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(54) **CUTTING UNIT FOR AN ELECTRIC RAZOR WITH SKIN PROTECTORS**

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UNITÉ DE COUPE POUR UN RASOIR ÉLECTRIQUE AVEC DISPOSITIFS DE PROTECTION DE PEAU

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Description

[0001] The present invention relates to a cutting unit for an electric razor including at least one outer blade unit (12) and one inner blade unit (14) that are borne driven by a motor to oscillate relative to one another, the inner blade unit (14) having an edge (24) with a cutting edge angle that is a maximum of 90°.. The invention furthermore relates to a cutting head having such a cutting unit and to an electric razor equipped therewith.

[0002] An electric razor as mentioned above is known from EP 0083952A1. Similar electric razors are known from US 4261101 and EP 0086536 A1. According to those razors aside from one inner blade further inner blade elements are provided that pull the hair before being cut.

[0003] An electric razor cutting head having such an inner blade unit is known for instance from EP 0 743 144 B1, the outer blade unit of the cutting head being embodied as perforated foil beneath which an inner blade unit in the form of a blade block moves back and forth. The edges of the blades of the inner blade unit are sharpened at an acute angle.

[0004] In contrast to such a inner blade unit sharpened at an acute angle, DE 44 23 503 C1 provides an inner blade unit for an electric razor cutting head that is also to cooperate with a perforated cutting foil, but the cutting edges of the blades in the inner blade unit are at a 90° cutting angle.

[0005] In the known electric razors, regardless of whether they are embodied as rotating or oscillating systems, inner and outer blade units cooperate that are always at least in part in direct contact with one another. Razor devices in which the inner blade units are provided with so-called 90° cutting edges are distinguished by very good skin-protecting properties and have good cutting edge stability, which is also associated with long service life.

[0006] In contrast to this, inner blades units having cutting edges that are sharpened at an acute angle are distinguished by lower cutting forces and thus are also distinguished by pulling the hairs through better. Basically, the smaller the angle selected for the cutting edge, the lower the cutting forces to be applied. However, as a rule a narrow cutting edge angle

[0007] represents a challenge with respect to skin irritation the user will experience. Thus when the razor is subjected to enough pressure, some of the user's skin can penetrate into the recesses of the inner blade unit in addition to the hair that is to be cut so that some of the skin may be injured by the cutting edge of the inner blade that is sharpened at an acute angle. On the other hand, this effect is not as pronounced with inner blade units that are provided with the so-called 90° cutting edges.

[0008] Figures 1 through 5 furthermore depict a common cutting system for prior art electric razors. The foil perforated with holes 20 in the outer blade unit 12 and the inner blade unit 14 that is provided with an edge 24 that is sharpened at an acute angle can be moved relative to one another. During the shaving process, a hair 18, together with a skin bit 16, is threaded into one of the holes in the outer blade unit 12 where, as depicted in Figures 2 and 3, it is gripped by an edge 24 of the inner blade unit 14, pressed against an edge of the outer blade unit 12, and then cut off.

[0009] Thus Figure 1 depicts a configuration in which the hair 18 that is to be cut goes through the opening 20 in the outer blade unit 12. Figure 2 shows the configuration of the components involved immediately prior to the cut and Figure 3 depicts the hair 18, partially cut off, shortly prior to completion of the cut.

[0010] A requirement for a close shave is that the hairs 18 that are to be cut must be threaded as deeply as possible into the perforation 20 in the outer blade unit 12. To this end, those skin bits 16 that are immediately adjacent to the locations at which the hair emerges from the skin should be pressed into the perforation 20 as close as possible to the contact surface between the outer blade unit 12 and the inner blade unit 14. Penetration of these skin bits 16 into the foil holes is a function of the pressure with which the user presses the razor against his skin, user-specific properties of the skin, and the quality of the foil or outer blade unit 12, especially the foil thickness, hole size, and distance between holes.

[0011] However, the pressure exerted during shaving and the skin properties vary among the various locations on the face and body and from user to user so that for many users these skin bits 16 do not reach the cutting surface for inner blade unit 14 and outer blade unit 12, as depicted in Figures 2 and 3, but with other users they pass through the imaginary extension of a contact surface for the outer blade unit 12 and the inner blade unit 14, as shown in Figure 5. While longer stubble remains behind in the instance shown according to Figures 2 and 3, in the configuration depicted in Figure 5 the sharp cutting edge 24 comes directly against the skin bit 16 so that undesired skin irritations and local injuries to the skin may result.

[0012] The systems known from the prior art are not able to satisfactorily attain a situation according to Figure 4, which depicts the skin being pressed in the best possible manner with respect to a close shave and protecting the skin.

[0013] In contrast, the underlying object of the invention is to provide a cutting unit for an electric razor, which cutting unit provides a close and yet skin-protecting shave, as much as possible regardless of user-specific skin properties and the pressure exerted by the user.

[0014] The underlying object of the invention is attained by means of a cutting unit in accordance with patent claim 1 and using a cutting head in accordance with patent claim 12 and an electric razor in accordance with patent claim 13.

[0015] The dependent claims provide advantageous embodiments of the invention.

[0016] The cutting unit for an electric razor that is pro-

posed in accordance with the invention has at least one outer blade unit and one inner blade unit that are borne driven by a motor to oscillate relative to one another. While the outer blade unit is typically embodied as a perforated cutting foil, the inner blade unit has an edge with a cutting edge angle that is a maximum of 90°, especially a cutting edge angle of significantly less than 90° that is sharpened at an acute angle. Consequently, in such an embodiment of the invention (cutting edge angle of significantly less than 90°, for instance 20°), the inner blade unit has a bevel that is adjacent to the cutting edge and that extends outside the contact surface of the outer blade unit and inner blade unit. The course of the bevels and the transition area from cutting edge to bevel can occur as suitable.

[0017] In accordance with the invention it is provided that at least one protector element having an outer contour that faces the outer blade unit and that is preferably rounded, at least in areas, is disposed in front of an edge of the inner blade unit. This protector element is borne such that it can be moved relative to the inner blade. It can therefore be moved into a position that is set back from the edge, that is a position that is farther from the outer blade unit, and thus into a position at a greater distance from the outer blade unit.

[0018] This protector element provides a skin protection or a skin deflector that is intended to prevent skin bits that penetrate into the perforation of the cutting foil from being grabbed by the edge of the inner blade unit that is sharpened at an acute angle. The protector element also reduces the pressure from any skin projecting through the outer blade unit onto the edges. The protector element allocated to the edge of the inner blade unit and possibly positioned against it causes skin bits to be pressed out of and back from the cutting surface between the inner and outer blade units, at least in sections.

[0019] In order to assure this protector function, it is provided that, under the pressure of the skin bits penetrating through the foil openings, a protector element retains its position at the cutting plane perpendicular to the inner blade unit oscillation direction with respect to the outer blade unit and does not move back. The protector element in question does not move back resiliently until its leading side, during a forward movement in the oscillation motion of the inner blade unit, presses a hair that is threaded through a foil opening against a bar limiting this foil opening.

[0020] While the protector element is moved back due to the effect of the growing pressure on the hair, the path for the cutting edge of the inner blade unit blade that is immediately following should be cleared for cutting the hair. Appropriately adjusting the resilience ensures that the protector element moves back at the right time, before the cutting force that is needed for cutting the hair is attained for the next inner blade unit blade.

[0021] It is furthermore provided that the protector element does not hinder the cutting function of the outer and inner blade units at all or at least does not noticeably hinder it. To this end the protector element can be moved into a position that is removed from the cutting edge, preferably immediately prior to a hair being cut, so that it is possible to attain an optimum shave.

[0022] The protector element can be moved with respect to the inner blade unit both in its oscillating direction and perpendicular thereto. It is therefore in particular provided that the protector element cooperates with the bevels of the inner blade unit such that, with the oscillating movement of the inner blade unit relative to the outer blade unit or relative to a hair threaded in, the protector element can be moved into a position that is set back or dipped relative to the cutting edge or relative to the outer blade unit due to the bevels embodied on the inner blade unit.

[0023] When the protector element is in such a setback position, the edge of the inner blade unit can move further forward than the protector element, at least in the area of the contact surface between outer blade unit and inner blade unit, and thus complete a skin-protecting cut immediately at the limiting surface between skin bit and the hair that is emerging from it.

[0024] According to one refinement of the invention it is provided that the protector element is pre-stressed against the outer blade unit and/or against the inner blade unit by at least one spring element. Because of the provided contact position between protector element and the bevel embodied on the inner blade unit, it is only necessary for a spring force that is essentially vertical to the oscillating movement of outer blade unit and inner blade unit to act on the spring element.

[0025] One goal of the vertical pre-stress against the contact surface is to pre-set the minimum force, above which force the protector element is to dip down out of its starting position. Another goal of the vertical stop is to set a starting position that is set back downward very slightly with respect to the perforated foil in order to prevent additional foil friction during movement by the inner blade unit. In addition, while the hairs are being cut the upper edges of the protector elements that face away from the hairs should be prevented from being pressed against the cutting edges of the adjacent inner blade unit blades, thereby damaging them.

[0026] The structural design of the spring element, especially its spring constants, is matched to the geometry of the protector element and inner blade unit. Furthermore, the selected spring constants may be matched to the size of the perforations embodied in the outer blade unit. The larger the holes embodied in the cutting foil, the greater the tendency for skin bits to be pressed through these openings in the outer blade unit.

[0027] According to one refinement of the invention, it is provided that the protector element is embodied rounded, at least on an end segment that faces the outer blade unit and that is on a side that faces away from the inner blade unit. This side of the protector element that faces away from the inner blade unit or its beveled side comes into contact with the skin bit that is to be pressed back.

The rounded embodiment and contour of the protector element in this area that is ahead of the inner blade unit should ensure that the skin bits are pressed back as gently as possible, and thus with no injury, out of the plane of the contact surface for outer blade unit and inner blade unit.

[0028] According to another embodiment of the invention, it is provided that the protector element is embodied rounded on both sides of its end segment that faces the outer blade unit. Thus the protector element also has a rounded outer contour on its end segment that faces the bevels of the inner blade unit. Such an embodiment of the protector element, the cross-section of which is symmetrical, is particularly favorable in terms of manufacturing and is advantageous compared to an asymmetrical cross-section for protector elements.

[0029] In accordance with one preferred embodiment of the invention, the protector element can be positioned against the bevel of the edge of the inner blade unit both in a starting position and in a withdrawn or set back position. The protector element can be set back from the edge along the bevel of the inner blade unit in a sliding manner, that is, it can be moved into a position that is farther away from the outer blade unit.

[0030] In accordance with another advantageous embodiment of the invention, the protector element is in its starting position with its end segment that faces the outer blade unit arranged positioned against the bevel of the inner blade unit. The point of contact formed by contact with the bevel is especially below the cutting surface between the outer and inner blade units. In this manner it is possible to effectively prevent the cutting edge that is sharpened at an acute angle from striking a protector element, which otherwise could lead to premature wear and to abrasion on the sharp cutting edge.

[0031] In accordance with the invention, it is in particular provided that the protector element is embodied such that it presses a skin bit back through a perforation or opening in the outer blade unit, preferably perpendicular to the oscillating movement of the cutting edge, and thus past the edge so that the skin is protected, by means of the protector element's rounded outer contour on its end segment that faces the outer blade unit.

[0032] In accordance with one particularly advantageous embodiment of the invention it is provided that the protector element can be moved sliding along the bevel and along the hair into the position that is set back from the edge by the effect of a hair that projects into the opening of the outer blade unit.

[0033] Thus the resilient pre-stress that acts on the protector element is designed such that the protector element is in front of the edge and remains in its starting position until the protector element comes into contact with a hair that is to be cut. In such a position, the distance between the edge and the hair to be cut equals the thickness of the protector element.

[0034] The motor-driven movement of the inner blade unit relative to the outer blade unit and the increased resistance that the hair places against the protector element causes the protector element, as the inner blade unit moves progressively towards the hair, to move along the bevel embodied on the inner blade unit into the position set back from the edge so that the edge of the inner blade unit cuts directly into the hair in the area where it emerges from the skin.

[0035] The movement mechanism furthermore makes use of the fact that the force that is necessary for cutting a hair far exceeds the force that is required to press a skin bit out of an opening in the outer blade unit. Thus simply appropriately selecting the resilient pre-stress for the protector element achieves the desired function so that the protector element does not dip into its withdrawn position until, seen in the oscillating direction for the outer and inner blade units, it is positioned with one side against the hair that is to be cut and with the other against the bevel of the inner blade unit or of a corresponding contact surface on the inner blade unit or a part connected thereto.

[0036] If the rounded outer contour of the protector element is merely positioned against a skin bit that is to be pressed back and against the bevels immediately adjacent to the cutting edge of the inner blade unit, the resilient pre-stress provided for the protector element is adequate to press the skin bit out of the imaginary cutting line for the outer and inner blade units in the manner provided.

[0037] In accordance with another embodiment of the invention it is provided that each individual blade in the inner blade unit has two edges that oppose one another in the direction of movement, one protector element being allocated to each edge. By means of such an allocation and arrangement of protector elements, during an oscillating movement by outer blade unit and inner blade unit it is possible to allocate one protector element in front of each opposing edge for each blade in the inner blade unit.

[0038] In accordance with another embodiment of the invention it is provided that protector elements are joined to one another in pairs via a bar. When assembled the bar comes to rest under a U-shaped blade that is in the inner blade unit and that has an cutting edge on both sides. The arrangement of protector elements by pairs for each blade in the inner blade unit is advantageous, both in terms of assembly and manufacture, because allocating and arranging a pre-configured pair of protector elements to a blade inherently allocates one protector element to each of the two cutting edges in the blade.

[0039] In accordance with one particularly advantageous embodiment of the invention, a support that extends along the direction of movement for the outer and inner blade units is provided, and it is embodied for receiving a plurality of protector elements or pairs of protector elements. The support may be borne rigidly and spring-loaded with respect to the inner blade unit.

[0040] In one advantageous embodiment, the support itself has individual spring elements, preferably made of plastic, by means of which the protector elements to be

arranged on the support may be pre-stressed against the inner blade unit in the aforesaid manner.

[0041] In particular it is provided that the support has individual spring elements for receiving individual protector elements or pairs of protector elements. It is furthermore provided that the protector element is produced from plastic, especially a liquid crystal polymer, a so-called LC polymer. Alternatively it can be provided that the protector element is produced from steel or steel sheet. The material provided for producing the protector element at least has a suitable hardness and suitable elasticity for the purpose provided, specifically for pressing skin bits back. Moreover, it must have adequate impact resistance because hairs may strike the protector elements at high speed.

[0042] It is especially advantageous to form the inner blade unit, the protector element, and/or the support for the protector elements from shaped sheet metal. The inner blade unit, individual protector elements, and/or the support for the protector elements can be produced by etching. Additional supplementary or alternative manufacturing processes include electrochemical etching, stamping, grinding, sintering, electroforming, injection molding, and so-called PEM (Precise Electrochemical Machining).

[0043] According to another independent aspect, the invention relates to a cutting head for an electric razor that has the aforesaid cutting unit with all features and combinations thereof.

[0044] The invention furthermore includes an electric razor equipped with an aforesaid cutting unit or with a corresponding cutting head.

Exemplary embodiments

[0045] Additional goals, features, advantages, and potential applications for the present invention result from the following description of exemplary embodiments.

Fig. 1 is a sectional depiction of a hair threaded between outer blade unit and inner blade unit according to the prior art;

Fig. 2 depicts the embodiment according to Fig. 1 immediately prior to a cut; and,

Fig. 3 depicts the arrangement according to Figures 1 and 2 during a cut;

Fig. 4 depicts the outer and inner blade units according to the prior art, with ideal pressure on the skin;

Fig. 5 depicts the outer and inner blade units in accordance with Fig. 4 while the skin is being pressed in in a manner that leads to skin irritation;

Fig. 6 is a schematic depiction of the inventive cutting unit with a protector element that is in front of the cutting edge;

Fig. 7 is a depiction in accordance with Fig. 6 shortly before the skin protector moves back,

Fig. 8 depicts a skin protector moving back and clearing the way for the edge; and

Fig. 9 depicts a hair that has been cut by the edge;

Fig. 10 is a perspective elevation of protector elements that have been joined to one another in a pair;

Fig. 11 is a side view of the protector elements in accordance with Fig. 10;

Fig. 12 is a perspective elevation of a support provided for receiving protector elements in which the transverse braces are embodied as springs for the protector elements;

Fig. 13 is an enlargement of a part of the support embodied as a spring frame in accordance with Fig. 12;

Fig. 14 depicts the support in accordance with Figures 12 and 13 with pairs of protector elements in accordance with Figures 10 and 11 arranged thereon; and

Fig. 15 is a perspective elevation of a pre-assembled protector element support in accordance with Fig. 14 inside a U-shaped, curved inner blade unit having a plurality of blades.

[0046] Figures 6 through 9 depict the chronological progression of the relative oscillating movement between outer blade unit 12 and inner blade unit 14, a protector element 10 that is upwardly rounded toward the outer blade unit 12 being disposed in front of the edge 24 of the inner blade unit 14. The protector element 10, shown in its starting position in Figures 6 and 7, presses a skin bit 16 that has penetrated too deeply into the opening 20 or perforation of the outer blade unit 12 back out this opening 20 or perforation, preventing the skin bit 16 from being cut or injured, as can happen according to the prior art as in Fig. 5.

[0047] In the sequence according to Figures 6 through 9 the outer blade unit 12 shown on the left and the inner blade unit 14 shown on the right move towards one another. The protector element 10, which is embodied rounded on both sides on its upper end segment, that is, towards the hair 18 and also towards the bevel 22 of the inner blade unit 14, travels close to the sharp edge 24 of the inner blade unit 14, coming in contact with the bevel 22. It is especially provided that the contact point between inner blade unit 14 and protector element 10 does not precisely coincide with the sharpened edge or the cutting edge 24, but rather is somewhat below that against the bevel 22. Because otherwise the protector element 10 could contribute to premature blunting of the edge 24 and therefore to associated blade wear.

[0048] In one variant the protector element is provided with a contact surface such as e.g. the bar 28 in Fig. 10 in order to be able to pre-stress the protector element vertically against the associated blade in the inner blade unit. In this example, the vertical resilience of the protector element causes the contact surface to be positioned against the bottom of the blade 14 in Fig. 15. Depending

on the protector resilience, all of the protector elements may be collectively and simultaneously pre-stressed against the inner blade unit 50 or each protector element may be individually pre-stressed against each blade, separately from one another.

[0049] One goal of the vertical pre-stressing against the contact surface is to pre-set the minimum force beginning at which the protector element is to dip downward out of its starting position. Another goal of the vertical stop is to adjust a starting position for the protector element that is very easily set downwardly back with respect to the perforated foil in order to prevent additional foil friction during the movement by the inner blade unit. In addition, this is to prevent the upper edges of the protector elements that face away from the hairs from being pressed against the cutting edges of the adjacent inner blade unit blades, thus damaging them, while hairs are being cut.

[0050] The cutting edge angle, which defines the inclination of the bevel 22 with respect to the top side of inner blade unit 14 that faces the outer blade unit 12, the geometric design, especially the rounding of the protector element 10, and its upwardly oriented resilient pre-stress are matched to one another such that, as depicted in Fig. 6, a skin bit 16 that penetrates into the opening 20 is pressed out of the imaginary cutting plane between inner blade unit and outer blade movement when there is a relative movement between inner blade unit 14 and outer blade unit 12.

[0051] As depicted in Fig. 7, as soon as the protector element 10 comes into contact with a hair 18 projecting into the opening 20, the protector element 10 experiences significantly increased resistance in its direction of movement to the left. The hair represents, so to say, an obstacle for the protector element 10 so that due to a further relative movement between inner blade unit 14 and outer blade unit 12 the protector element dips with respect to the cutting edge 24 of the inner blade unit 14, the protector element sliding along the bevel 22 in the depicted embodiment.

[0052] The protector element is, so to say, clamped between the inner blade unit 14 and the hair 18 and due to the appropriately designed resilient pre-stress it completes a downward yielding movement in order to clear the way for the cutting edge 24 of the inner blade unit 14 to initiate a cut, as is depicted in Figure 8. In this manner the hair 18 can be cut as close as possible to the location at which it emerges from the skin, as is depicted schematically in Fig. 9.

[0053] As soon as the hair segment 18 projecting from the skin bit 16 has been cut through completely, the protector element 10 can return to its starting position relative to the inner blade unit 14 because of the effect of its resilient pre-stress, regardless of the relative position of outer blade unit 12 and inner blade unit 14 to one another.

[0054] Fig. 10 is a perspective elevation of one advantageous embodiment of an arrangement by pairs of two protector elements 10, 30. The individual protector elements 10, 30 are curved convexly so that they are essentially adapted to the shape of individual blades 52, 54 of an inner blade unit 50 that has an essentially U-shaped cross-section and of the curved outer blade unit.

[0055] The two protector elements 10, 30 depicted in Fig. 10 and Fig. 11 are joined to one another via a connecting bar 28. Below this, the connecting bar 28 is joined to a shaft 26 that at its bottom end has an insertion part 40 by means of which a protector unit that has two protector elements 10, 30 pre-configured in this manner can be inserted into recesses 38 provided this purpose in a support 32 depicted in Fig. 12 and Fig. 13. The support 32 depicted in Figures 12 through 15 extends essentially along the profile of the inner blade unit 50 and is provided for use inside the inner blade unit 50.

[0056] The support 32, which may be embodied as shaped sheet metal but may also be embodied as an injection molded part, has ribs 34, 36 that run transversely and that have a recess 38 in the center for the insertion part 40 of a protector unit, as depicted in Figs. 10 and 11. The individual ribs 34, 36 are embodied resilient with respect to the frame of the support 32 in order to enable the protector units to dip down or move back independently of one another.

[0057] It is furthermore provided that the shaft 26 in the horizontally-running oscillation direction for the outer blade unit and inner blade unit in Figs. 15 and 14 is not as wide as perpendicular thereto.

[0058] Moreover, provided in the exemplary embodiment in the transition area between the shaft 26 and the insertion part 40 is a widened base segment 42 that is supported on its bottom on the ribs 34, 36 of the support 32 and thus represents vertical positioning of protector units with respect to the support 32 because as resilient bars the ribs 34, 36 each act like a leaf spring for the protector elements 10, 30. This makes possible vertical dipping perpendicular to the cutting surface.

[0059] Overall, providing protector elements 10, 30 to be arranged on both sides of individual blades 14, 52, 54 in an inner blade unit 50 makes it possible to increase the hole size in the outer blade unit 12 embodied as a cutting foil so that when using appropriate pressure the skin bits are more likely to pass through the openings 20 embodied in the cutting foil. The protector element 10, 30 and its pressing back of the skin bits make it possible to shave the hair immediately where it emerges from the skin so that an optimum shave results without or with diminished skin irritation at the cutting surface of an inner blade unit cutting edge.

[0060] Instead of a paired arrangement for every two protector elements 10, 30 on a resilient element 34, 36 of a support 32, it is also possible to arrange each protector element 10, 30, separately on individual spring elements provided on the support 32, without a connecting bar 28.

Legend

[0061]

10	Protector element
12	Outer blade unit
14	Inner blade unit/blade
16	Skin bit
18	Hair
20	Opening
22	Bevel
24	Edge
26	Shaft
28	Bar
30	Protector element
32	Support
34	Rib/resilient element
36	Rib/resilient element
38	Recess
40	Insertion part
42	Base
50	Inner blade unit
52	Blade
54	Blade

Claims

1. Cutting unit for an electric razor including at least one outer blade unit (12) and one inner blade unit (14) that are borne driven by a motor to oscillate relative to one another, the inner blade unit (14) having an edge (24) with a cutting edge angle that is a maximum of 90°, wherein at least one protector element (10) having an outer contour that faces the outer blade unit (12) is in front of the edge (24) of the inner blade unit and can be moved into a position that is set back relative to the edge (24), **characterized in that** the protector element (10) is embodied rounded on both sides of its end segment that faces the outer blade unit (12) and that is on a side that faces away from the inner blade unit (14) and that is on a side that faces the inner blade unit (14).

2. Cutting unit in accordance with Claim 1, wherein the protector element (10) is pre-stressed against the outer blade unit (12) and/or the inner blade unit (14) by a spring element.

3. Cutting unit in accordance with any of the preceding claims, wherein the inner blade unit (14) has a cutting edge angle of less than 90° and has a corresponding bevel (22) adjacent to the edge (24).

4. Cutting unit in accordance with Claim 3, wherein the protector element (10) in its starting position is positioned with its end segment that faces the outer blade unit (12) against the bevel (22) and comes to rest with a contact point spaced apart from the edge (24) of the inner blade unit (14), wherein the protector element (10) can be moved in a sliding manner along the bevel (22) into a position that is set back relative to the edge (24).

5. Cutting unit in accordance with any of the preceding claims, wherein the protector element (10) is embodied by means of its rounded outer contour to pass by a skin bit (16) projecting through an opening (20) in the outer blade unit (12) on the edge (24).

6. Cutting unit in accordance with any of the preceding claims, wherein the protector element (10) can be moved relative to the inner blade unit (14) and sliding along the hair (18) into the position that is set back from the edge (24) by the effect of a hair (18) that projects into the opening (20) of the outer blade unit (12).

7. Cutting unit in accordance with any of the preceding claims, wherein individual blades (14, 52, 54) for the inner blade unit (50) have two edges (24) that oppose one another in the direction of movement, one protector element (10) being allocated to each edge (24).

8. Cutting unit in accordance with any of the preceding claims, wherein protector elements (10, 30) are joined to one another in pairs via a bar (28).

9. Cutting unit in accordance with Claim 8,wherein a plurality of protector elements (10, 30) are arranged on a support (32) that extends along the movement direction for the outer and inner blade units (14), the support (32) having individual spring element (32, 34) for receiving protector elements (10, 30).

10. Cutting unit in accordance with any of the preceding claims, wherein the protector element (10, 30) and/or the support (32) are produced from plastic, especially a liquid crystal polymer.

11. Cutting unit in accordance with any of the preceding claims, wherein the inner blade unit (14), the protector element (10, 30), and/or the support (32) is formed by shaped sheet metal.

12. Cutting head for an electric razor having at least one cutting unit according to any of the preceding claims.

13. Electric razor having at least one cutting unit according to any of the preceding claims 1 through 11.

Patentansprüche

1. Schneideinheit für einen Elektrorasierer, aufwei-

send mindestens eine äußere Klingeneinheit (12) und eine innere Klingeneinheit (14), die gelagert durch einen Motor angetrieben werden, um relativ zueinander zu schwingen, wobei die innere Klingeneinheit (14) eine Kante (24) mit einem Schneidkantenwinkel aufweist, der maximal 90° beträgt, wobei mindestens ein Schutzelement (10) mit einer äußeren Kontur, die der äußeren Klingeneinheit (12) zugewandt ist, sich vor der Kante (24) der inneren Klingeneinheit befindet und in eine Position bewegt werden kann, die relativ zu der Kante (24) zurückgesetzt ist, **dadurch gekennzeichnet, dass** das Schutzelement (10) an beiden Seiten seines Endsegments, das der äußeren Klingeneinheit (12) zugewandt ist und das sich auf einer Seite befindet, die der inneren Klingeneinheit (14) abgewandt ist, und das sich auf einer Seite befindet, die der inneren Klingeneinheit (14) zugewandt ist, gerundet ausgeführt ist.

2. Schneideinheit nach Anspruch 1, wobei das Schutzelement (10) durch ein Federelement gegen die äußere Klingeneinheit (12) und/oder die innere Klingeneinheit (14) vorgespannt ist.

3. Schneideinheit nach einem der vorstehenden Ansprüche, wobei die innere Klingeneinheit (14) einen Schneidkantenwinkel von weniger als 90° aufweist und eine entsprechende abgeschrägte Kante (22) angrenzend an die Kante (24) aufweist.

4. Schneideinheit nach Anspruch 3, wobei das Schutzelement (10) in seiner Ausgangsposition mit seinem Endsegment, das der äußeren Klingeneinheit (12) zugewandt ist, gegen die abgeschrägte Kante (22) angeordnet ist und mit einem Kontaktpunkt, der von der Kante (24) der inneren Klingeneinheit (14) beabstandet ist, zur Ruhe kommt, wobei das Schutzelement (10) gleitend entlang der abgeschrägten Kante (22) in eine Position bewegt werden kann, die relativ zu der Kante (24) zurückgesetzt ist.

5. Schneideinheit nach einem der vorstehenden Ansprüche, wobei das Schutzelement (10) mittels seiner gerundeten äußeren Kontur so ausgeführt ist, dass es an einem Hautstück (16) vorbeigeführt wird, das durch eine Öffnung (20) in der äußeren Klingeneinheit (12) auf die Kante (24) ragt.

6. Schneideinheit nach einem der vorstehenden Ansprüche, wobei das Schutzelement (10) durch die Wirkung eines Haars (18), das in die Öffnung (20) der äußeren Klingeneinheit (12) ragt, relativ zu der inneren Klingeneinheit (14) und an dem Haar (18) entlang gleitend in die Position bewegt werden kann, die von der Kante (24) zurückgesetzt ist.

7. Schneideinheit nach einem der vorstehenden Ansprüche, wobei einzelne Klingen (14, 52, 54) für die innere Klingeneinheit (50) zwei Kanten (24) aufweisen, die in der Bewegungsrichtung einander gegenüberliegen, wobei ein Schutzelement (10) jeder Kante (24) zugeordnet ist.

8. Schneideinheit nach einem der vorstehenden Ansprüche, wobei Schutzelemente (10, 30) durch einen Balken (28) paarweise miteinander verbunden sind.

9. Schneideinheit nach Anspruch 8, wobei eine Vielzahl von Schutzelementen (10, 30) auf einem Träger (32) angeordnet ist, der sich entlang der Bewegungsrichtung für die äußere und die innere Klingeneinheit (14) erstreckt, wobei der Träger (32) einzelne Federelemente (32, 34) zum Aufnehmen der Schutzelemente (10, 30) aufweist.

10. Schneideinheit nach einem der vorstehenden Ansprüche, wobei die Schutzelemente (10, 30) und/oder der Träger (32) aus Kunststoff, insbesondere einem Flüssigkristallpolymer, hergestellt sind.

11. Schneideinheit nach einem der vorstehenden Ansprüche, wobei die innere Klingeneinheit (14), die Schutzelemente (10, 30) und/oder der Träger (32) aus geformtem Blech hergestellt sind.

12. Schneidkopf für einen Elektrorasierer, aufweisend mindestens eine Schneideinheit nach einem der vorstehenden Ansprüche.

13. Elektrorasierer, aufweisend mindestens eine Schneideinheit nach einem der vorstehenden Ansprüche 1 bis 11.

Revendications

1. Unité de coupe pour un rasoir électrique incluant au moins une unité de lame extérieure (12) et une unité de lame intérieure (14) qui sont supportées et entraînées par un moteur pour osciller l'une par rapport à l'autre, l'unité de lame intérieure (14) ayant un bord (24) pourvu d'un angle de bord de coupe qui est au maximum de 90°, dans laquelle au moins un élément protecteur (10) ayant un contour extérieur qui fait face à l'unité de lame extérieure (12) se trouve devant le bord (24) de l'unité de lame intérieure et peut être déplacé dans une position qui est en retrait par rapport au bord (24), **caractérisée en ce que** l'élément protecteur (10) est réalisé arrondi sur les deux côtés de son segment d'extrémité faisant face à l'unité de lame extérieure (12) et qui est sur un côté opposé à l'unité de lame intérieure (14) et qui est sur un côté qui fait face à l'unité de lame intérieure (14).

2. Unité de coupe selon la revendication 1, dans la-

quelle l'élément protecteur (10) est précontraint contre l'unité de lame extérieure (12) et/ou l'unité de lame intérieure (14) par un élément de ressort.

3. Unité de coupe selon l'une quelconque des revendications précédentes, dans laquelle l'unité de lame intérieure (14) présente un angle de bord de coupe inférieur à 90° et un biseau (22) correspondant attenant au bord (24).

4. Unité de coupe selon la revendication 3, dans laquelle l'élément protecteur (10) dans sa position de départ est positionné avec son segment d'extrémité qui fait face à l'unité de lame extérieure (12) contre le biseau (22) et vient en appui avec un point de contact espacé du bord (24) de l'unité de lame intérieure (14), l'élément protecteur (10) pouvant être déplacé de manière coulissante le long du biseau (22) dans une position qui est en retrait par rapport au bord (24).

5. Unité de coupe selon l'une quelconque des revendications précédentes, dans laquelle l'élément protecteur (10) est réalisé par son contour extérieur arrondi qui passe sur un fragment de peau (16) faisant saillie à travers une ouverture (20) dans l'unité de lame extérieure (12) sur le bord (24).

6. Unité de coupe selon l'une quelconque des revendications précédentes, dans laquelle l'élément protecteur (10) peut être déplacé par rapport à l'unité de lame intérieure (14) et glisser le long du poil (18) dans la position qui est en retrait par rapport au bord (24) sous l'effet d'un poil (18) qui fait saillie dans l'ouverture (20) de l'unité de lame extérieure (12).

7. Unité de coupe selon l'une quelconque des revendications précédentes, dans laquelle les lames individuelles (14, 52, 54) de l'unité de lame intérieure (50) ont deux bords (24) qui se font face dans la direction de déplacement, un élément protecteur (10) étant attribué à chaque bord (24).

8. Unité de coupe selon l'une quelconque des revendications précédentes, dans laquelle des éléments protecteurs (10, 30) sont reliés les uns aux autres par paires par l'intermédiaire d'une barre (28).

9. Unité de coupe selon la revendication 8, dans laquelle une pluralité d'éléments protecteurs (10, 30) sont disposés sur un support (32) qui s'étend le long de la direction de déplacement des unités de lame extérieure et intérieure (14), le support (32) comportant un élément de ressort individuel (32, 34) pour recevoir des éléments protecteurs (10, 30).

10. Unité de coupe selon l'une quelconque des revendications précédentes, dans laquelle l'élément protecteur (10, 30) et/ou le support (32) sont en plastique, particulièrement un polymère de cristal liquide.

11. Unité de coupe selon l'une quelconque des revendications précédentes, dans laquelle l'unité de lame intérieure (14), l'élément protecteur (10, 30) et/ou le support (32) est formé(e) par une feuille métallique mise en forme.

12. Tête de coupe pour un rasoir électrique ayant au moins une unité de coupe selon l'une quelconque des revendications précédentes.

13. Rasoir électrique ayant au moins une unité de coupe selon l'une quelconque des revendications précédentes 1 à 11.

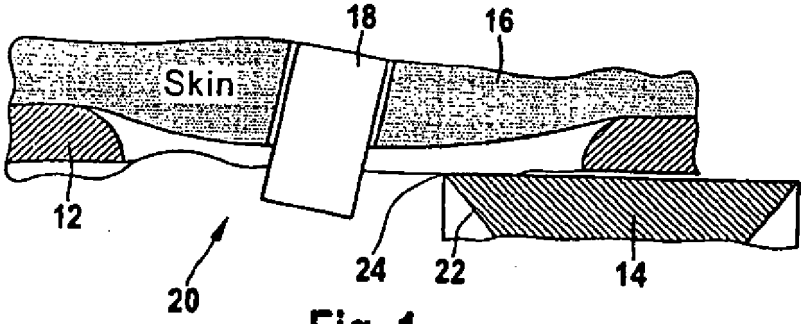


Fig. 1
(Prior Art)

Fig. 2
(Prior Art)

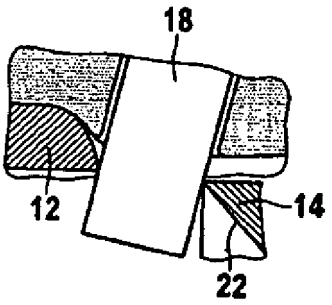
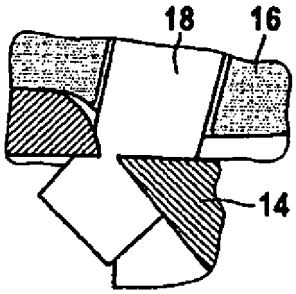


Fig. 3
(Prior Art)



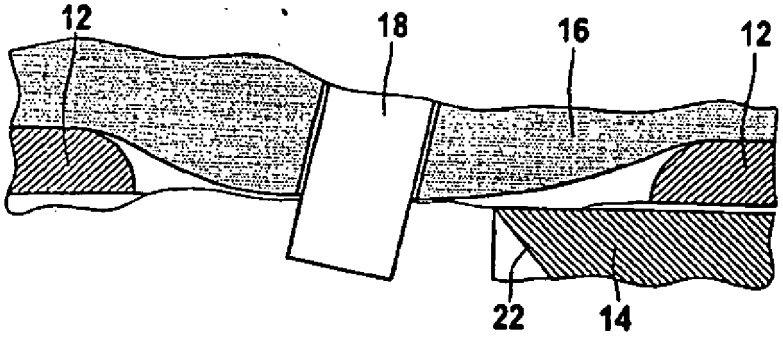


Fig. 4
(Prior Art)

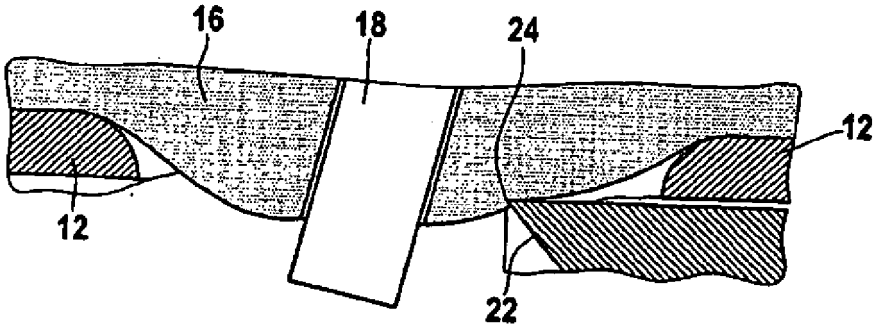


Fig. 5
(Prior Art)

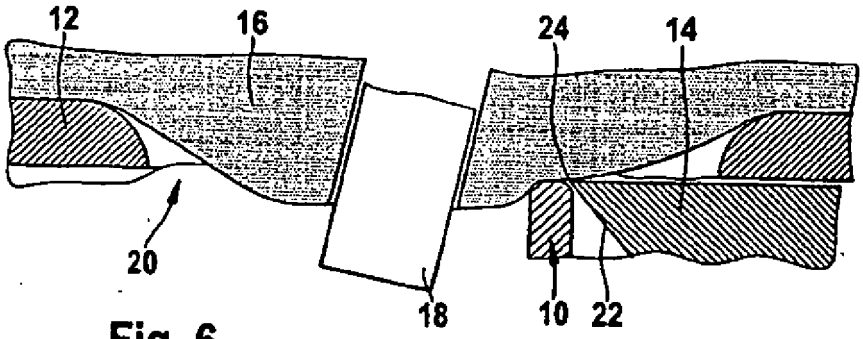


Fig. 6

Fig. 7

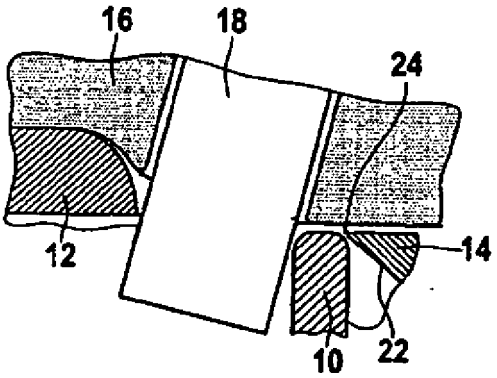
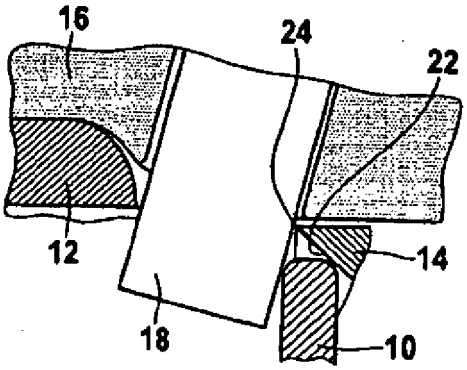


Fig. 8



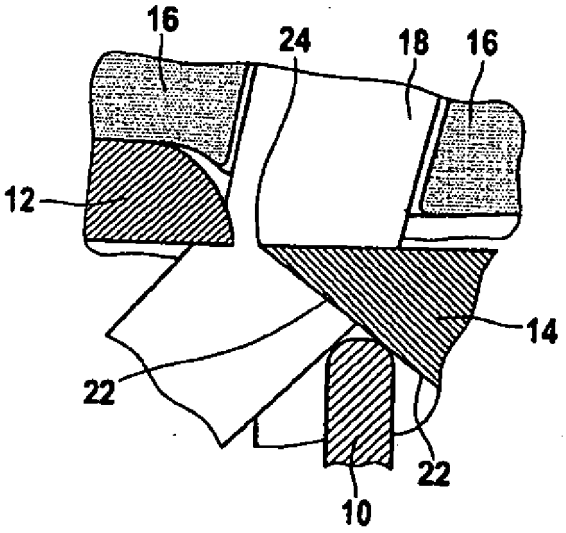


Fig. 9

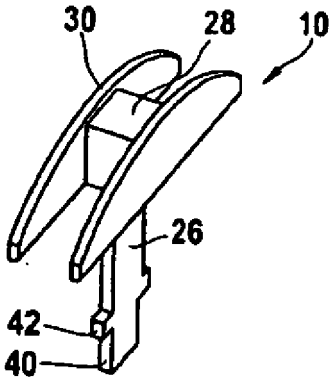


Fig. 10

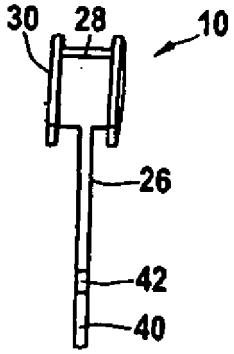


Fig. 11

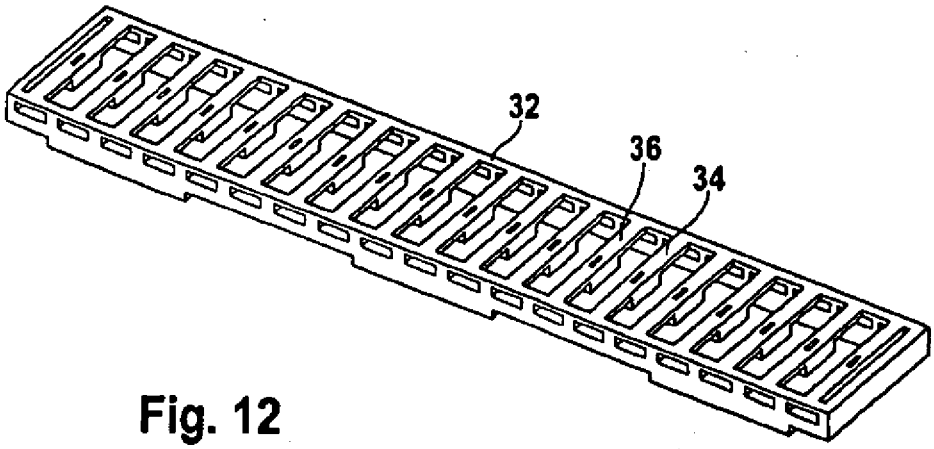


Fig. 12

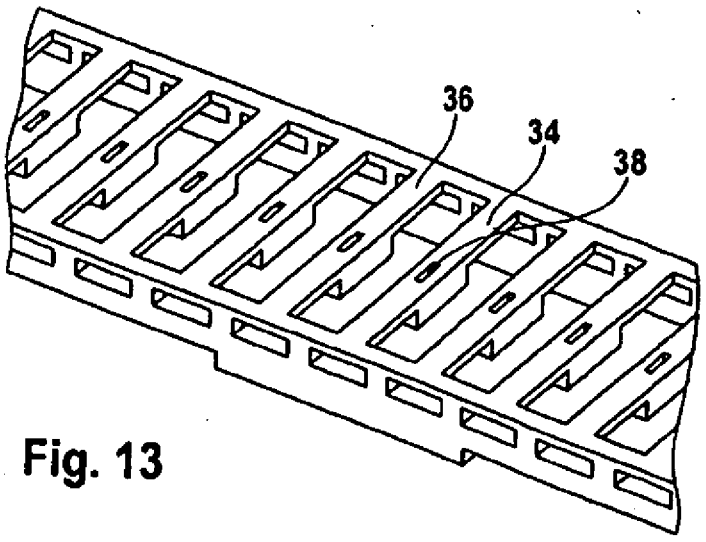


Fig. 13

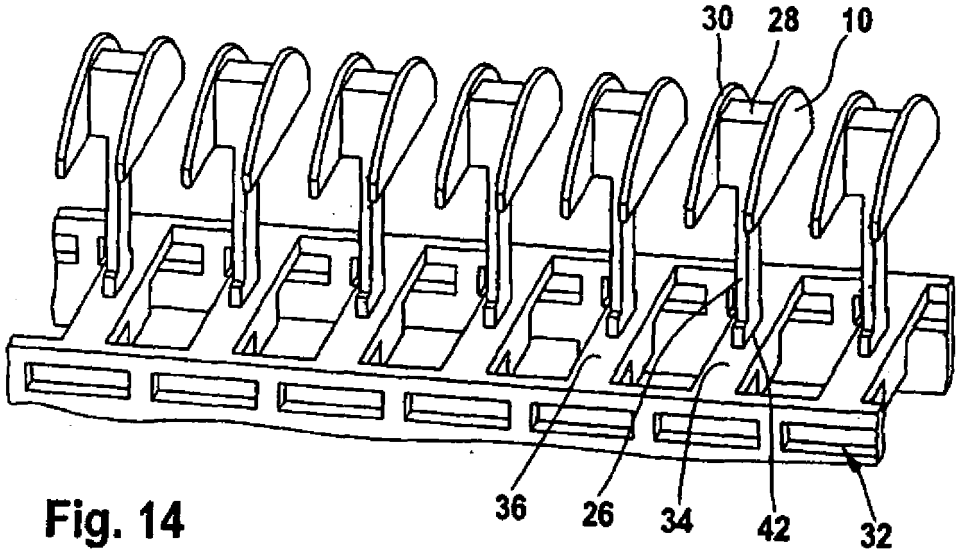


Fig. 14

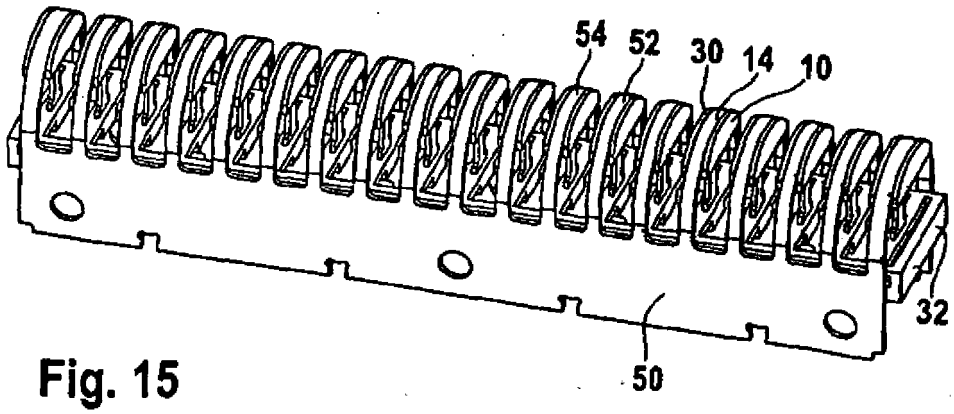


Fig. 15

REFERENCES CITED IN THE DESCRIPTION

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