-blade guard and can penetrate a gap between the first side and the inter-blade guard to further prevent or delay the onset of user-visible electrochemical corrosion of the first side of the razor blade. The application of the array of droplets a liquid adapted to inhibit corrosion of the razor blade is preferably performed to the assembled razor cartridge. The droplet array is preferably restricted to the razor blade assembly and suitably controlled so that the aforementioned liquid is not unnecessarily applied to e.g. outer surfaces of the housing.

[0010] These and other advantages of the present disclosure will be apparent to one of ordinary skill in the art in light of the following Detailed Description and Drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011]

Fig. 1 is a sectional view of an embodiment of a razor blade and an inter-blade guard.

Fig. 2 is a schematic view of an embodiment of process equipment to provide a chromium oxide layer.

Fig. 3 is a schematic cross section of a razor cartridge including a razor blade and inter-blade guard.

Fig. 4 is a schematic plan view of apparatus to deposit a liquid corrosion inhibitor to a razor cartridge.

Fig. 5 is a schematic plan view of the razor cartridge of Fig. 3 after processing in the apparatus of Fig. 4.

DETAILED DESCRIPTION

[0012] Referring now to the drawings, and in particular Fig. 1, a sectional view of a razor blade assembly 10 for use in a razor cartridge (100 in Fig. 3) is depicted. A razor blade 20 includes a stainless steel substrate, which typically has a thickness of about 0.05 - 0.10 mm. The stainless steel typically contains about 0.4 to 0.7% carbon and about 12 to 13.5% chromium, both by weight. The stainless steel has been hardened to effect a martensitic transformation to harden the substrate material to e.g. 700-850HV. In the present disclosure, HV designates hardness measured on the Vickers scale at a 1.0kg load. The blade 20 has a cutting edge 22 and a body 24 having a first side and a second side, 26, 28 respectively. An inter-blade guard 30 is attached to the first side 26 of the razor blade 20. The inter-blade guard 30 includes a surface 36 adapted to contact a skin surface of a user during a normal use of the razor cartridge. Further desired features and function of the inter-blade guard 30 are disclosed in the aforementioned U.S. -B-7,681,314.

[0013] The inter-blade guard 30 is preferably manufactured from an annealed low-carbon austenitic stainless steel such as grade AISI 301 (DIN 1.4310) and has a thickness preferably in the range about 0.05 - 0.076mm although the present disclosure is not limited in this regard and other materials that may be readily formed to a desired profile and/or joined to the razor blade 20 may be usefully employed. The inter-blade guard 30 is permanently joined to the razor blade for example by a known laser spot welding process (Fig. 1 sectionally depicts the welding zone 32). Other joining methods may also be employed such as use of a suitable adhesive such as an epoxy (e.g. a two-part epoxy) or cyanoacrylate.

[0014] The razor blade assembly 10 can also comprise a support member 40 as is well known in the art.

[0015] The razor blade 20 is manufactured as follows. First, a rolled sheet of stainless steel is slit into elongated strips. The strips can be perforated for ease of handling during subsequent processing. Other pre-hardening steps, such as scoring, may be performed, if desired.

[0016] When the desired sequence of pre-hardening steps has been completed, the strip is subjected to a hardening process, which includes austenitization of the stainless steel. The hardening process is conducted in a first muffle furnace or tunnel oven. The strip is provided in coil form and is uncoiled and fed into the furnace where it is quickly ramped up to a high temperature, e.g., approximately 1160°C, maintained at this temperature for a period of time, during which austenization of the stainless steel occurs. The strip is then rapidly quenched (e.g. in an ice-box) to a low temperature e.g. approximately -70°C, to effect a martensitic transformation of the stainless steel substrate material. The strip is recoiled and passes to subsequent processes. The hardness of the strip thus processed has a hardness approximately 700-850HV.

[0017] The strip is subsequently sharpened by known process steps to provide a cutting edge. After the process to provide a cutting edge the strip can be severed into lengthwise extending portions to provide razor blades having a length suitable for use in a razor cartridge and stacked one upon the other in suitable carriers or the strip can be recoiled for further processing. If necessary, the stack of razor blades (or recoiled strip) is then cleaned by any one of a number of processes known in the art to remove residues from the sharpening process and other contamination. Coatings are applied to the cutting edge that can be metallic (e.g. titanium, niobium or chromium), ceramic (e.g. chromium nitride) or hard carbon (e.g. amorphous diamond or DLC (diamond-like carbon) or combinations thereof and a further outer layer of a low friction coating of a fluorinated polymer such as PTFE is applied. The PTFE is applied by spraying a suspension of PTFE particles in a suitable medium such as water and/or alcohol on to the cutting edge(s). To effect a continuous adherent (i.e. cured) film of PTFE, the razor blades in their carrier or the strip in its coil are loaded on a conveyor and passed through a second muffle furnace

or tunnel oven at approx 360°C to cure the PTFE. Reheating the razor blades to perform the PTFE curing process has the effect of partially annealing the razor blades to a hardness about 600HV or more, e.g. about 680HV. The process equipment is schematically shown in Fig. 2 which depicts stacked blades in carriers 48 that are transported on conveyor 50 though furnace 60.

[0018] As previously mentioned, modem safety razors are normally used in a wet environment and can be stored by a user in a variably humid environment. When used, the razor blades of a razor cartridge are brought into contact with a variety of mildly corrosive substances in a variety of concentrations, such as the constituents of sweat, soap, and shaving aids such as shaving foam or gel. Furthermore, the composition of typical tap water as is generally used for shaving can vary from city to city. Moreover, modem safety razor cartridges can have an extended useful life compared to earlier razor cartridges. Improved coatings on cutting edges (e.g. hard carbon) can increase the useful life of the cutting edge and improvements in the composition or construction of so-called lubricating strips can extend the life of the lubricating strip of the razor cartridge. A modem safety razor cartridge having an extended life has more opportunity to suffer corrosion during its life than an earlier razor cartridge.

[0019] To enhance corrosion resistance of the stainless steel material of the razor blade 20 over a range of possible use environments a chromium oxide layer is formed on outer sides 26, 28 of the razor blade 20 by a thermal oxidation process. The razor blade is introduced into an atmosphere of clean dry air at approximately 160°C to 215°C, e.g. 190°C. In simplified terms, the aforementioned hardening process converts a portion of the chromium and carbon of the stainless steel material to chromium carbide which partially provides the cited hardness. Some chromium remains unreacted with carbon and this so-called free chromium at the surface of the stainless steel is oxidized as follows to form a corrosion resisting chromium oxide layer on the stainless steel substrate.

[0020] The razor blades 20 in their carrier are passed through a third muffle furnace or tunnel oven 70 that is preferably arranged sequentially with the second furnace 60 to advantageously benefit from the provision of the conveyor 50 for the PTFE curing process. The furnace is set to the aforementioned temperature 160°C to 215°C, e.g. 190°C and clean dry air 80 at ambient temperature is passed through the furnace muffle tube 82 in the direction indicated or in the reverse direction. The aforementioned temperature range is selected to avoid any significant further partial annealing of the razor blades. A chromium oxide layer is formed on the outer sides of the razor blades.

[0021] The thickness of the chromium oxide layer is preferably controlled to about 10nm to about 15nm thick (about 100Å to about 150Å). A thickness less than about 10nm is less preferred as the razor blade can lack a desired increase in corrosion resistance. A thickness more than about 15nm is less preferred as the corrosion resistance of the razor blade is not proportionately increased. Also a thickness of more than about 15nm can result in an undesirable color change of the surface of the razor blade that can be subjectively recognized by a casual observer. Preferably the thickness of the chromium oxide layer does not substantially alter the color of the razor blade as a color change can be deemed commercially undesirable for a razor blade or a razor cartridge including such a razor blade. Control of the thickness of the chromium oxide layer can be controlled by primarily adjusting the time the strip is in the furnace (e.g. by adjusting the conveyor speed) and/or the temperature of the furnace and secondarily by adjusting the air flow rate through the muffle tube of the furnace.

[0022] In other embodiments the third furnace can be arranged separately from the second furnace. The third furnace can also be arranged sequentially with the first furnace and ice-box in which case the oxide layer is formed on the strip before the provision of the cutting edge and subsequent coatings. As an alternative to use of a muffle furnace the third furnace can also be a sealed furnace and blade carriers or entire coils of strip can be processed therein in a so-called batch process.

[0023] It is known to provide a chromium oxide layer up to about 8nm (80Å) thick by chemical or electrochemical passivation. However, this process is undesirable in present-day manufacturing for various reasons including: capital cost; the environmental impact of use and subsequent disposal of the chemicals required and general storage, health and safety issues.

[0024] Corrosion resistance of strip or of a razor blade made from the strip or a razor cartridge including such a razor blade is assessed in an accelerated corrosion test as follows:

a) A test specimen that can be include a portion of strip or a razor blade made from the strip or a razor cartridge including such a razor blade is dipped in a 0.2% salt solution at 60°C for 10 seconds.

b) The specimen is removed from the solution and placed in a Temperature/Humidity oven at 60°C, 95% RH (relative humidity) for 25 minutes.

c) The specimen is removed from the oven and visually inspected at up to 2.5X magnification and any corrosion is compared to a predefined severity rating scale.

d) Steps a) to c) are repeated for a total of 15 cycles.

[0025] Referring back to Fig. 1, the razor blade 20 can be joined to a metallic support 40 as is well known in the art, e.g. as disclosed in US-A-4,586,255. An inter-blade guard 30 (as previously described) is joined to a side of the razor blade 20, the side being visible to a user during normal use and handling of the safety razor including such a razor blade 20. As can be seen in Fig. 1 certain narrow gaps 34 exist between the razor blade 20 and the

inter-blade guard 30 that can trap moisture and/or a dilute mildly corrosive substance after use and retain said moisture etc by capillary/surface tension effects. As previously mentioned, the composition of the stainless steels of the razor blade 20 and the inter-blade guard 30 can be slightly different. Without the protective chromium oxide layer on the razor blade acting as an insulator an electrochemical cell could be created of an anode and cathode being the razor blade 20 and inter-blade guard 30 and an electrolyte being the moisture etc. thus resulting in electrochemical corrosion that will occur on the razor blade 20 on a side visible to a user and that could be sufficient to be undesirably visible to the user.

[0026] Referring now to Fig. 3 an exemplary schematic cross section of a razor cartridge 100 including a razor blade and inter-blade guard assembly 10 is depicted. The razor cartridge 100 can be generally as disclosed in US-A-4568255 or can be another type of razor cartridge and the present disclosure is not limited to the type of razor cartridge. The razor cartridge can also include more than two razor blade assemblies 10, e.g. three, four or more and the present disclosure is not limited to the number of razor blade assemblies 10 in the razor cartridge. The cartridge includes a housing 110 that comprises a guard 112, a cap 114 and a blade mounting region 116. A (vertical) portion of the blade support 40 is disposed in slots 126 of the end wall 118 of the housing 110 to provide independent movement of each blade assembly under the forces encountered during shaving. The guard 112 and the cap 114 can comprise, respectively, elastomeric and lubricious elements 122, 124, as are well known in the art. A spring element 130 can be provided as is well known in the art.

[0027] Referring now to Fig. 4, apparatus for a further advantageous process to inhibit corrosion of a razor blade assembly of a razor cartridge is schematically depicted in plan view. This process can be performed in addition to, or in the alternative to the thermal oxidation process previously described. After assembly of a razor cartridge, e.g. a razor cartridge as depicted in Fig. 3, the razor cartridge 100 is placed on a conveyor 150, preferably in a nest 152 of a conveyor, preferably an indexing conveyor. The razor cartridge 100 is positioned so that the cutting edges 22 and inter-blade guards 30 of the blade assemblies 10 are exposed. During the indexing dwell at position 154 spray head 160 passes over the cartridge 100 preferably in a direction transverse to the direction of motion of the conveyor 150. The spray head 160 has a controlled spray pattern to deposit a predetermined closely packed array 170 (see Fig. 5) of droplets of a liquid rust inhibitor / oil mix on the exposed surfaces of the blade assemblies of the razor cartridge. Preferably the spray pattern is restricted to the aforementioned surfaces of the blade assemblies 10 and is not unnecessarily applied to e.g. outer surfaces of the housing 110. In order to achieve suitable control of the spray pattem preferably the spray head 160 is an ink-jet spray head modified to spray a predetermined array of rust inhibitor / oil mix in place of ink. A suitable ink jet spray head 160 is a SCANTRUE II provided by TRIDENT. Modification of the spray head to be suitable for the aforementioned mix includes replacing the internal seals (e.g. "O" rings) with seals of VITON material to resist deterioration from contact with the aforementioned mix. The rust inhibitor / oil mix is also formulated to have a viscosity approximately equivalent to typical inks used in such ink-jet equipment, e.g. about 7 - 10 centistokes and preferably comprises (each by volume) 10% rust inhibitor such as CRODASINIC-O and/or CRODAZOLINE-O both provided by CRODA INC and more preferably comprises 5% of each rust inhibitor. The mixture further preferably comprises 70% mineral oil such as Naphtha Hydrotreated Heavy oil provided by EXXON MOBIL. The mixture further preferably comprises 20% mineral spirits, e.g. odourless mineral spirits. The rust inhibitor / oil mix preferably avoids separation to its constituent parts over an extended period, e.g. 25 days or more. The rust inhibitor / oil mix also preferably has a surface tension low enough to resist beading on the exposed surfaces of the blade assemblies of the razor cartridge. The spray pattern of the spray head 160 can be programmed by conventional ink-jet spray control equipment to spray a closely packed array of droplets as previously mentioned. The spray head 160 can be arranged to pass over each razor cartridge 100 once, twice (i.e. by a forward and back motion synchronized to each index of the conveyor) or more times depending on the desired deposition quantity of the mix. As the spray head 160 is programmable razor cartridges 100 having various exposed blade arrangements can be accommodated, e.g. the exposed arrangement can be rectangular, trapezoidal, oval etc. The total quantity of rust inhibitor / oil mix thus applied can be about 2 mg per razor cartridge 100. As the rust inhibitor / oil mix is a liquid, some liquid thus applied will flow at least partially into the gap 34 between the razor blade 20 and the inter-blade guard 30 by capillary action. This can delay or prevent the aforementioned ingress of moisture and/or a dilute mildly corrosive substance into the gap 34 and in turn delay or prevent the onset of user-visible electrochemical corrosion. Also as the rust inhibitor / oil mix remains liquid and resists beading, over a short time the droplets will spread and eventually merge with adjacent droplets to provide a substantially continuous film over the applied surfaces. In an accelerated corrosion test as previously described, a razor cartridge treated by this apparatus can have threshold for unacceptable corrosion greater than 2-3 times that of an untreated razor cartridge 100.

[0028] While various embodiments have been described above, it should be understood that they have been presented by way of example only, and not limitation. For instance, modifications or changes as can be made within the scope of the attached claims and features disclosed in connection with any one embodiment can be used alone or in combination with each feature of the respective other embodiments. Thus, the breadth and scope of any embodiment should not be limited by

any of the above described exemplary embodiments, but should be defined only in accordance with the following claims.

Claims

1. A method of making a razor blade assembly for a razor cartridge, comprising the steps of:

   a) providing a razor blade (20) comprising a stainless steel of a first composition, the razor blade (20) having a first side (26) and a cutting edge (22) extending along a front edge thereof, the razor blade (20) further having been processed to effect a martensitic transformation thereof to harden the razor blade (20);
   b) providing a chromium oxide layer on the first side (26) by a thermal oxidation process; and
   c) permanently joining an inter-blade guard (30) to the first side (26) of the razor blade (20), the inter-blade guard (30) comprising a stainless steel of a second composition and including a surface adapted to contact a skin surface of a user during a normal use of the razor cartridge (100) including the razor blade assembly (10).

2. The method of claim 1, further comprising the step of applying to at least a portion of the first side (26) of the razor blade (20) an array (170) of closely spaced droplets of a liquid adapted to inhibit corrosion of the razor blade (20).

3. The method of claim 1 or 2, further comprising the step of assembling the razor blade assembly (10) to a housing (110), the resultant assembly comprising the razor cartridge (100); and wherein the step of applying the array (170) of closely spaced droplets of a liquid adapted to inhibit corrosion of the razor blade (20) occurs after the razor blade (20) is assembled to the housing (110).

4. The method of any one of claims 1 to 3, wherein the chromium oxide layer is between about 10 nm and 15 nm thick, and wherein the chromium oxide layer does not substantially alter a color of the first side (26) of the razor blade (20).

5. A method of making a razor blade assembly for a razor cartridge, comprising the steps of:

   a) providing a razor blade (20) comprising a stainless steel of a first composition, the razor blade (20) having a first side (26) and a cutting edge (22) extending along a front edge thereof;
   b) permanently joining an inter-blade guard (30) to the first side (26) of the razor blade (20), the inter-blade guard (30) comprising a stainless steel of a second composition and including a surface (36) adapted to contact a skin surface of a user during a normal use of the razor cartridge (100) including the razor blade assembly (10); and
   c) applying to at least a portion of the first side (26) of the razor blade (20) an array (170) of closely spaced droplets of a liquid adapted to inhibit corrosion of the razor blade (20).

6. A razor cartridge, comprising:

   - a housing (110); and
   - a razor blade assembly (10), the razor blade assembly (10) including a razor blade (20) having a first side (26) and an inter -blade guard (30) permanently attached to the first side (26) of the razor blade (20);
   - wherein the inter-blade guard (30) includes a skin engaging surface adapted to contact a skin surface of a user during a normal use of the razor cartridge (100); **characterized in that**
   - the razor blade (20) comprises stainless steel of a first composition and the inter-blade guard (30) comprises stainless steel of a second composition different from the first composition; and
   - the first side (26) of the razor blade (20) includes a chromium oxide layer.

7. The razor cartridge of claim 6; further comprising an array (170) of droplets of a liquid adapted to inhibit corrosion of the razor blade (20) on at least a portion of the first side (26) of the razor blade (20).

8. The razor cartridge of claim 7, wherein the array (170) of droplets of a liquid adapted to inhibit corrosion of the razor blade is further on at least a portion of the skin engaging surface of the inter-blade guard.

9. The razor cartridge of claim 7 or 8, wherein the array (170) of droplets of a liquid adapted to inhibit corrosion of the razor blade (20) is further in at least a portion of a gap (34) between the first side (26) of the razor blade (20) and the inter-blade guard (30).

10. The razor cartridge of any one of claims 6 to 9, wherein the chromium oxide layer is between about 10 nm and 15 nm thick, and wherein the chromium oxide layer does not substantially alter a color of the first side (26) of the razor blade (20).

11. The razor cartridge of any one of claims 6 to 10, wherein the chromium oxide layer is provided by a thermal oxidation process.

Patentansprüche

1. Verfahren zum Herstellen einer Rasierklingenvorrichtung für eine Rasierer-Cartridge, mit den Schritten:

   a) Bereitstellen einer Rasierklinge (20), die einen rostfreien Stahl einer ersten Zusammensetzung aufweist, wobei die Rasierklinge (20) eine erste Seite (26) und eine entlang eines Vorderrandes der Klinge verlaufende Schneidkante (22) hat, wobei die Rasierklinge (20) ferner zum Bewirken einer martensitischen Transformation der Klinge verarbeitet ist, um die Rasierklinge (20) zu härten;
   b) Erzeugen einer Chromoxidschicht auf der ersten Seite (26) durch einen thermischen Oxidationsvorgang; und
   c) dauerhaftes Verbinden einer Zwischenklingen-Schutzvorrichtung (30) mit der ersten Seite (26) der Rasierklinge (20), wobei die Zwischenklingen-Schutzvorrichtung (30) einen rostfreien Stahl einer zweiten Zusammensetzung aufweist und eine Oberfläche hat, die in der Lage ist, während einer normalen Benutzung- der mit der Rasierklingenvorrichtung (10) versehenen Rasierer-Cartridge (100) eine Hautoberfläche eines Benutzers zu kontaktieren.

2. Verfahren nach Anspruch 1, ferner mit dem Schritt des Aufbringens eines Arrays (170) eng beabstandeter Tröpfchen einer Flüssigkeit, die zum Verhindern einer Korrosion der Rasierklinge (20) in der Lage ist, auf mindestens einen Teil der ersten Seite (26) der Rasierklinge (20).

3. Verfahren nach Anspruch 1 oder 2, ferner mit dem Schritt des Anbringens der Rasierklingenvorrichtung (10) an einem Gehäuse (110), wobei die resultierende Vorrichtung die Rasierer-Cartridge (100) aufweist; und wobei der Schritt des Aufbringens des Arrays (170) eng beabstandeter Tröpfchen einer dem Verhindern einer Korrosion der Rasierklinge (20) dienenden Flüssigkeit nach dem Anbringen der Rasierklinge (20) an dem Gehäuse (110) erfolgt.

4. Verfahren nach einem der Ansprüche 1 bis 3, bei dem die Chromoxidschicht eine Dicke ungefähr im Bereich von 10 nm bis 15 nm hat und bei dem die Chromoxidschicht die Farbe der ersten Seite (26) der Rasierklinge (20) nicht wesentlich verändert.

5. Verfahren zum Herstellen einer Rasierklingenvorrichtung für eine Rasierer-Cartridge, mit den Schritten:

   a) Bereitstellen einer Rasierklinge (20), die einen rostfreien Stahl einer ersten Zusammensetzung aufweist, wobei die Rasierklinge (20) eine erste Seite (26) und eine entlang eines Vorderrandes der Klinge verlaufende Schneidkante (22) hat,
   b) dauerhaftes Verbinden einer Zwischenklingen-Schutzvorrichtung (30) mit der ersten Seite (26) der Rasierklinge (20), wobei die Zwischenklingen-Schutzvorrichtung (30) einen rostfreien Stahl einer zweiten Zusammensetzung aufweist und eine Oberfläche (36) hat, die in der Lage ist, während einer normalen Benutzung der mit der Rasierklingenvorrichtung (10) versehenen Rasierer-Cartridge (100) eine Hautoberfläche eines Benutzers zu kontaktieren; und
   c) Aufbringen eines Arrays (170) eng beabstandeter Tröpfchen einer dem Verhindern einer Korrosion der Rasierklinge (20) dienenden Flüssigkeit auf mindestens einen Teil der ersten Seite (26) der Rasierklinge (20).

6. Rasierer-Cartridge mit:

   - einem Gehäuse (110); und
   - einer Rasierklingenvorrichtung (10), wobei die Rasierklingenvorrichtung (10) eine Rasierklinge (20) mit einer ersten Seite (26) und eine Zwischenklingen-Schutzvorrichtung (30) aufweist, die dauerhaft an der ersten Seite (26) der Rasierklinge (20) angebracht ist;
   - wobei die Zwischenklingen-Schutzvorrichtung (30) eine Hautanlagefläche aufweist, die in der Lage ist, während einer normalen Benutzung der Rasierer-Cartridge (100) eine Hautoberfläche eines Benutzers zu kontaktieren;
   dadurch gekennzeichnet, dass
   - die Rasierklinge (20) rostfreien Stahl einer ersten Zusammensetzung aufweist und die Zwischenklingen-Schutzvorrichtung (30) rostfreien Stahl einer zweiten Zusammensetzung aufweist, die sich von der ersten Zusammensetzung unterscheidet, und
   - die erste Seite (26) der Rasierklinge (20) eine Chromoxidschicht aufweist.

7. Rasierer-Cartridge nach Anspruch 6, ferner mit einem Array (170) von Tröpfchen einer dem Verhindern einer Korrosion der Rasierklinge (20) dienenden Flüssigkeit auf mindestens einem Teil der ersten Seite (26) der Rasierklinge (20).

8. Rasierer-Cartridge nach Anspruch 7, bei dem das Array (170) von Tröpfchen einer dem Verhindern einer Korrosion der Rasierklinge dienenden Flüssigkeit ferner auf mindestens einem Teil der Hautanlagefläche der Zwischenklingen-Schutzvorrichtung aufgebracht ist.

9. Rasierer-Cartridge nach Anspruch 7 oder 8, bei dem

das Array (170) von Tröpfchen einer dem Verhindern einer Korrosion der Rasierklinge (20) dienenden Flüssigkeit ferner in mindestens einem Teil eines Spalts (34) zwischen der ersten Seite (26) der Rasierklinge (20) und der Zwischenklingen-Schutzvorrichtung (30) angeordnet ist.

10. Rasierer-Cartridge nach einem der Ansprüche 6 bis 9, bei dem die Chromoxidschicht eine Dicke ungefähr im Bereich von 10 nm bis 15 nm hat und bei dem die Chromoxidschicht eine Farbe der ersten Seite (26) der Rasierklinge (20) nicht wesentlich verändert.

11. Rasierer-Cartridge nach einem der Ansprüche 6 bis 10, bei dem die Chromoxidschicht durch einen thermischen Oxidationsvorgang gebildet ist.

Revendications

1. Procédé de réalisation d'un ensemble de lame de rasoir pour une cartouche de rasoir, comprenant les étapes consistant à :

a) fournir une lame de rasoir (20) comprenant un acier inoxydable d'une première composition, la lame de rasoir (20) comportant un premier côté (26) et un bord coupant (22) s'étendant le long d'un bord avant de celle-ci, la lame de rasoir (20) ayant de plus été traitée de façon à produire une transformation martensitique de celle-ci de façon à durcir la lame de rasoir (20) ;
b) réaliser une couche d'oxyde de chrome sur le premier côté (26) à l'aide d'un processus d'oxydation thermique ; et
c) réunir de façon permanente un élément intercalaire entre lames (30) au premier côté (26) de la lame de rasoir (20), l'élément intercalaire entre lames (30) comprenant un acier inoxydable d'une deuxième composition et comprenant une surface adaptée de façon à venir en contact avec une surface de peau d'un utilisateur durant une utilisation normale de la cartouche de rasoir (100) comprenant l'ensemble de lame de rasoir (10).

2. Procédé selon la revendication 1, comprenant de plus l'étape d'application à au moins une partie du premier côté (26) de la lame de rasoir (20) d'un groupement (170) de gouttelettes étroitement espacées d'un liquide adapté de façon à inhiber une corrosion de la lame de rasoir (20).

3. Procédé selon la revendication 1 ou 2, comprenant de plus l'étape d'assemblage de l'ensemble de lame de rasoir (10) à un boîtier (110), l'ensemble résultant constituant la cartouche de rasoir (100) ; et dans lequel l'étape d'application du groupement (170) de gouttelettes étroitement espacées d'un liquide adapté de façon à inhiber une corrosion de la lame de rasoir (20) est effectuée après que la lame de rasoir (20) ait été assemblée au boîtier (110).

4. Procédé selon l'une quelconque des revendications 1 à 3, dans lequel la couche d'oxyde de chrome a une épaisseur comprise entre environ 10 nm et 15 nm, et dans lequel la couche d'oxyde de chrome n'altère pas sensiblement une couleur du premier côté (26) de la lame de rasoir (20).

5. Procédé de réalisation d'un ensemble de lame de rasoir pour une cartouche de rasoir, comprenant les étapes consistant à :

a) fournir une lame de rasoir (20) comprenant un acier inoxydable d'une première composition, la lame de rasoir (20) comportant un premier côté (26) et un bord coupant (22) s'étendant le long d'un bord avant de celle-ci ;
b) réunir de façon permanente un élément intercalaire entre lames (30) au premier côté (26) de la lame de rasoir (20), l'élément intercalaire entre lames (30) comprenant un acier inoxydable d'une deuxième composition et comprenant une surface (36) adaptée de façon à venir en contact avec une surface de peau d'un utilisateur durant une utilisation normale de la cartouche de rasoir (100) comprenant l'ensemble de lame de rasoir (10) ; et
c) appliquer à au moins une partie du premier côté (26) de la lame de rasoir (20) un groupement (170) de gouttelettes étroitement espacées d'un liquide adapté de façon à inhiber une corrosion de la lame de rasoir (20).

6. Cartouche de rasoir, comprenant :

- un boîtier (110) ; et
- un ensemble de lame de rasoir (10), l'ensemble de lame de rasoir (10) comprenant une lame de rasoir (20) comportant un premier côté (26) et un élément intercalaire entre lames (30) réuni de façon permanente au premier côté (26) de la lame de rasoir (20) ;
- dans laquelle l'élément intercalaire entre lames (30) comprend une surface de contact de peau adaptée de façon à venir en contact avec une surface de peau d'un utilisateur durant une utilisation normale de la cartouche de rasoir (100) ;

caractérisée en ce que :

- la lame de rasoir (20) comprend un acier inoxydable d'une première composition et l'élément intercalaire entre lames (30) comprend un acier inoxydable d'une deuxième composition différente de la première composition ; et

- le premier côté (26) de la lame de rasoir (20) comprend une couche d'oxyde de chrome.

7. Cartouche de rasoir selon la revendication 6, comprenant de plus un groupement (170) de gouttelettes d'un liquide adapté de façon à inhiber une corrosion de la lame de rasoir (20) sur au moins une partie du premier côté (26) de la lame de rasoir (20).

8. Cartouche de rasoir selon la revendication 7, dans laquelle le groupement (170) de gouttelettes d'un liquide adapté de façon à inhiber une corrosion de la lame de rasoir se trouve de plus sur au moins une partie de la surface de contact de peau de l'élément intercalaire entre lames.

9. Cartouche de rasoir selon la revendication 7 ou 8, dans laquelle le groupement (170) de gouttelettes d'un liquide adapté de façon à inhiber une corrosion de la lame de rasoir (20) se trouve de plus dans au moins une partie d'un espace (34) entre le premier côté (26) de la lame de rasoir (20) et l'élément intercalaire entre lames (30).

10. Cartouche de rasoir selon l'une quelconque des revendications 6 à 9, dans laquelle la couche d'oxyde de chrome a une épaisseur comprise entre environ 10 nm et 15 nm, et dans laquelle la couche d'oxyde de chrome n'altère pas sensiblement une couleur du premier côté (26) de la lame de rasoir (20).

11. Cartouche de rasoir selon l'une quelconque des revendications 6 à 10, dans laquelle la couche d'oxyde de chrome est réalisée à l'aide d'un processus d'oxydation thermique.

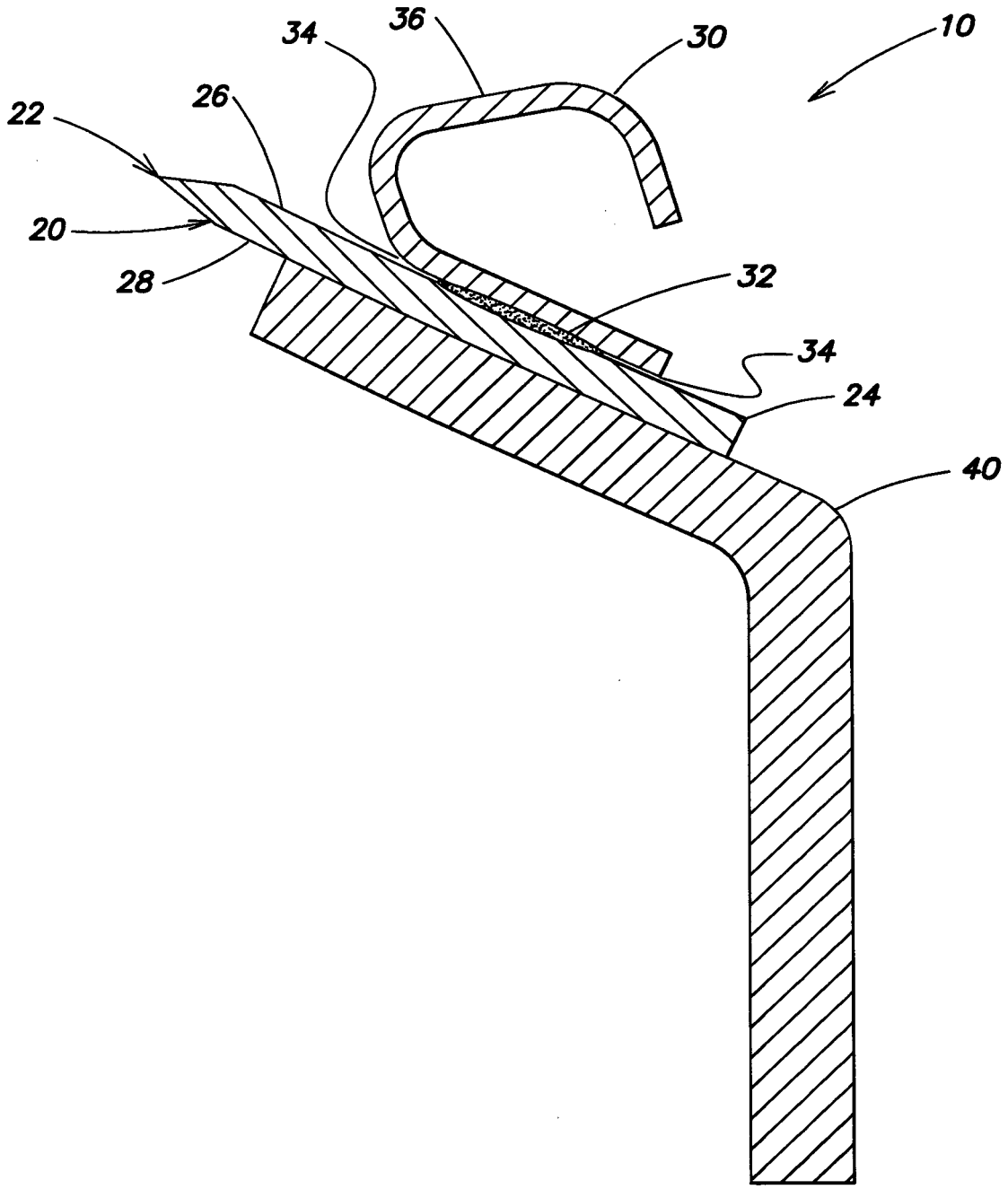


FIG. 1

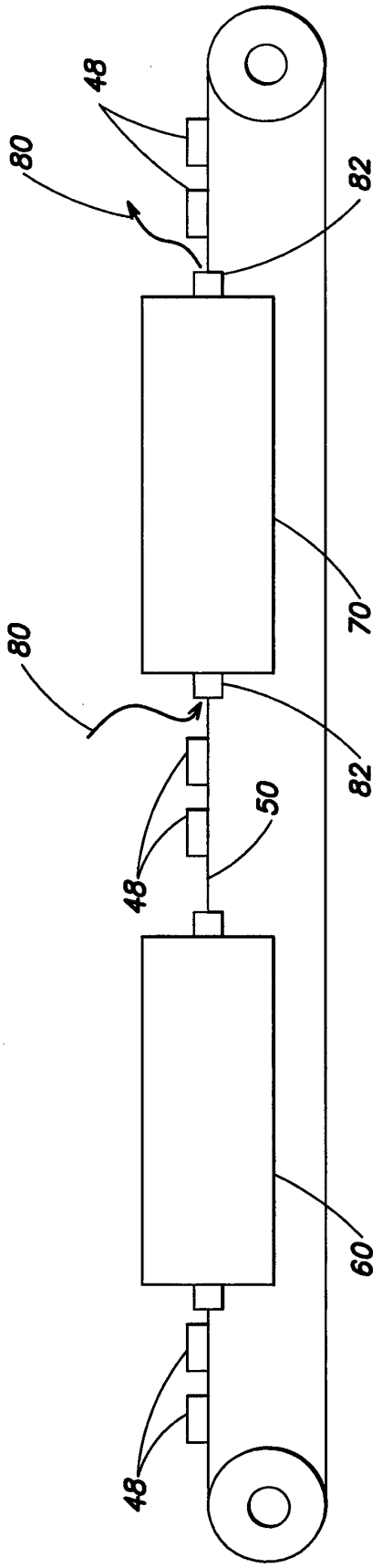


FIG. 2

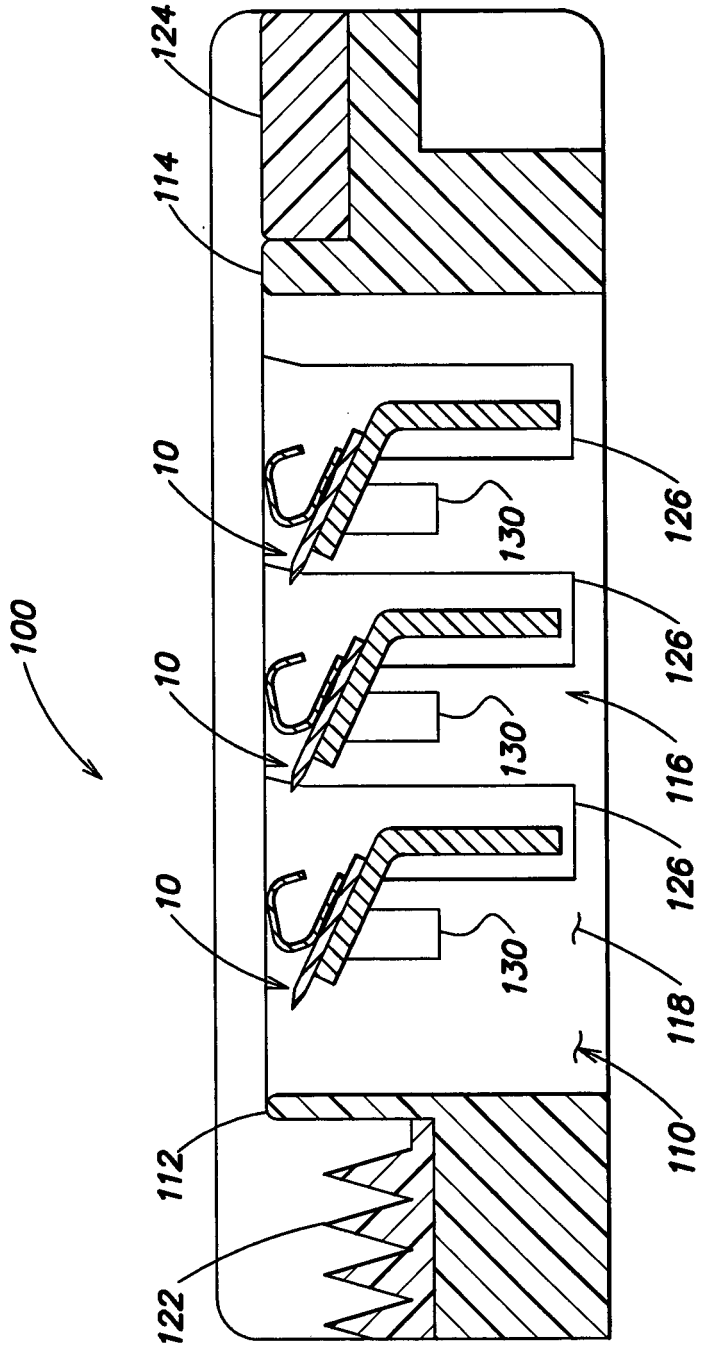


FIG. 3

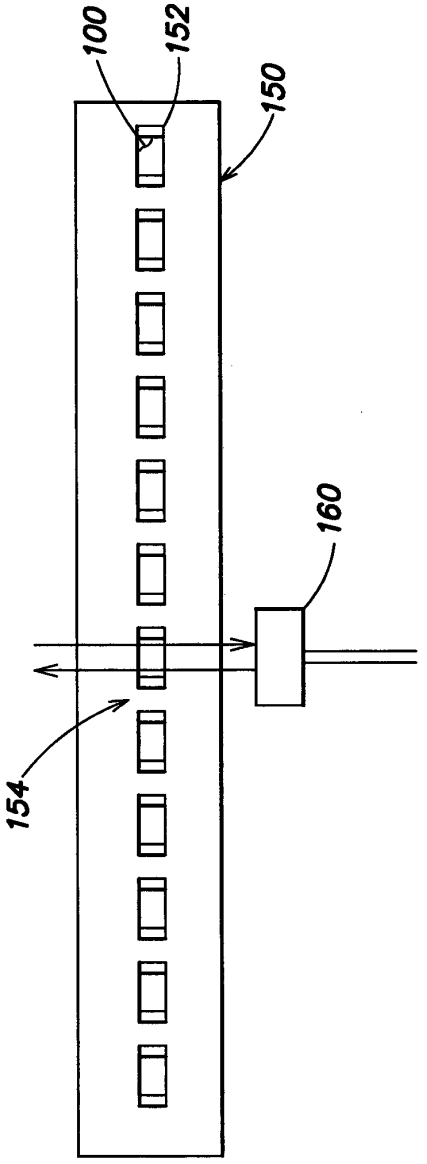


FIG. 4

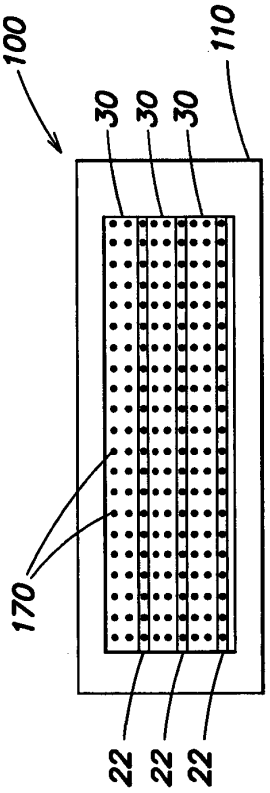


FIG. 5

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 7681314 B **[0003] [0004] [0006] [0012]**
- US 4586255 A **[0004] [0025]**
- US 4568255 A **[0026]**