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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 :		(11) International Publication Number:
B26B 21/22	A1	WO 96/29183
		(43) International Publication Date: 26 September 1996 (26.09.96)

(21) International Application Number: PCT/US96/03758

(22) International Filing Date: 21 March 1996 (21.03.96)

(30) Priority Data:
9505917.6 23 March 1995 (23.03.95) GB

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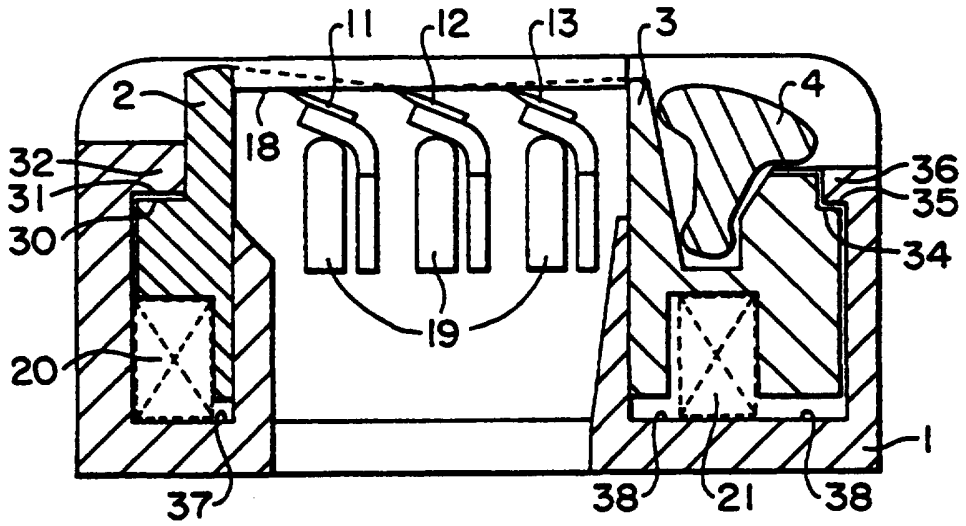
(81) Designated States: AL, AM, AT, AU, AZ, BB, BG, BR, BY, CA, CH, CN, CZ, DE, DK, EE, ES, FI, GB, GE, HU, IS, JP, KE, KG, KP, KR, KZ, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, TJ, TM, TR, TT, UA, UG, US, UZ, VN, ARIPO patent (KE, LS, MW, SD, SZ, UG), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).

Published
With international search report.
Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.

(54) Title: SAFETY RAZORS



(57) Abstract

A safety razor blade unit has a guard (2), a cap (3), and three parallel blades (11, 12, 13) mounted between the guard and cap, at least one of the blades, guard and cap being movable from a non-shaving position to modify a blade exposure dimension, and to attain a modified blade geometry in which the exposure of the first blade (11) is not greater than zero and the exposure of the third blade (13) is not less than zero. At least one of the cap (2) and guard (3) can be movable against the force of a spring (20 or 21) from a non-shaving position in which all the blades between the guard and cap have their edges disposed below a plane tangential to the skin contacting surfaces of the guard and cap. The blades can be independently sprung or carried for movement in unison on a carrier pivotally mounted in a frame of the blade unit.

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Safety Razors

This invention relates to safety razors and is particularly concerned with safety razors having blade units with a plurality of blades defining parallel sharpened edges arranged to pass in succession over a skin surface being shaved. The invention is applicable to safety razors having their blade units permanently attached to the razor handle, and to safety razors having their blade units detachably mounted on the handle for replacement when the blade edges have become dulled, and in either case the invention can be incorporated whether the blade unit is immovably mounted to the handle or mounted to move, e.g., to pivot about an axis parallel to the blade edges, relative to the handle under the influence of forces imparted on the blade unit during shaving.

The present invention has specific reference to safety razor blade units incorporating three blades, and the relative positioning of the blade edges. Our prior patent application No. PCT/US94/10717 teaches that with such blade units an improved overall shaving performance can be achieved when the blade edges are set according to a particular geometrical pattern, namely with the first blade, which has its edge nearest the guard, having an exposure not greater than zero, and the third blade, which defines the edge nearest the cap, having an exposure not less than zero. In the most efficacious geometrical arrangement, the first or primary blade has a negative exposure with an absolute

value in the range of 0 to 0.2mm, preferably equal to about -0.04mm for a primary blade span of around 0.7mm, the third blade has an exposure with a positive value not greater than about +0.3mm (preferably less than +0.2mm), for example around +0.06mm or +0.09mm, and the second blade has an exposure of about zero, the second and third blade spans each being 1.0 to 2.0mm, preferably about 1.5mm. For convenience the geometrical arrangements described and claimed in the aforementioned prior application are referred to herein as "the target geometry for the blades". For further information and details of the blade geometry reference may be made to the earlier application the contents of which are incorporated herein by this reference.

The blade exposure is defined to be the perpendicular distance or height of the blade edge measured with respect of a plane tangential to the skin contacting surfaces of the blade unit elements next in front of and next behind the blade edge. This can be a positive number if the blade edge is above this plane i.e., closer to the skin surface to be shaved than the tangential plane, or a negative number if the blade edge is below this tangent plane, i.e., further away from the skin than the tangent plane. The span of a blade is the distance from the blade edge to the skin contacting element immediately in front of that edge as measured along & tangent line extending between said element and the blade edge.

The three-blade geometry specified above is applicable to a blade unit in which the blades are immovably mounted relative to the guard and cap. It also applies to the initial or at rest geometry in the case of a blade unit in which the blades are spring mounted and capable of being deflected under the forces applied to the blades during shaving.

The present invention, recognizes that it may be desirable for some parts of a blade unit to be

movable relative to other parts and that this may be accommodated without forfeiting the advantages of the blade geometry discussed above. Thus, according to a preferred embodiment of the present invention there is provided a safety razor blade unit comprising a guard, a cap, and first, second and third blades with parallel sharpened edges located in sequence between the guard and cap, at least one element selected from the blades, guard and cap being movable from a non-shaving position to modify a blade exposure dimension of the blade unit and to attain a modified blade geometry wherein the exposure of the first blade is not greater than zero and the exposure of the third blade is not less than zero, at least one of the first and third blades having a different exposure when the at least one movable element is in the non-shaving position.

The at least one element can be lightly biased, such as by means of a spring, to an initial, non-shaving position at which the target geometry of the blades does not apply, but when the blade unit is applied to the skin during shaving the at least one element can be displaced to a position in which the target geometry of the blades is attained.

The at least one element can comprise the guard and/or the cap and/or one or more of the blades.

In accordance with another aspect the present invention provides a safety razor blade unit comprising a guard, a cap and a plurality of blades with a parallel sharpened edges located in succession between the guard and cap, at least one of the guard and cap being movable against a spring force from a non-shaving position to a predetermined operable position in which a modified blade geometry is obtained, in the non-shaving position the blade edges being disposed below a plane tangential to the skin contacting surfaces of the guard and cap.

A full understanding of the invention will be

gained from the following detailed description in which reference is made to the accompanying drawings, wherein:

Figure 1 illustrates a preferred blade geometry during shaving and corresponds to Figure 2 of earlier application No. PCT/US94/10717;

Figure 2 is a transverse cross-section through a first embodiment of the present invention when not in use;

Figure 3 shows the blade unit of Figure 2 with the parts occupying different relative positions;

Figures 4 and 5 are views corresponding to Figures 2 and 3, respectively and showing a second embodiment of the invention; and

Figures 6 and 7 are views corresponding to Figures 2 and 3 and illustrating a third ebbodiment of the invention.

Figures 8-10 are illustrations of different orientations of a cartridge with respect to a shaver's skin.

Figure 11 is a cross-section through a further embodiment showing the use of cantilever arms for spring mounting of blades.

Figure 1 illustrates schematically a safety razor blade unit having a frame 1 defining a guard 2 and a cap 3 and mounting a lubricating strip 4. Supported by the frame and carried by respective support members are a primary blade 11, a secondary blade 12 and a tertiary blade 13, the blades having their edges lying in a common plane P. The geometry of the blade unit is as follows:

a) The span S_1 of the primary blade 11 is 0.5 to 1.5mm, and is preferably 0.7mm;

b) The span S_2 of the secondary blade 12 and the span S_3 of the tertiary blade 13 are in the range of 1.0 to 2.0mm, and each is preferably 1.5mm;

c) The distance S_4 from the edge of the

tertiary blade to the cap is about 1.80mm;

d) The exposure of the primary blade is -0.04mm;

e) The exposure of the secondary blade 12 is not less than the exposure of the primary blade 11 and not greater than the exposure of the tertiary blade 13 and, as shown, is equal to zero;

f) The exposure of the tertiary blade is about +0.09mm.

Except as otherwise noted, the embodiments of the present invention described below are so arranged that a substantially similar blade geometry can be achieved although such geometry does not apply when the blade unit is at rest and not in use.

In the blade unit shown in Figures 2 and 3, the guard 2 is mounted to the frame for up and down sliding movement between upper and lower end positions defined by stop surfaces provided on the frame. The guard is urged lightly to the upper end position by a spring 20. The cap 3 is similarly slidably mounted by the frame for up and down movement between end positions defined by stops, and a spring 21 lightly biases the cap to its upper end position. In the upper end position of the guard an upwardly facing shoulder 30 on the guard abuts a stop surface 31 defined by a flange 32 integral with the frame, as seen in Fig. 2. Similarly, in the upper end position of the cap an upwardly facing shoulder 34 on the cap abuts a stop surface 35 defined by a flange 36 integral with the frame. In the lower end positions of the guard and cap, the guard and cap respectively abut stop surfaces 37 and 38 defined by a bottom wall portion of the frame, as shown in Fig 3. The three blades 11, 12, 13, can be stationarily mounted in the frame or can be biased by respective springs against a stop surface 18 defined by inturned flanges on the end walls of the frame. In the out of use condition, the blade geometry

is outside the target geometry for the blades. The negative exposure of the primary blade has an absolute value significantly greater than 0.2mm and the tertiary blade has a negative exposure. In use, the guard and cap can be depressed against the springs 20, 21 which act respectively thereon and occupy their lower end positions, as shown in Figure 3, when a modified geometry substantially corresponding to that of Figure 1 is obtained. From this target geometry the blades may be deflected downwardly against their individual springs 19, but the enhanced shaving performance due to the target geometry need not be lost. Furthermore, it is not essential that the guard and cap remain in their lower end positions when they are in contact with the skin in use of the blade unit and they can be permitted to move under the influence of their respective springs 20, 21.

In the embodiment of Figures 4 and 5, the cap 3 and guard 2 are fixed to the frame as in figure 1, but the blades in this case are movable and influenced by respective springs 24. The springs could press the blades lightly upwardly against a stop surface (as mentioned in relation to Figures 2 and 3) but as shown the springs are unstressed when the blade unit is at rest and not in use so there is no preload on the blades. In this condition of the blade unit the target geometry for the blades is not satisfied, e.g., because the primary blade has a positive exposure, and the exposure of the tertiary blade is greater than the preferred maximum of +0.2mm. In use, however, the blades are depressed against the force of the springs so that a modified geometry is obtained, as shown in Figure 5, and substantially the target geometry of Figure 1 can be obtained. If required the blades could be provided with stops to predetermine the positions to which they need to be deflected to reach the target geometry. Alternatively, the spring rates can be

chosen so that deflection from positions according to the target geometry will not be excessive.

The embodiment of Figures 6 and 7 also has a stationary guard 2 and cap 3. The three blades 11, 12, 13 are mounted on a rocker unit 26 supported in the frame 1, such as by a shell bearing, for pivotal movement of the blades in unison about a pivot axis A located above the blade edges. A leaf spring 28 carried by the frame acts on the rocker urging it lightly to the non-shaving position shown in Figure 6, at which the blades are outside the target geometry for the blades, the primary blade having a positive exposure and the tertiary blade having a negative exposure. In use, forces applied will cause the rocker unit 26 to pivot against the action of the spring 28 and to take up the position which is shown in Figure 7 and which may be predetermined by a stop fixed on the frame such as stop 40 or stop 41 indicated schematically in the drawings. In this condition of the blade unit the geometry is substantially as specified above in relation to Figure 1, and hence the target geometry for the blades applies. As illustrated, the blades are fixedly mounted on the rocker but the blades may be mounted on the rocker by springs so that during shaving the blades may become deflected from the target geometry, as mentioned above in relation to Figures 2 and 3.

It will be understood that although they do not initially satisfy the geometrical parameters to obtain the best shaving performance, all of the embodiments are adapted so that these geometrical parameters will be obtained in use. While some embodiments have been described it will be appreciated that others are also possible within the scope of the claims. For example, just one of the guard and cap could be movable, or the blades and the guard and/or cap could be movable, or just one or two of the blades

could be movable. Other combinations of movable elements are also possible. Futhermore, the elements could be adapted to move in a different manner, such as by the guard being arranged to flex or tilt and/or to move to vary the span of the primary blade as well as modify the blade exposure.

A feature of the guard and/or cap being movably and sprung as in the embodiment of Figures 2 and 3 is that when not in use the blade edges are all disposed below a plane tangential to the skin contacting surfaces of the guard and cap. However, the guard and/or cap can be readily displaced to the retracted position defined by a stop so that a desired blade geometry is obtained.

It is believed that beneficial shaving results are achieved when cartridges with three resiliently mounted blades exhibit, during shaving, a "progressive force" pattern, i.e. the force on the tertiary blade is greater than the force on the primary blade and the force on the seconary blade is intermediate to the forces on the primary and tertiary blades or equal to the force on either the tertiary or the primary blade. The force pattern on the blades can be influenced by the cartridge orientation bias effect, blade geometry, and blade spring arrangement, as is discussed in detail below.

The cartridge orientation bias effect relates to how the angular orientation of the cartridge with respect to the skin surface influences the forces on the individual blades. Figs. 8-10 illustrate three cartridge orientations, a neutral orientation, a cap-heavy orientation, and a guard-heavy orientation. In these figures, cartridge 130 is illustrated schematically to include a guard 132, cap 134 and blades 136, 138, 140 and is shown with a cartridge orientation relative to the skin surface 142 before the skin surface has been deflected. During actual

shaving, the cartridges would in general be pushed into the skin surface, deflecting it so that the entire top part of the cartridge will contact the skin. If it is assumed that the exposures at best (non-shaving condition), spring preloads and spring rates are equal for each of the blades, then the cartridge orientation will control the force pattern on the blades during shaving.

In Figure 8, the cartridge 130 is oriented in the neutral condition. In this case, as the cartridge 130 is pressed against the skin surface 142 by the user to bring all of the blades into shaving contact, the forces are applied uniformly to the three blades. To produce a progressive force pattern, the blade geometry and/or the blade spring arrangement can be modified, as discussed in detail below.

In Figure 9, the cartridge 130 has a cap-heavy orientation. In this case, the cap 132 contacts the skin surface initially. As the remainder of the top part of the cartridge is pushed against the skin, more force is applied to the blades near the cap. Accordingly, the force on the tertiary blade is greater than the force on the secondary blade, which is greater than the force on the primary blade, which is a progressive force pattern.

In Figure 10, the cartridge 130 has a guard-heavy orientation. In this case, the guard 134 contacts the skin surface initially. As the remainder of the top part of the cartridge is pushed against the skin, more force is applied to the blades near the guard. Accordingly, the force on the primary blade is greater than the force on the secondary blade, which is greater than the force on the tertiary blade. The guard-heavy condition thus promotes the opposite of "progressive force." To produce a progressive force pattern, the blade geometry and/or the blade spring arrangement can be modified to counteract the force

pattern that would otherwise be caused by the guard heavy condition, as discussed in detail below.

For cartridges that are not pivotally connected to the handle, the cartridge orientation with respect to the skin, and thus the cartridge orientation bias effect, is generally determined by the orientation of the cartridge with respect to the handle. For cartridges attached to the handle through a pivot, in addition to the at rest orientation of the cartridge, the pivot location and return spring force will affect the cartridge orientation bias effect. For example, if the at rest cartridge orientation is as shown in Figure 9, the cap will initially contact the skin; hovever, if the pivot is in the region of the guard, and there is light return spring force, the cartridge will become guard heavy during shaving.

As noted above, the force pattern on the blades can also be influenced by the blade geometry and blade spring arrangement. The blade geometry refers to the exposure at rest. The blade spring arrangement refers to the spring rate and preload.

Figure 11 illustrates one way of providing resilient mounting for the blades and how at rest exposure of a blade can be adjusted. (Other spring mounting approaches can also be used.) Referring to Figure 11, cantilevered plastic arm 144 extends in from housing side wall 146 and provides resilient support for the bent upper portion 146 at one end of the blade. The cutting edge 150 of the blade is prevented from further upward movement by metal clip 152, which is secured to the housing. A similar arm extends in from the other side of the cartridge and provides resilient support for the other end of the blade under a similar retaining clip. The pair of arms 144 corresponds to springs 19, 24 shown in Figures 2-5. The upward force F that arm 144, acting as a cantilevered beam, exerts on blade portion 148 is a linear function of its

downward displacement, y, from its unbiased position: $F = k * y$, where k is a spring constant that depends upon the length of the arm, L, the moment of inertia of the arm, I, and the modulus of elasticity, E ($k = L^3/(3EI)$). If arm 144 is deflected a distance y_p by clip 152 in manufacture (i.e., providing arm 144 with a preload force F_p of $k * y_p$), then y in the formula equals $y_p + y_d$, where y_d equals the movement downward from the at rest position shown in Figure 11.

The forces on the blades can be controlled in a variety of ways to cause a progressive force pattern during shaving. E.g., arm 144 can be provided with a different spring constant by changing the length of arm 144 or the movement of inertia (e.g., by providing a thicker cross-section for arm 144). Arm 144 can also be provided with a different preload force F_p by keeping the same arm section and length, but moving the location at which the arm 144 is attached to housing side wall 146 upward (to increase preload force) or downward (to decrease preload force). The position or shape of clip 152 could also be adjusted relative to the arms to adjust preload force F_p; e.g., clip 152 could be mounted so that the portion contacting one blade is lower or higher than the portion contacting a different blade.

One way to achieve a progressive force pattern during shaving is to have an initial progressive exposure and the same preload force and spring constant for all blades. Another way to achieve a progressive force pattern during shaving is to have the same initial exposure (e.g., all zero) and to have progressive preload. A progressive preload can be provided by having the spring constant for the tertiary blade be higher than the spring constant for the second blade, and by having the spring constant for the primary blade be less than the spring constant for the second blade. A progressive preload can also be

achieved by using the same arms (i.e., same spring constants) for all blades, but having the second arm mounted higher than the primary blade and the third arm mounted higher than the second.

The springs, preloads and initial exposures can be used in combination with the cartridge orientation bias effect to produce progressive exposure and/or a progressive force pattern. For example, if the cartridge has a guard-heavy orientation (e.g., a cap first orientation though with a pivot in the proximity of the guard and a light return spring, as noted above) & progressive geometry in use can be effected with higher preloads, spring constants, and at-rest exposures on the tertiary and secondary blades than on the primary blade. Other combinations that can be used to promote a progressive force during shaving include a higher preload, spring constant, or at rest exposure on the third blade than on the first blade or combinations of these parameters having higher values on the third blade as compared to the first blade. Preferably the second blade would have intermediate values or values that are the same as the third blade in order to promote the progressive force pattern.

The spring preloads are typically in the range of about 25g or less. The force on the individual blades would be expected to be in the range of about 0-40g, with between zero and 20 gms on the first blade, and between greater than zero and less than 40 gms on the third blade. Typically the forces on the individual blades would be greater than 5gm. At rest exposures and exposures during shaving typically are in the ranges noted earlier.

C L A I M S

1. A safety razor blade unit comprising a guard, a cap, and first, second and third blades with parallel sharpened edges located in succession between the guard and cap, at least one element selected from the three blades, guard and cap being movable from a non-shaving position to modify a blade exposure dimension of the blade unit and attain a modified blade geometry wherein the exposure of the first blade is not greater than zero and the exposure of the third blade is not less than zero, at least one of the first and third blades having a different exposure when the at least one movable element is in the non-shaving position.

2. A safety razor blade unit according to claim 1, wherein the at least one element is movable from the non-shaving position to a predetermined position defined by stop means or a pressure arrangement.

3. A safety razor blade unit according to claim 1 or 2, wherein the at least one movable element is biased by spring means to the non-shaving position.

4. A safety razor blade unit according to claim 3, wherein the at least one element is biased by the spring means to an end position defined by stop means.

5. A safety razor blade unit according to any one of claims 1 to 4, wherein the at least one movable element comprises the guard.

6. A safety razor blade unit according to any one of claims 1 to 5, wherein the at least one movable element comprises the cap.

7. A safety razor blade unit according to any one of claims 1 to 4, wherein the at least one movable element comprises one or more of the blades.

8. A safety razor blade unit according to claim 7, wherein the blades are movable independently of each other.

9. A safety razor blade unit according to claim 7, wherein the blades are movable in unison.

10. A safety razor blade unit according to claim 9, wherein the blades are carried by a member mounted for pivotal movement.

11. A safety razor blade unit according to claim 10, wherein the pivotal member is pivotable about an axis located above the blade edges.

12. A safety razor blade unit comprising a guard, a cap and a plurality of blades with parallel sharpened edges located in succession between the guard and cap, at least one of the guard and cap being movable against a spring force from a non-shaving position to a predetermined operable position in which a modified blade geometry is obtained, in the non-shaving position the blade edges being disposed below a plane tangential to the skin contacting surfaces of the guard and cap.

13. A safety razor according to claim 12, wherein first, second and third blades are provided and have edges disposed between the guard and cap.

14. A safety razor blade unit according to any one of claims 1 to 11, or 13, wherein in said modified blade geometry the exposure of the first blade has a negative exposure with an absolute value in the range of 0 to 0.2mm.

15. A safety razor blade unit according to claim 14, wherein in said modified blade geometry the span between the first blade edge and the guard is in the range of 0.5mm to 1.5mm.

16. A safety razor blade unit according to claim 14 or 15, wherein in said modified blade geometry the exposure of the first blade is substantially equal to -0.04mm.

17. A safety razor blade unit according to any one of claims 1 to 11 or 13 to 16, wherein in said modified blade geometry the exposure of the third blade has a positive value not greater than +0.3mm.

18. A safety razor blade unit according to any one of claims 1 to 11 or 13 to 17, wherein in said modified blade geometry the span between the edge of the third blade and the edge of the second blade is in the range of 1.0 to 2.0mm.

19. A safety razor blade unit according to any one of claims 1 to 11 or 13 to 18, wherein in said modified blade geometry the span between the edge of the second blade and the edge of the first blade is in the range of 1.0 to 2.0mm.

20. A safety razor blade unit according to claim 18 or 19, wherein in said modified blade geometry the span between the edges of the first and second blades and/or between the edges of the second and third blades is substantially equal to 1.5mm.

21. A safety razor blade unit according to any one of claims 1 to 11 or 13 to 20, wherein in said modified blade geometry the second blade has an exposure not less the the exposure of the first blade and not greater than the exposure of the third blade.

22. A safety razor blade unit according to claim 21, wherein in said modified blade geometry the exposure of the second blade is substantially equal to zero.

23. A safety razor blade unit according to any one of claims 1 to 11 or 13 to 22, wherein in said modified blade geometry the exposure of the third blade has a positive value substantially equal in magnitude to the negative value of the exposure of the first blade.

24. A safety razor blade unit according to any one of claims 1 to 11 or 13 to 23, wherein in said modified blade geometry the span between the first blade edge and the guard is substantially smaller than the span between the edges of the first and second blades and the span between the edges of the second and third blades.

25. A safety razor blade unit according to any one of claims 1 to 11 or 13 to 24, wherein in said modified blade geometry the span between the first blade edge and the guard is substantially equal to 0.7mm.

26. A safety razor blade unit substantially as herein described with reference to Figures 2 to 7 of the accompanying drawings.

27. A shaving cartridge comprising

a housing having connecting structure for making a removable connection to a handle,

a guard at the front of the cartridge,

a cap at the back of the cartridge, and

first, second and third blades with parallel sharpened edges located in succession on said housing between said guard and cap and independently mounted for spring-biased movement with respect to said housing,

said blades being movable from non-shaving positions to shaving positions in which the force on the first blade is less than the force on the third blade.

28. The cartridge of claim 27, wherein in said shaving positions the force on the first blade is less than or equal to the force on the second blade, and the force on the second blade is less than or equal to the force on the third blade.

29. The cartridge of claim 27, wherein said housing has pivoting structure for providing pivoting of said housing about a pivot axis.

30. The cartridge of claim 29, wherein said pivot axis is in front of blades in the region of said guard.

31. The cartridge of claim 27, wherein said cartridge is guard heavy.

32. The cartridge of claim 30, wherein said cartridge is guard heavy.

33. A shaving razor comprising

a handle,
a housing connected to said handle,
a guard at the front of the housing,
a cap at the back of the housing, and
first, second and third blades with parallel sharpened edges located in succession on said housing between said guard and cap and independently mounted for spring-biased movement with respect to said housing,

said blades being movable from non-shaving positions to shaving positions in which the force on the first blade is less than the force on the third blade.

34. The cartridge of claim 27, 31 or 32 or the razor of claim 33, wherein said third blade has a higher spring constant than said first blade.

35. The cartridge of claim 27, 31 or 32 or the razor of claim 33, wherein said third blade has a higher preload than said first blade.

36. The cartridge of claim 27, 31 or 32 or the razor of claim 33, wherein said third blade has a higher exposure at rest than said first blade.

37. The cartridge of claim 28, 31 or 32 or the razor of claim 33, wherein said second and third blades have higher spring constants than said first blade.

38. The cartridge of claim 28, 31 or 32 or the razor of claim 33, wherein said second and third blades have higher preloads than said first blade.

39. The cartridge of claim 28, 31, or 32 or the razor of claim 33, wherein said second and third blades have higher exposure at rests than said first blade.

40. The cartridge of claim 27, 31, or 32 or the razor of claim 33, wherein said third blade has a higher exposure at rest and a higher preload than said first blade.

41. The cartridge of claim 27, 31, or 32 or the razor of claim 33, wherein said third blade has a

higher exposure at rest and a higher spring constant than said first blade.

42. The cartridge of claim 27, 31, or 32 or the razor of claim 33, wherein said third blade has a higher preload and a higher spring constant than said first blade.

43. The cartridge of claim 27, 31, or 32 or the razor of claim 33, wherein said third blade has a higher exposure at rest, higher preload, and higher spring constant than said first blade.

44. The cartridge of claim 27, 28, 31, or 32 or the razor of claim 33, wherein said second and third blades have higher exposure at rests and higher preloads than said first blade.

45. The cartridge of claim 27, 28, 31, or 32 or the razor of claim 33, wherein said second and third blades have higher exposure at rests and higher spring constants than said first blade.

46. The cartridge of claim 27, 28, 31, or 32 or the razor of claim 33, wherein said second and third blades have higher preloads and higher spring constants than said first blade.

47. The cartridge of claim 27, 28, 31, or 32 or the razor of claim 33, wherein said second and third blades have higher exposure at rests, higher preloads, and higher spring constants the said first blade.

48. The cartridge of claim 27, 28, 31 or 32 or the razor of claim 33, wherein the force on said first blade during shaving is between zero and 20 gms and the force on said third blade during shaving is greater than zero and less than 40 gms.

49. A shaving cartridge comprising

a housing having connecting structure for making a removable connection to a handle,

a guard at the front of the cartridge,

a cap at the back of the cartridge, and

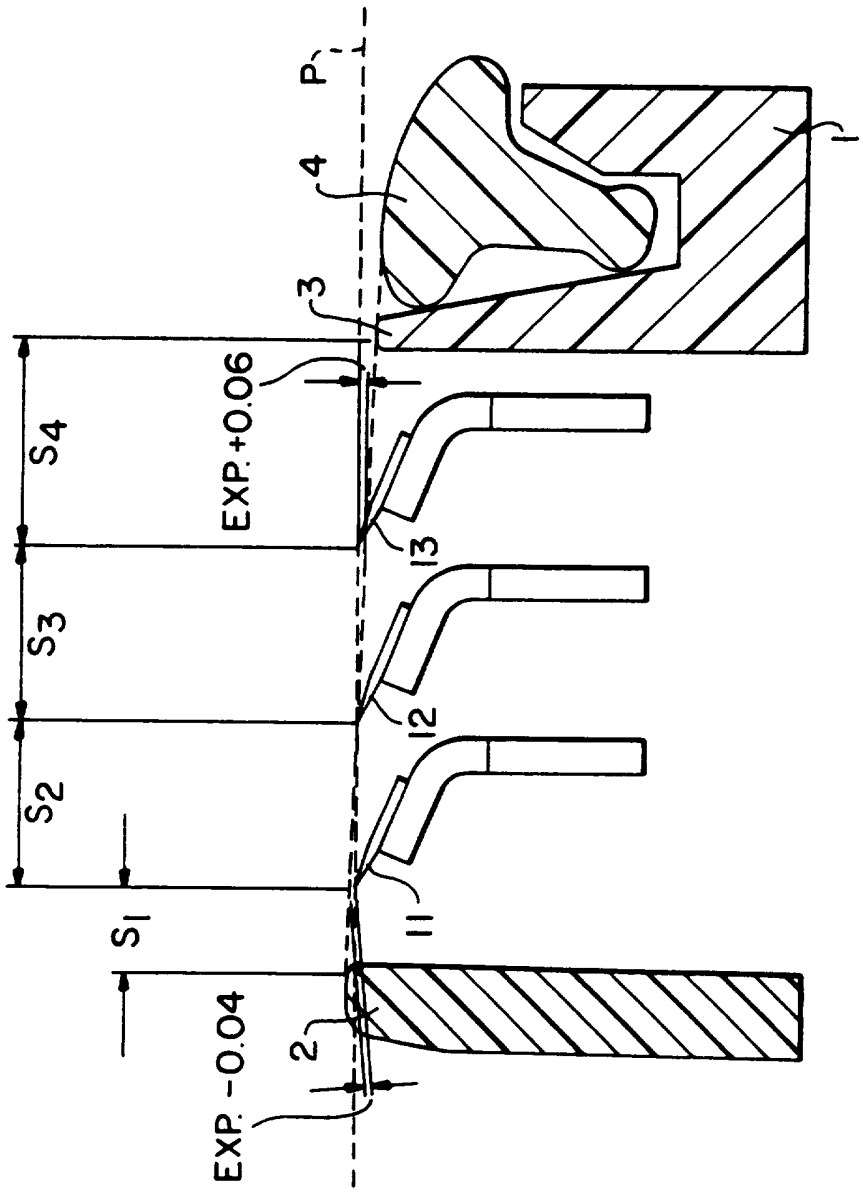
first, second and third blades with parallel

sharpened edges located in succession on said housing between said guard and cap and independently mounted for spring-biased movement with respect to said housing,

said blades being movable from non-shaving positions to shaving positions in which the exposure on the first blade is less than the exposure on the third blade.

50. The cartridge of claim 49, wherein in said shaving positions the exposure on the first blade is less than or equal to the exposure on the second blade, and the exposure on the second blade is less than or equal to the exposure on the third blade.

FIG. 1



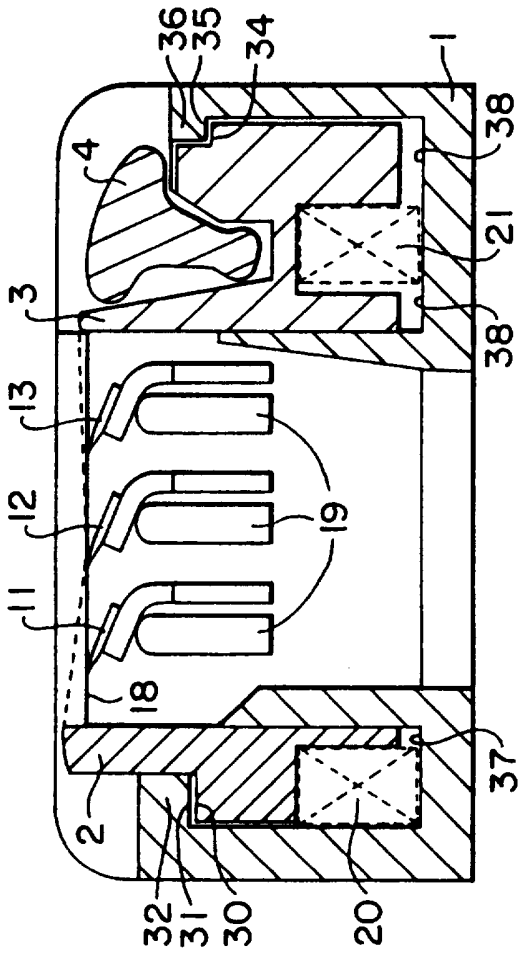

36
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FIG. 2

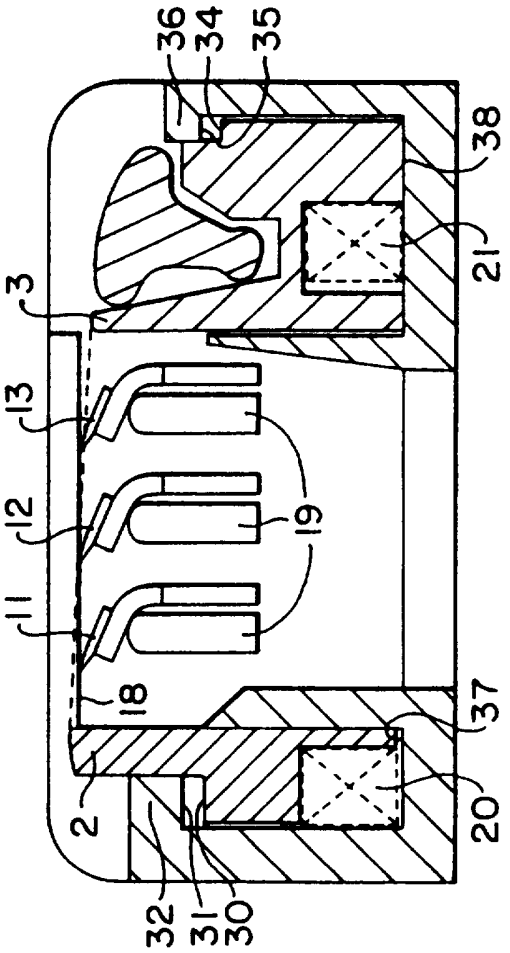
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FIG. 3

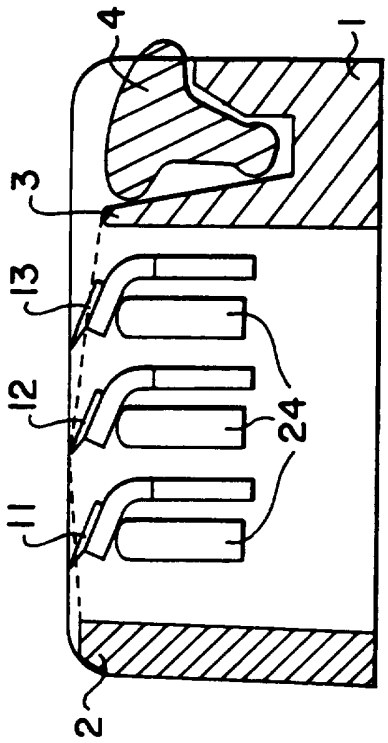


FIG. 4

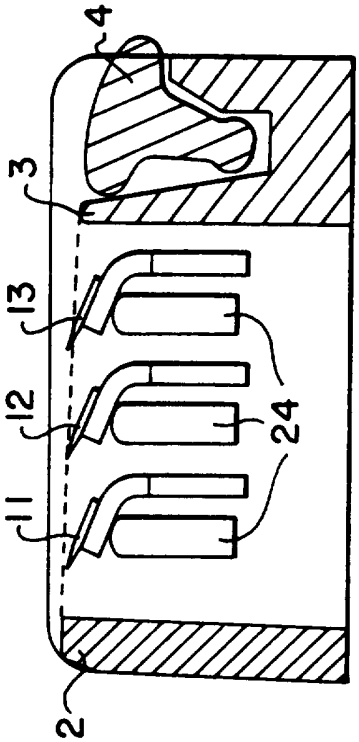


FIG. 5

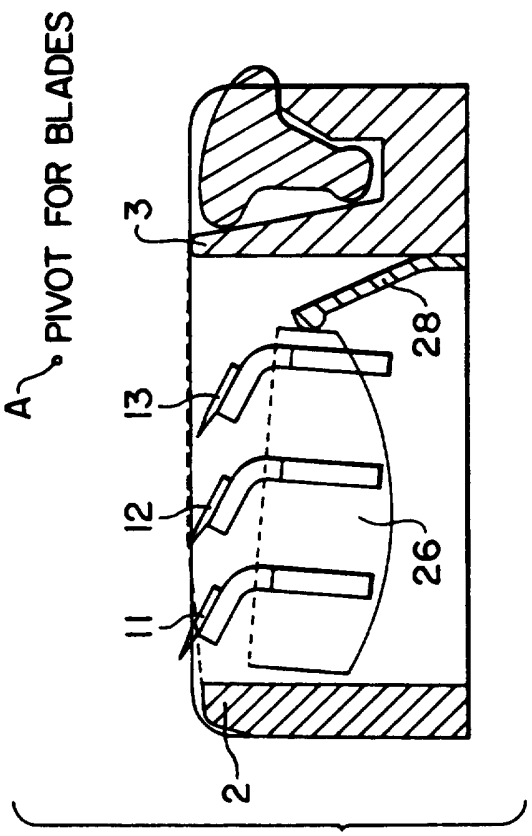


FIG. 6

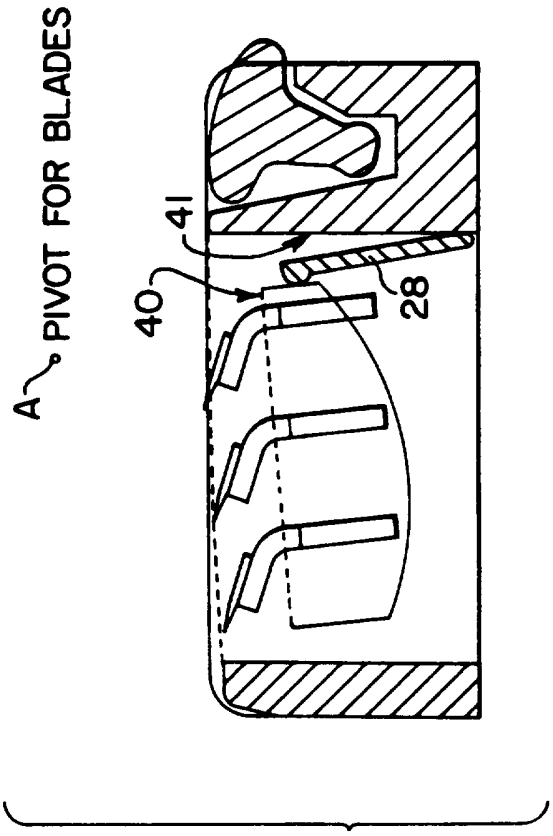


FIG. 7

FIG. 8

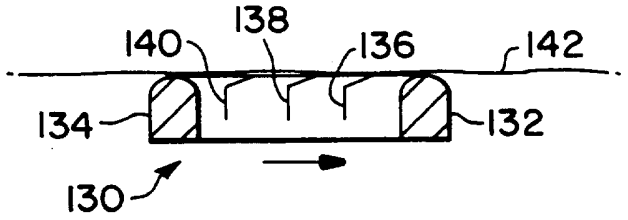


FIG. 9

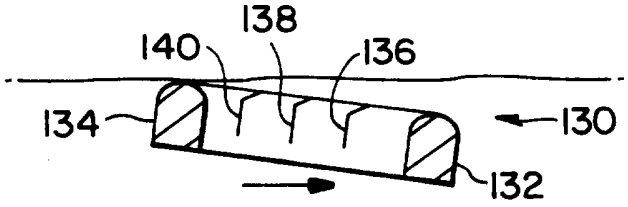


FIG. 10

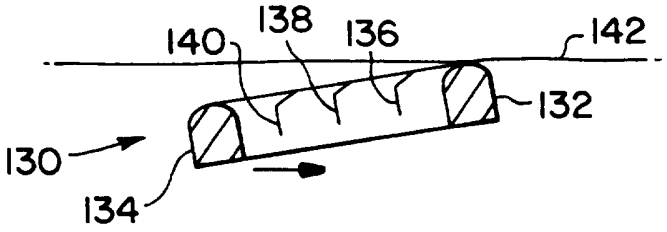
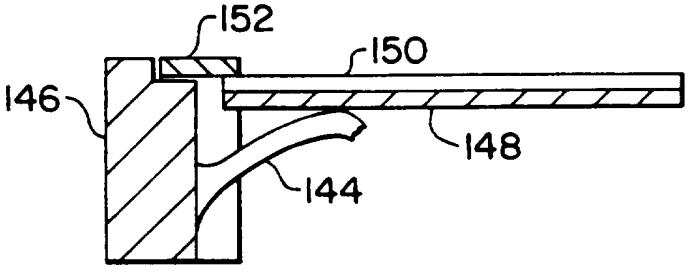


FIG. 11



INTERNATIONAL SEARCH REPORT

Inter ›nal Application No
PCT/US 96/03758

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 B26B21/22

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 B26B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P,X	WO,A,95 09071 (THE GILLETTE CO) 6 April 1995 see page 6, line 12 - page 7, line 23; figures 1,2	1-4,7,9, 12-14
A	FR,A,2 379 357 (THE GILLETTE CO) 1 September 1978 see page 6, line 19 - page 7, line 16; figures 8,9	1
A	DE,A,33 03 095 (FEATHER SAFETY RAZOR CO) 25 August 1983	
A	US,A,4 854 042 (BYRNE J J) 8 August 1989	

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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Date of the actual completion of the international search
30 July 1996

Date of mailing of the international search report
14. 08. 96

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INTERNATIONAL SEARCH REPORT

Information on patent family members

Int ·onal Application No
PCT/US 96/03758

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