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(54) **MOVABLE BLADE SHAVING CARTRIDGE OR THE LIKE**

RASIERKLINGENEINHEIT MIT BEWEGLICHEN KLINGEN ODER ÄHNLICHE VORRICHTUNG

TETE DE RASOIR A LAMES MOBILES OU ANALOGUE

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Description

BACKGROUND OF THE INVENTION

[0001] The present invention relates to wet shaving systems of the blade type and more particularly to a shaving system having a movable blade positioned within a blade cartridge or the like.

[0002] During the shaving process, shavers have long sought a wet shaving system which provides a smooth and comfortable shave without having annoying cuts and abrasions. In order to accomplish this objective, it has been known in the art to utilize multiple blade shaving systems which provide independent movement of the blades relative to the blade cartridge. (See, U.S. Patent No. 4,168,571).

[0003] Typically, such shaving systems include two blades disposed parallel to one another so as to provide first and second cutting edges which successively engage the shaving surface in a predetermined spaced relationship. The use of multiple blades operates to provide a close, more efficient shave. Further, the independent movable blades permit the shaving geometry of each blade to adapt to the various conditions encountered during the shaving process in an effort to reduce nicks and cuts.

[0004] The terms utilized to define the various geometric relationships between the blades, the various elements of the blade cartridge and the shaving surface include "shaving plane", "blade exposure" and "shaving angle". The term "shaving plane" means the plane tangent to skin engaging surfaces, for example a guard and a cap, which are disposed on both sides of the blade so as to engage the shaving surface before and after engagement by the blade. The term "blade exposure" means the distance by which the blade edge projects forwardly of the shaving plane. Finally, the term "shaving angle" means the acute angle between the plane tangent to the cutting edge of the blade and the shaving plane.

[0005] Various approaches have been used to enable the shaving blade to move relative to the blade cartridge or razor body in response to shaving forces encountered during the shaving process in an effort to present the correct blade exposure and shaving angle.

[0006] One approach disclosed in prior art patents illustrates a blade cartridge comprising two blades separated by a spacer with the blades and the spacer attached to a cap to form a unitary assembly. The blade assembly is movable between various blade exposures and shaving angles within various degrees of control and direction in response to forces encountered during shaving. For example, Ciaffone et al., U.S. Patent No. 4,461,079, discloses a razor cartridge comprising a body portion 10 which includes a guard bar 12 (Figs. 1-5). The guard bar 12 defines a leading skin-engaging surface fixed to the body portion. A rear beam 17 spans end walls 14 and 16 of the body portion 10 and a medial support member 13 to join the front of the cartridge 12 to the end thereof. A plurality of generally flat coplanar segments 18,19,21,22, each having an opening 23, are hinged to the rear beam 17 by mating webs 24,26,27,28 (col. 2, lines 50-52). Collectively, the segments 18,19,21,22 define a blade seat which is operable to pivot about the beam 17, thereby changing the attitude of blade edge relative to guard bar 12 (col. 2, lines 53-57). A cap 33 is apparently placed above an assembly of two skin-engaging blades 34,36, straddling a spacer 37 (Fig. 3). The two blades and the spacer are secured to one coplanar segment 21 of the blade support or blade seat by a conventional rivet 38 to form a rigid unit. A hinge 27 connects the coplanar segment 21 to the rear-beam 17 (col. 3, lines 1-8). As compared to the position of the blade edges relative to the guard bar at the normal or free position set in accordance with a predetermined blade geometry (Fig. 3), a change in blade geometry occurs during the course of shaving when a shaving force F causes the blade package to rotate or pivot about rear-beam 17 in the direction of arrow R where the blade edges are rendered less "aggressive" (Fig. 4, col. 3, lines 13-23). Upon relaxation of shaving forces, the elastic memory of hinges 24,26,27,28 forces the blade seat, and therefore the blade edges, to return to their normal position (Fig. 3., col. 3, lines 24-26).

[0007] In an alternative embodiment, Ciaffone et al. shows the blade seat is hinged to a front beam 175 by webs 240,260,270,280 (Figs. 6-10, col. 3, lines 46-48). Upon exertion of a shaving force F' (Fig. 9) onto the cap 330, the coplanar segments 180,190,210 and 220, move in the direction of the arrow R (Fig. 9) to provide a more aggressive edge exposure (col. 4, lines 1-9). As in the embodiment of Figs. 1-5, the elastic memory of the hinges 240,260,270,280 forces the blade edges to return to the free position when shaving forces are released (col. 4, lines 11-13).

[0008] Oldroyd et al., U.S. Patent No. 4,063,354, discloses a shaving unit wherein a blade unit comprises two blades separated by a spacer 5 (Figs. 13-16). A resiliently flexible metallic or plastic guard 3 is secured to the blade unit by spot welding or other means (col. 3, lines 26-28). The blade unit, which is illustrated in its normal forward position of maximum blade exposure in Fig. 13, can bow rearwardly under pressure applied during shaving to carry the blade unit along a plane to the rear, relative to the platform 1 and cap 4. This reduces blade exposure but increases the shaving angle, as indicated by dotted lines 3' in Figs. 13 and 15 (col. 3, lines 26-37).

[0009] Althauset et al., U.S. Patent No. 5,074,042, discloses a shaver head comprising two staggered blades 7 embedded in a blade block 6 (Fig. 3). A cover cap portion 9 covers the top side of the blade block 6 (col. 3, lines 12-15). A spring 14 is placed between the blade block 6 and a body 2. The blade block 6, together with the two staggered blades 7, can swivel about an axis A (col. 3, lines 17-43). During shaving, pressure is

applied to the razor blade unit, thereby causing the blade block 6 to swivel and alter shaving geometry of the blades (col. 3, lines 46-60).

[0010] Jacobson U.S. Patent Nos. 4,442,598, 4,378,634 and 4,270,268 disclose a razor blade assembly including a body member 2 having blade means 36,36' being independently movable in response to spring finger biasing means 18,18' integral with the body member. In the Jacobson patents, the spring fingers 18,18' move the blade means 36,36' along planes defined by slots 16 in end portions 4,6 of the body member 2.

[0011] In all of the aforementioned patents, the blade members either engage movable spring fingers formed integral with the blade cartridge, or are mounted permanently to a platform which is movably connected to the blade cartridge. These methods of providing a movable blade necessitate an elaborate and expensive molding procedure to create a blade cartridge having either integral spring fingers or a movable blade platform. While it has been noted that blades movable relative to the shaving surface during the shaving process are advantageous, it is desirable to eliminate the need for the elaborate molding process required by the movable blade assemblies of the prior art.

[0012] Additionally, prior art shaving systems have attempted to reduce the uncomfortableness in shaving caused by the frictional drag of the razor across the skin in conjunction with the force necessary to sever the hair protein structure or whisker. One known method of reducing the frictional drag is shown in U.S. Patent 4,170,821 issued to Booth. As described in Booth, a lubricating agent commonly referred to as a "lube strip" is cemented to the cap portion of the blade cartridge to reduce the frictional forces between the razor and the skin.

[0013] However, such systems suffer from various drawbacks. First, a significant portion of the blade cartridge not containing any friction reducing agent remains in contact with the skin. For example, the ends of the blade cartridge extending perpendicular to the cutting edge remain in contact with the skin. As such, the frictional drag encountered during shaving remains significant. Second, the requirement of producing and cementing an additional "lube strip" to the blade cartridge increases manufacturing costs.

[0014] US 4,574, 476 on which the preamble of claim 1 is based, and which is regarded as the closest prior art discloses a razor blade assembly having two blades spaced apart by spacer segments.

SUMMARY OF THE INVENTION

[0015] The present invention provides a flexible blade cartridge as set out in claim 1. According to an embodiment, a plurality of blade members are permanently fixed relative to the blade cartridge. Unlike the movable blade assemblies of the prior art, there are no movable support members in the blade cartridge. Each blade is mounted such that a substantial portion of the blade is free from contact with support members. The free end of each blade functions as a single cantilever forming a "flexing zone" about which the cutting edge of the blade bends in response to an applied force. Each blade is flexible about the longitudinal axis of the blade. Thus, the present invention can provide for individually movable blades without requiring an elaborate molding procedure to create movable spring fingers or movable blade platforms.

[0016] In addition, the present invention can optimizes the geometric relationship between the blade means and the other elements of the blade cartridge so as to maximize the comfort and closeness of the shave without the associated nicks and cuts normally associated with twin blade shaving cartridges designed to shave close.

[0017] Furthermore, the present invention may provide a novel means of applying a friction reduction agent to a substantial portion of the blade cartridge so as to improve shaving comfort, while minimizing manufacturing costs associated with incorporating the friction reducing agent in the blade cartridge.

[0018] Accordingly, an embodiment of the present invention relates to a blade cartridge comprising a platform member having a blade seat and a guard member. The guard member is located forward of and parallel to the blade seat so as to form a longitudinal slot between the blade seat and the guard member. The blade cartridge also comprises a primary blade which is disposed on the blade seat such that the cutting edge of the blade is located rearwardly of the guard member. A substantial portion of the primary blade extends into the slot formed between the guard member and the blade seat such that the blade is flexible about the longitudinal axis of the blade into the slot. Preferably, the cutting edge of the primary blade is parallel to the guard member.

[0019] The blade cartridge also comprises a spacer which is located on the upper surface of the primary blade. The spacer comprises a rear portion which functions to separate the primary blade and a secondary blade. The spacer also comprises a forward portion which extends from the rear portion and functions to prevent upward movement of the primary blade, and to create an opening beneath the forward portion of the lower surface of the secondary blade.

[0020] The blade cartridge also comprises a cap member disposed on the secondary blade. The cap member comprises fastening means to secure the members forming the blade cartridge together, and a member which prevents upward movement of the secondary blade.

[0021] The corners or outer edges of the primary and secondary blades are covered by "C" shaped end clips which are coated with a friction reduction agent so as to minimize the drag forces associated with the shaving process. The end clips also function to provide addition-

al stability to the ends of the primary and secondary blades (i.e. prevents the ends or corners of the blades from moving in the upward direction).

[0022] As described hereinafter, each blade is independently movable in response to shaving forces applied to the blade. Specifically, each blade is flexible about the longitudinal axis of the blade within a flexing zone defined by the ratio between the portion of the blade overlying a physical structure and the portion of the blade overlying the opening formed beneath the forward portion of each blade, in combination with the physical characteristics of the blade. If a force exceeding the resilient force of the blade is exerted on the blade, the blade flexes about the longitudinal axis so as to bend in the downward direction against the resilient force of the blade. The bending movement of the blade results in the simultaneously decrease of blade exposure and shaving angle.

[0023] Preferably, the blade cartridge is connected to a handle, and can be pivotally connected so as to allow the blade cartridge to further respond to shaving forces encountered during the shaving process.

[0024] The invention itself, together with further objects and advantages, will best be understood by reference to the following detailed description taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0025]

Figure 1 is a cross-sectional view of the blade cartridge of an embodiment of the present invention through a rivet on the cap member illustrating the assembly with both the primary and secondary blade at rest.

Figure 2 illustrates a top plan view of the platform member of an embodiment of the present invention showing the blade seat, the guard member and a plurality of support members integrally molded to the blade seat and guard member.

Figure 3 illustrates a top plan view of a first embodiment of the spacer of the present invention.

Figure 4 illustrates an end view of the spacer shown in Fig. 3.

Figure 5 illustrates a top plan view of the primary and secondary blade, and the spacer in the assembled position.

Figure 6 illustrates a front view of a first embodiment of the cap member of the present invention.

Figure 7 illustrates an end view of the cap member shown in Fig. 6.

Figure 8 illustrates a blade used for the primary blade structure.

Figure 9 illustrates a blade used for the secondary blade structure.

Figure 10 illustrates one embodiment of the platform member adapted to receive a razor handle so as to pivotally connect the blade cartridge to the razor handle.

Figure 11 is the same cross-sectional view of the blade cartridge as shown in Fig. 1 illustrating the optimum geometric relationships of the various components with the blades at rest.

Figure 12 is the same cross-sectional view of the blade cartridge as shown in Fig. 1 illustrating the blades fully flexed.

Figure 13 illustrates a side view of an end clip.

Figure 14 is a perspective view of the blade cartridge of an embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0026] Turning now to the drawings, Figs. 1-14 illustrate a movable blade shaving cartridge ("MBSC" or blade cartridge) or razor head 10 which comprises a platform member 2, flexible blade means 32, 34, a spacer 6 and a cap member 8.

[0027] As shown in Figure 2, the platform member 2 comprises a blade seat 24 having a front and rear wall 12,14, and ends 16,18. The ends 16,18 extend beyond the front wall 12 so as to allow a guard member 20 to be interconnected between the ends 16,18 at a position forward of the front wall 12. The guard member 20 extends parallel to the front wall 12 forming a slot 26 between the guard member 20 and the front wall 12. The guard member 20 also is connected to the front wall 12 by a plurality of support members 22, which extend substantially perpendicular to the longitudinal axis of the both the guard member 20 and the front wall 12.

[0028] The blade seat 24 further comprises an upper surface 28, as well as a plurality of securing apertures 30. The securing apertures operate in conjunction with fastening means 80 located on the cap member 8, such as rivets, to permanently secure the platform member 2, the flexible blade means, the spacer 6 and the cap member 8 together.

[0029] The flexible blade means comprises a primary and secondary blade 32,34, each having substantially parallel front and rear edges with the front edge of each blade defining a cutting edge 36,38. Each blade 32,34 defines a longitudinal axis which is parallel to the cutting edge of the blade 32,34, and a lateral axis which is perpendicular to the cutting edge of the blade 32,34. Each blade 32,34 is flexible about its longitudinal axis. As shown in Fig. 8, the primary blade 32 comprises securing apertures 40 which align with the securing apertures 30 of the blade seat 24 so as to allow the fastening means 80 to pass through the securing apertures 40 of the primary blade 32, thereby securing the primary blade 32 to the blade cartridge 10.

[0030] The secondary blade 34 is illustrated in Fig. 9. Similar to the primary blade 32, the secondary blade 34 comprises securing apertures 43 which align with the securing apertures 30 of the blade seat 24 so as to allow

the fastening means 80 to pass through the securing apertures 43 of the secondary blade 34, thereby securing the blade to the blade cartridge 10. However, the securing apertures 43 of the secondary blade 34 preferably are oval in shape and perform a dual function. The first function, which has already been stated, is to secure the secondary blade 34 to the blade cartridge 10. The second function of the apertures 43 is to contribute to the flexibility of the secondary blade 34. The secondary blade 34 is positioned such that the fastening means 80 passes through the rear portion of each securing aperture 43 (i.e. the portion farthest away from the cutting edge 38). As a result, the portion of the aperture 43 free from contact with the fastening means 80 contributes to the flexibility of the secondary blade 34.

[0031] Furthermore, both the primary and secondary blades 32,34 comprise a plurality of holes 42 located proximate the cutting edge 36,38 of the respective blade 32,34. The holes 42 provide a passage to facilitate the removal of shaving debris and contribute to the flexibility of the blades 32,34. Specifically, the diameter of the holes 42 in combination with the thickness of the blades 32,34 partially determines the degree of flexibility of the blades 32,34. Preferably, the sum of the longitudinal dimensions of the holes 42 on the primary blade 32 should be between 35 to 75 percent of the length of the blade. Similarly, the sum of the longitudinal dimensions of the apertures 43 and holes 42 on the secondary blade 34 should be between 35 to 75 percent of the length of the blade.

[0032] As shown in Figures 1 and 2, the support members 22 extend downwardly away from the upper surface 28 of the blade seat 24 so as to create a gap 46 between the lower surface 48 of the primary blade 32 and the upper surface of each support member 22. Preferably, each support member 22 also comprises a lip 60 which operates as a stop to prevent further downward movement of the primary blade 32.

[0033] The spacer or "soap bar" 6, which is placed between the primary and secondary blades 32,34, functions to separate the blades 32,34. As shown in Figures 1 and 4, the spacer 6 comprises an upper and lower surface 58,56 and is divided into a forward portion 62 and a rear portion 64. The rear portion 64 of the spacer 6 exhibits a uniform height (i.e. the distance between the blades 32,34 measured perpendicularly to the longitudinal axis of the blades), so that when the blades 32,34 are secured to the upper and lower surface 58,56 of the spacer 6, respectively, the blades 32,34 are parallel to one another.

[0034] Preferably, as shown in Fig. 1, the primary blade 32 and the secondary blade 34 are separated from each other by a distance of about 0.0508 cm (0.020 inches) to about 0.127 cm (0.050 inches) by the spacer 6. The height of the rear portion 64 of spacer 6 defines the separation between the two blades 32,34.

[0035] The forward portion 62 of the spacer 6 comprises portions having a reduced height relative to the rear portion 64 so as create areas where the blades 32,34 do not contact the spacer 6. Specifically, as shown in Figures 1 and 4, the upper surface 58 of the forward portion 62 exhibits an arcuate downward slope proximate the rear portion 64 and thereafter extends in the direction parallel to the plane of the blade 34. Furthermore, a plurality of ribs 66 are disposed on the upper surface 58 of the forward portion 62 of the spacer 6. The ribs 66 extend perpendicularly to the longitudinal axis of the blades 32,34 and exhibit a height such that the top of ribs 66 are below the plane of the upper surface 58 of the rear portion 64 of the spacer 6.

[0036] The lower surface 56 of the forward portion 62 of the spacer 6 forms a cavity 68, which extends in a direction parallel to the cutting edge 36,38 of the blades 32,34. The lower surface 56 of the forward portion 62 of the spacer 6 further comprises a plurality of downwardly extending pads 70 on the outer edge of the forward portion 62 of the spacer 6. As shown in Fig. 3, the pads 70 are separated from one another so as to allow water to flow through the front of the spacer 6 into the cavity 68. Referring to Fig. 1, it is apparent that the primary blade 32 extends beyond the downwardly extending pads 70 of the spacer 6. As a result, the pads 70 operate as a stop limiting the upward movement of the primary blade 32.

[0037] Furthermore, similar to both blades 32,34, the spacer 6 comprises four securing apertures 44 which are located on the rear portion 64 of the spacer 6. The securing apertures 44 operate in conjunction with the fastening means 80 to secure the spacer 6 to the blade cartridge 10. The spacer 6 also comprises a plurality of holes 41 located on the forward portion 62 of the spacer 6, which align with the holes 42 of both the primary and secondary blades 32,34. The alignment of the spacer holes 41 and blade holes 42 allows water to be directed to the edges of both blades 32,34 so as to facilitate the removal of shaving debris.

[0038] Figure 5 illustrates the alignment of the primary and secondary blades 32,34 and the spacer 6. As shown the cutting edge 36 of the primary blade 32 is located forward of the cutting edge 38 of the secondary blade 34. The holes 42 in the blades 32,34 and the holes 41 in the spacer 6 align such that the water can flow from the lower surface 48 of the primary blade 32 to the upper surface 54 of the secondary blade 34. The water passage facilities the removal of shaving debris from the cutting edges 36,38 of the blades 32,34.

[0039] The cap member 8 is disposed on the upper surface 54 of the secondary blade 34. As shown in Figure 1 and 6, similar to the spacer 6, the lower surface 72 of the cap member 8 forms a cavity 76 which extends parallel to the cutting edge 36,38 of the blades 32,34. Also, the lower surface 72 of the cap member 8 comprises a plurality of downwardly extending pads 78 on the forward portion of the cap member 8. Again, similar to the spacer 6, the pads 78 are separated from one another so as to allow water to flow through the front of

the cap member 8 into the cavity 76. As shown in Fig. 1, the secondary blade 34 extends beyond the downwardly extending pads 78 of the cap member 8, and therefore the pads 78 operate as a stop limiting the upward movement of the secondary blade 34.

[0040] In addition, the cap member 8 comprises a plurality of fastening means 80, such as rivets. The fastening means 80 extend downwardly from the lower surface 72 of the cap member 8 and pass through the securing apertures 44 of the spacer 6 and the securing apertures 40,43 of the blades 32,34 and into the securing apertures 30 of the blade seat 24. The ends of the fastening means 80 extend beyond the blade seat 24 and are upset thereby permanently affixing the blade seat 24, blades 32,34, spacer 6 and cap member 8 together.

[0041] Figure 1 illustrates in detail the novel structure of the blade cartridge 10 of the present embodiment. As is apparent, the primary blade 32 is disposed on the upper surface 28 of the blade seat 24 with the cutting edge 36 extending over the slot 26 between the guard member 20 and the front wall 12 of the blade seat 24. The width of the blade seat 24 (i.e distance between the front and rear wall 12,14) and the width of the primary blade 32 is such that a substantial portion of the primary blade 32 extends over the slot 26.

[0042] The spacer 6 is disposed on the upper surface 50 of the primary blade 32. As shown in Figure 1, one edge of the cavity 68 generally aligns with the front wall 12 of the blade seat 24 so as to form a vertical plane, thereby partially defining a flexing zone for the primary blade 32. The application of force upon the primary blade 32 causes the primary blade 32 to flex about the longitudinal axis in a downwardly direction. The downward movement of the primary blade 32 stops when the blade 32 engages the lips 60 formed on the support members 22. Thus, the distance the blade 32 is allowed to flex is defined by the height of the lip 60 relative to the upper surface 28 of the blade seat 24. The resiliency of the primary blade 32 returns the blade to the normal, horizontal position (as shown in Fig. 1) upon removal of the applied shaving force.

[0043] The secondary blade 34 is disposed on the upper surface 58 of the spacer 6 with the cutting edge extending over the opening 47 created between the forward portion 62 of the spacer 6 and the lower surface 52 of the secondary blade 34. Similar to the primary blade 32, the width of the rear portion 64 of the spacer 6 is such that a substantial portion of the secondary blade 34 extends over the opening 47.

[0044] The cap member 8 is disposed on the upper surface 54 of the secondary blade 34 such that one edge of the cavity 76 formed on the lower surface 72 of the cap member 8 generally aligns with beginning of the forward portion 62 of the spacer 6 so as to form a vertical plane. As shown in Figure 1, the edge of the cavity 76 in conjunction with the sloping surface of the forward portion 62 of the spacer 6 partially defines the flexing zone for the secondary blade 34. As with the primary blade 32, the application of a force on the secondary blade 34 causes the blade 34 to flex about the longitudinal axis in the downwardly direction. The downward movement of the secondary blade 34 stops when the blade engages the ribs 66 formed on the upper surface 58 of the spacer 6. The resiliency of the secondary blade 34 returns the blade to the normal, horizontal position upon removal of the applied force.

[0045] As previously stated, the downwardly extending pads 70,78 of the spacer 6 and the cap member 8 prevent movement of the primary and secondary blades 32,34, respectively, in the upward direction beyond the horizontal position. It will be appreciated that as the portion of the primary and secondary blade 32,34 extending over the slot and opening 26,47, respectively, is reduced (i.e. as the flexing zone moves closer to the cutting edge), the flexibility of the blade will also be reduced. The flexibility of each blade depends upon factors including (1) the location of the flexing zone, (2) the thickness of the blade, and (3) the dimensions of the holes 42 in the blades (apertures 43 also contribute to the flexibility of the secondary blade). These factors can be adjusted so that the blades 32,34 flex when the applied force exceeds a predetermined level.

[0046] In order to maximize shaving comfort and closeness, and minimize the potential for nicks and cuts, the blade exposure and shaving angle of the primary and secondary blades 32,34 are preset to the "at-rest" positions shown in Fig. 11.

[0047] More specifically, referring to Fig. 11, the shaving plane of the primary blade 32, denoted by reference line 100, is defined by the plane tangent to the upper portion 21 of the guard 20 and the skin engaging portion 88 of the spacer 6. The shaving plane of the secondary blade 34, denoted by reference line 102, is defined by the plane tangent to the skin engaging portion 88 of the spacer 6 and the upper portion 9 of the cap 8. Thus, the skin engaging portion 88 of the spacer 6 functions to maintain the geometry of the primary blade 32 relative to the shaving surface by establishing a safe contact and control surface behind the primary blade 32. The skin engaging portion 88 of the spacer 6 also maintains the geometry of the secondary blade 34 relative to the shaving surface.

[0048] The blade exposure of the primary blade "eP" in the "at-rest" position ranges between about - 0.0025 to 0.0051 cm (-0.001 to 0.002 inches), with the preferred range being between about 0.002 to 0.003 cm (0.0008 to 0.0012 inches). The blade exposure of the secondary blade "eS" ranges between about -0.0025 to 0.0076 cm (-0.001 to 0.003 inches), with the preferred range being between about 0.003 to 0.0048 cm (0.0012 to 0.0019 inches).

[0049] The shaving angle of the primary blade, which is the acute angle between the plane tangent to the cutting edge 36 of the primary blade 32 and the shaving plane denoted by reference line 100, ranges from 22 to 28 degrees, with the preferred range being between

25.8 to 26.6 degrees. The shaving angle of the secondary blade, which is the acute angle between the plane tangent to the cutting edge 38 of the secondary blade 34 and the shaving plane denoted by reference line 102, ranges from 18 to 24 degrees, with the preferred range being between 21.0 to 22.4 degrees.

[0050] As stated previously, the separation between the primary and secondary blades 32,34 in the "at-rest" position is governed by the thickness of the spacer 6, which ranges from 0.0508 to 0.127 cm (0.020 and 0.050 inches). The preferred thickness of the spacer 6 is 0.0762 cm (0.030 inches).

[0051] Fig. 11 also illustrates the aperture ranges and edge separation for both the primary and secondary blades 32,34. First, the primary aperture is the distance from the upper portion 21 of the guard 20 to the cutting edge 36 of the primary blade 32 measured along the shaving plane 100. Referring to the figure, the primary aperture is denoted Pa and ranges from 0.0635 to 0.1143 cm (0.025 to 0.045 inches), with the preferred aperture being about 0.0914 cm 0.036 inches.

[0052] Similarly, the secondary aperture, which is denoted by Sa is the distance from the skin engaging portion 88 of the spacer 6 to the cutting edge 38 of the secondary blade 34 measured along shaving plane 102. The range of the secondary aperture is also 0.0635 to 0.1143 cm (0.025 to 0.045 inches), with the preferred aperture being about 0.0914 cm (0.036 inches).

[0053] Finally, the edge separation of the primary blade 32 is the distance from the cutting edge 36 of the primary blade 32 to the skin engaging portion 88 of the spacer 6 measured along the shaving plane 100. Referring to the Fig. 11, the edge separation of the primary blade 32 is denoted Pe and ranges from about 0.1219 to 0.3124 cm (0.048 to 0.123 inches), with the preferred aperture being about 0.2134 cm (0.084 inches).

[0054] Similarly, the edge separation of the secondary blade 34, which is denoted by Se is the distance from the cutting edge 38 of the secondary blade 34 to the upper portion 9 of the cap 8 measured along shaving plane 102. The range of the secondary aperture is also about 0.1219 to 0.3124 cm (0.048 to 0.123 inches), with the preferred aperture being about 0.1219 cm (0.048 inches).

[0055] The foregoing geometric dimensions concerning blade position operate to maximize both shaving comfort and the closeness of the shave, while at the same time minimizing the potential for nicks and cuts. This results, in part, from the skin engaging portion 88 of the spacer 6 which allows for an aggressive exposure of both the primary and secondary blades 32, 34, while at the same time contributing to the prevention of nicks and cuts.

[0056] Fig. 12 illustrates both the primary blade 32 and the secondary blade 34 in the fully flexed position. As shown in Fig. 12, the downward movement of the primary and secondary blades 32,34 are limited by the lip 60 of the support member 22 and the ribs 66 on the spacer 6, respectively.

[0057] In order to prevent the corners of the blades 32,34 from engaging the skin of the user, end clips 82 cover the outer edges of the primary and secondary blades 32,34. As shown in Figure 13, each end clip 82 comprises a thin strip of material having a leg 31,33 on each end and is generally in a "C" shape. Each end clip wraps around the blade cartridge 10, whereby the legs 31,33 of each end clip are secured to the bottom of blade cartridge 10. Referring to Fig. 2, one end clip 82 is disposed in a slot 84 adjacent end 16. A second end clip 82 is disposed in a slot 86 adjacent end 18. Each end clip 18 runs perpendicular to the longitudinal axis of the blades 32,34 and covers the outer edges of the blades 32,34.

[0058] Furthermore, the end clips 82 which represent a significant portion of the skin engaging surface of the blade cartridge 10, are coated with a friction reduction agent so as reduce the drag forces associated with the blade cartridge 10 engaging the skin, thereby improving shaving comfort.

[0059] The friction reduction agent is applied to the end clips 82 prior to the end clips 82 being secured to the blade cartridge 10. Specifically, the friction reduction agent is applied in liquid form to the end clip, which can comprise, for example, an aluminum wire. The friction reduction agent is applied such that a thin film of the agent completely covers each end clip 82. The end clip 82 is then exposed to heat, or other appropriate means, so that molecules of the friction reduction agent crosslink with the molecules of the material of the end clip 82 to form a solid, thereby bonding the friction reduction agent to the end clip 82. The preferred range of the thickness of the friction reduction agent is between about 0.0008 to 0.0013 (0.0003 to 0.0005 inches). Multiple applications of the friction reduction agent are employed, if necessary.

[0060] While other friction reduction agents can be utilized, the preferred agent is polyvinyl acetyl (PVA). Some other acceptable agents include: nylon 515, polyimide, polyester imide, polyamide, polyester and teflon.

[0061] As a result of mounting the blades 32,34 in accordance with the present embodiment, there is no longitudinal movement of either the primary or secondary blade 32,34 relative to the remainder of the blade cartridge 10. Only rotational movement about the flexing zone associated with the each blade 32,34 is possible. More specifically, each blade 32,34 can only bend about the longitudinal axis of the blade within the flexing zone in a direction which reduces the blade exposure and shaving angle of the blade relative to a shaving surface. Furthermore, the primary and secondary blades 32,34 flex independently of one another.

[0062] For example, if the pressure encountered by the primary blade 32 exceeds the resilient force of the primary blade 32, the primary blade 32 bends in response to that force. Specifically, the primary blade 32 bends about the flexing zone, thereby causing the cut-

ting edge 36 to move in a downward manner. Upon removal of the force, the primary blade 32 would return to the horizontal position as shown in Figure 1. If an equivalent force were applied to the secondary blade 34, it would respond in a similar manner. Thus, the cutting edges 36,38 of the blades 32,34 move downwardly away from the shaving plane and adjust to a lower, safer shaving angle and blade exposure.

[0063] As illustrated in Figs. 1 and 2, the guard member 20 placed in front of the primary blade 32 is integral with the ends 16,18 of the platform member 2 and is therefore stationary relative to the blade cartridge 10. Similar to the guard 20 being positioned in front of the primary blade 32, as shown in Fig. 5, the spacer 6 has a raised oval or round skin engaging portion 88, which provides an engaging surface to control exposure of the secondary blade 34 to the shaver's skin.

[0064] Finally, Fig. 14 is a perspective view of the blade cartridge of the present embodiment, which is useful in understanding the structure as well as the position of the components identified in Figs. 1-13 relative to one another. The components identified in Figs. 1-13 are identified by the same numeral in Fig. 14. It is noted that the arrows 95 shown in Fig. 14 represent possible water flow paths for the removal of shaving debris from the blade cartridge. It is also noted that end clips 82 are not shown in Fig. 14.

[0065] Variations on the embodiments described above are possible. In a first variation, the height of the lips 60 formed of the support members 22 may be varied so as to effect different bending patterns. For example, if the lips 60 on the support members 22 in the center of the platform member 2 are lower relative to the lips 60 on the support members located proximate the ends of the platform member 2, the primary blade 32 exhibit increases movement in the center of the blade. With regard to the secondary blade, the same changes can be effected by varying the height of the ribs 66 located on the upper surface 58 of the spacer 6.

[0066] Furthermore, numerous variations of the flexible blades 32,34 are possible. For example, each blade 32,34 may be tapered such that the thickness of the blade decreases in the direction of the forward portion of the blade. Also, each blade 32,34 can comprise a U-shaped channel in the forward portion of the blades, which functions to define the flexing zone for the blade 32,34. Finally, the additional holes can be added to the blades of the preferred embodiment to vary the flexibility of the blades 32,34.

[0067] In another variation, the blade means comprises a single blade positioned between the platform member 2 and the cap member 8. The operation and movement of the single blade is the same as either blade in the two blade embodiment. However, the forward portion of the cap member would be extended relative to the cap member of the two blade embodiment such that the single blade razor exhibits the correct shaving geometry.

[0068] In another variation, as shown in Fig. 6 and 7, the cap member 8 further comprises a downwardly extending guide member 99 which functions to locate the secondary blade 34 in the desired position prior to permanently securing the cap member 8 to the platform member 2.

[0069] In another variation, the guard member 20 may include means to allow independent movement of the guard member 20 in the direction away from the direction of shaving forces acting upon the guard member 20. Jacobson U.S. Patent Nos. 4,442,598, 4,378,634 and 4,270,268 disclose a blade cartridge having movable guard means.

[0070] Similarly, the cap member 8 may include means to allow independent movement in a direction away from the direction of shaving forces acting upon said cap member 8. Oldroyd et al., U.S. Patent No. 4,063,354, discloses a shaving unit having a movable cap member 8 suitable for use with this invention.

[0071] In yet another variation, an additional shaving aid may be affixed or included with the blade cartridge 10. Typically, as shown in Figure 1, the shaving aid comprises a polystyrene-polyethylene oxide blend in the form of lubricating strip 92, which may affixed to the upper surface 74 of the cap member 8 behind the secondary blade 34. During shaving, the polyethylene oxide leaches out of the styrene matrix. Other suitable shaving aids for use with the invention are also described in U. S. Patent No. 4,170,821 issued to Booth entitled "Razor Cartridges." Preferably, the shaving aid comprises a matrix of polystyrene, polyethylene oxide and aloe and/or vitamin E. Also, the shaving aid 90 may define a lubrication strip 94, shown by dotted lines in Fig. 1, positioned near the guard member 20, either separately or in combination with the lubrication strip 92 located on the cap member 8.

[0072] In yet a further variation, the blade cartridge 10 may be permanently or detachably connected to a handle by suitable structures formed on the bottom surface of the blade cartridge 10. For example, the bottom surface of the blade cartridge 10 can be formed so as to attach to a handle in the manner described in U.S. Patent No. 4,883,779 entitled PLATFORM, HANDLE AND SHIELD FOR SAFETY RAZOR, which issued to C. Iten.

[0073] Alternatively, the blade cartridge 10 can be mounted on a handle in such a manner that it pivots or is stationary while it is used to shave a surface. For example, as illustrated in Fig. 10, the bottom surface of the platform member 2 comprises mounting members 98 which allow the blade cartridge 10 to be pivotally mounted to a handle.

[0074] Still further, it is within the scope of this invention, which is defined by claim 1, to detachably connect the blade cartridge 10 to a handle, such as in U.S. Patent No. 4,026,016 entitled RAZOR BLADE ASSEMBLY, issued to Warren I. Nissen.

[0075] In another variation, the upper and lower surfaces 58,56 of the rear portion 64 of the spacer 6 com-

prises a plurality of channels so as to allow shaving debris to be led out the back of the blade cartridge 10. Conversely, water can be directed into the back of the blade cartridge 10 to be channeled out through the front of the blade cartridge 10 and the edges 36,38 of the blades 32,34.

[0076] In another variation, the downwardly extending pads 70,78 located on the spacer 6 and the cap member 8 are replaced by a single downwardly extending pad which is parallel to the cutting edges of the blades and has a length at least equal to the length of the blades.

[0077] The embodiments described above provide a number of significant advantages. The use of a blade which is flexible about the longitudinal axis of the blade within a body portion of a blade cartridge or the like precisely controls blade geometry in response to shaving forces. Any flexing of the blade results in the simultaneous reduction of both critical safety dimensions, blade exposure and shaving angle.

[0078] Furthermore, the optimized geometric relationships between the various components of the blade cartridge as disclosed provide for maximum comfort and closeness, while simultaneously minimizing the potential for nicks and cuts.

[0079] As yet another advantage, the blade cartridge of the present invention can simplify the manufacturing process for creating blade cartridges. The present invention can eliminate the need for creating an injection mold comprising a plurality of thin, individual spring fingers or leaf springs or the like.

[0080] In addition, the use of end clips coated with a friction reduction agent provide for a significant reduction in the drag forces associated with the shaving process so as to provide a more comfortable shave.

[0081] Of course, it should be understood that a wide range of changes and modifications can be made to the preferred embodiment described above within the scope of the claims.

Claims

1. A flexible blade cartridge which comprises:

a platform (2) having a guard member (20), a cap (8), a spacer (6), and

blade means, said blade means having first and second blades (32, 34) which each have a forward portion, a rearward portion and a cutting edge (36, 38), each of the rearward portions of the blades (32, 34) being secured between the guard member (20) and the cap (8) so as to be immovable relative to the platform (2), the forward portions of one or both the first and second blades (32,34) being flexible about a longitudinal axis of the respective blade (32, 34) downward and away from the cap (8) to a less aggressive shaving angle in response to forces applied during shaving, said blade means comprising a continuous blade edge extending substantially the length of said guard member, said spacer (6) being disposed between the first and second blades (32, 34) to define a predetermined distance between the reaward portion of said first and second blades and provided with a first surface (66) which limits the degree to which the second blade (34) can be flexed to a less aggressive shaving angle,

characterized in that said spacer (6) has a skin engaging surface (88) which engages, in use, a skin surface being shaved to define, in combination with the guard member (20), a first shaving angle of the first blade (32), and to define, in combination with the cap member (8), a second shaving angle of the second blade (34).

2. A flexible blade cartridge as set forth in claim 1, **characterized in that** the spacer (6) projects forward to a position which is intermediate of the cutting edges (36, 38) of the first and second blades (32, 34) so as to locate the skin engaging surface (88) between the cutting edges (36,38).

3. A flexible blade cartridge as set forth in claims 1 or 2, **characterized in that** the first shaving angle is greater than the second shaving angle when the first and second blades (32,34) are not flexed away from their respective rest positions.

4. A flexible blade cartridge as set forth in claim 3, **characterized in that** the first shaving angle is in the range of 25.8 to 26.6 degrees, and **in that** the second shaving angle is in the range of 21.0 to 22.4 degrees.

5. A flexible blade cartridge as set forth in any of the preceding claims, **characterized in that** the blades (32, 34) are permanently and immovably fixed in position between said cap (8) and the guard member (20) by a plurality of rivets (80) which extend down from the cap (8) through the rearward portion of the blades (32, 34), the spacer (6) and the platform (2).

6. A flexible blade cartridge as set forth in any of the preceding claims **characterized by** a plurality of end clips (82) which cover the corners of the forward portions of the first and second blades (32, 34) and which prevent the comers from moving upward.

7. A flexible blade cartridge as set forth in claim 6, **characterized in that** the plurality of end clips (82), which cover the outer edges of the forward portions of the first and second blades (32, 34), are coated with a friction reducing agent which reduces clip-skin drag forces encountered when shaving.

8. A flexible blade cartridge as set forth in claim 7, **characterized in that** the friction reducing agent is bonded to a surface or surfaces of the end clips (82) at a molecular level and **in that** the agent is polyvinyl acetate (PVA), nylon 515, polyimide, polyester imide, polyamide, polyester or Teflon.

9. A flexible blade cartridge as set forth any of the preceding claims, **characterized in that** the platform is formed with a lip or lips (60) which engage the first blade (32) after a predetermined amount of downward flexure to limit the amount of aggressive shaving angle.

10. A flexible blade cartridge as set forth any of the preceding claims, **characterized in that** the spacer (6) has downwardly extending pads (70) which engage the upper surface of the first blade (32) when the first blade (32) is in an un-flexed, rest position and prevents upward flexure of the first blade in a direction which increases its aggressive shaving angle.

11. A flexible blade cartridge as set forth any of the preceding claims, **characterised in that** the cap (8) has downwardly extending pads (78) which engage the upper surface of the second blade (34) when the second blade (34) is in an un-flexed, rest position and prevents upward flexure of the second blade in a direction which increases its aggressive shaving angle.

12. A flexible blade cartridge as set forth in any of the preceding claims, **characterized in that** the first and second blades (32, 34) are formed with holes/apertures (42, 43) which permit water to pass therethrough to flush away shaving debris, and **in that** the holes/apertures (42, 43) contribute to the flexibility of the first and second blades (32, 34) which permits the blades to be flexed downwardly to their respective less aggressive shaving angles.

Patentansprüche

1. Flexible Klingeneinheit mit:

einer Plattform (2) mit einem Schutzelement (20), einer Kappe (8), einem Abstandshalter (6) und
einer Klingeneinrichtung mit einer ersten und einer zweiten Klinge (32, 34), die jeweils einen Vorderbereich, einen Hinterbereich und eine Schnittkante (36, 38) aufweisen, wobei die Hinterbereiche der Klingen (32, 34) so zwischen dem Schutzelement (20) und der Kappe (8) befestigt sind, daß sie relativ zur Plattform (2) unbeweglich sind, die Vorderbereiche der ersten und/oder der zweiten Klinge (32, 34) um eine Längsachse der jeweiligen Klinge (32, 34) nach unten und weg von der Kappe (8) zu einem weniger aggressiven Rasierwinkel in Reaktion auf während der Rasur angewandte Kräfte flexibel sind, die Klingeneinrichtung eine zusammenhängende Klingenkante aufweist, die sich im wesentlichen über die Länge des Schutzelements erstreckt, und der Abstandshalter (6) zwischen der ersten und der zweiten Klinge (32, 34) angeordnet ist, um einen vorbestimmten Abstand zwischen den Hinterbereichen der ersten und der zweiten Klinge zu definieren, und mit einer ersten Fläche (66) versehen ist, die den Grad begrenzt, bis zu dem die zweite Klinge (34) zu einem weniger aggressiven Rasierwinkel gebogen werden kann,

dadurch gekennzeichnet, daß der Abstandshalter (6) eine Hauteingriffsfläche (88) aufweist, die in Benutzung in Eingriff mit einer zu rasierenden Hautfläche ist, um in Kombination mit dem Schutzelement (20) einen ersten Rasierwinkel der ersten Klinge (32) und in Kombination mit dem Kappenelement (8) einen zweiten Rasierwinkel der zweiten Klinge (34) zu definieren.

2. Flexible Klingeneinheit nach Anspruch 1, **dadurch gekennzeichnet, daß** der Abstandshalter (6) sich nach vorne zu einer Position erstreckt, die zwischen den Schneidekanten (36, 38) der ersten und der zweiten Klinge (32, 34) liegt, so daß sich die Hauteingriffsfläche (88) zwischen den Schneidekanten (36, 38) befindet.

3. Flexible Klingeneinheit nach Anspruch 1 oder 2, **dadurch gekennzeichnet, daß** der erste Rasierwinkel größer ist als der zweite Rasierwinkel, wenn die erste und die zweite Klinge (32, 34) nicht aus ihren jeweiligen Ruhepositionen weggebogen werden.

4. Flexible Klingeneinheit nach Anspruch 3, **dadurch gekennzeichnet, daß** der erste Rasierwinkel zwischen 25,8 und 26,6 Grad und der zweite Rasierwinkel zwischen 21,0 und 22,4 Grad liegt.

5. Flexible Klingeneinheit nach einem der vorstehenden Ansprüche, **dadurch gekennzeichnet, daß** die Klingen (32, 34) durch mehrere Nieten (80) die abwärts von der Kappe (8) durch den Hinterbereich der Klingen (32, 34), den Abstandshalter (6) und die Plattform (2) verlaufen, in ihrer Position permanent und unbeweglich zwischen der Kappe (8) und dem Schutzelement (20) fixiert sind.

6. Flexible Klingeneinheit nach einem der vorstehenden Ansprüche, **gekennzeichnet durch** mehrere Seitenclips (82), die die Ecken der Vorderbereiche der ersten und der zweiten Klinge (32, 34) abdek-

ken und die Ecken an der Aufwärtsbewegung hindern.

7. Flexible Klingeneinheit nach Anspruch 6, **dadurch gekennzeichnet, daß** die mehreren Seitenclips (82), die die Außenkanten der Vorderbereiche der ersten und der zweiten Klinge (32, 34) abdecken, mit einem Reibungsreduktionsmittel überzogen sind, das die beim Rasieren auftretenden Clip/Haut-Widerstandskräfte reduziert.

8. Flexible Klingeneinheit nach Anspruch 7, **dadurch gekennzeichnet, daß** das Reibungsreduktionsmittel an einer oder mehreren Flächen der Seitenclips (82) auf Molekularniveau angebracht ist, und das Mittel in Polyvinylacetat (PVA), Nylon 515, Polyimide, Polyester Imid, Polyamid, Polyester oder Teflon besteht.

9. Flexible Klingeneinheit nach einem der vorstehenden Ansprüche, **dadurch gekennzeichnet, daß** die Plattform mit einer oder mehreren Lippen (60) ausgebildet ist, die nach einem vorbestimmten Betrag an Herunterbiegung in die erste Klinge (32) eingreifen, um den Betrag des aggressiven Rasierwinkels zu begrenzen.

10. Flexible Klingeneinheit nach einem der vorstehenden Ansprüche, **dadurch gekennzeichnet, daß** der Abstandshalter (6) nach unten verlaufende Polster (70) aufweist, die in Eingriff mit der oberen Fläche der ersten Klinge (32) sind, wenn die erste Klinge (32) in einer ungebogenen Ruheposition ist, und ein Heraufbiegen der ersten Klinge in eine ihren aggressiven Rasierwinkel vergrößernde Richtung verhindert.

11. Flexible Klingeneinheit nach einem der vorstehenden Ansprüche, **dadurch gekennzeichnet, daß** die Kappe (8) nach unten verlaufende Polster (78) aufweist, die in Eingriff mit der oberen Fläche der zweiten Klinge (34) sind, wenn die zweite Klinge (34) in einer ungebogenen Ruheposition ist, und ein Heraufbiegen der zweiten Klinge in eine ihren aggressiven Rasierwinkel vergrößernde Richtung verhindert.

12. Flexible Klingeneinheit nach einem der vorstehenden Ansprüche, **dadurch gekennzeichnet, daß** die erste und die zweite Klinge (32, 34) mit Löchern/Öffnungen (42, 43) ausgebildet sind, die Wasserdurchtritt zum Wegspülen von Rasierabfall erlauben, und daß die Löcher/Öffnungen (42, 43) zur Flexibilität der ersten und der zweiten Klinge (32, 34) beitragen, was ein Herunterbiegen der Klingen zu ihren jeweiligen weniger aggressiven Rasierwinkeln erlaubt.

Revendications

1. Tête à lames flexibles comprenant :

   un plateau (2) muni d'un organe de protection (20), un chapeau (8), un élément intercalaire (6) et des moyens formant lames, lesdits moyens formant lames comportant des première et seconde lames (32, 34) qui possèdent chacune une partie avant, une partie arrière et un bord de coupe (36, 38), chacune des parties arrière des lames (32, 34) étant assujettie entre l'organe de protection (20) et le chapeau (8) de manière à être immobile par rapport au plateau (2), tandis que la partie avant de l'une ou de chacune des deux première et seconde lames (32, 34) est flexible autour d'un axe longitudinal de la lame (32, 34) correspondante vers le bas et à distance du chapeau (8) pour adopter un angle de rasage moins agressif en réponse à des forces appliquées au cours du rasage, lesdits moyens formant lames comprenant un bord de lame continu qui s'étend sensiblement sur toute la longueur dudit organe de protection, et ledit élément intercalaire (6) étant disposé entre les première et seconde lames (32, 34) pour définir une distance prédéterminée entre la partie arrière desdites première et seconde lames et étant muni d'une première surface (66) qui limite le degré de flexion possible de la seconde lame (34) pour adopter un angle de rasage moins agressif,

   caractérisée en ce que ledit élément intercalaire (6) comporte une surface (88) de contact avec la peau, qui, en service, vient en contact avec une surface cutanée en cours de rasage pour définir, en combinaison avec l'organe de protection (20), un premier angle de rasage de la première lame (32), et, en combinaison avec le chapeau (8), un second angle de rasage de la seconde lame (34).

2. Tête à lames flexibles telle que définie dans la revendication 1, **caractérisée en ce que** l'élément intercalaire (6) fait saillie vers l'avant jusqu'à une position intermédiaire entre les bords de coupe (36, 38) des première et seconde lames (32, 34) afin de positionner la surface (88) de contact avec la peau entre les bords de coupe (36, 38).

3. Tête à lames flexibles telle que définie dans la revendication 1 ou 2, **caractérisée en ce que** le premier angle de rasage est supérieur au second angle de rasage lorsque les première et seconde lames (32, 34) ne sont pas fléchies à distance de leurs positions de repos respectives.

4. Tête à lames flexibles telle que définie dans la revendication 3, **caractérisée en ce que** le premier angle de rasage se situe dans la plage de 25,8 à 26,6 degrés, et **en ce que** le second angle de rasage se situe dans la plage de 21,0 à 22,4 degrés.

5. Tête à lames flexibles telle que définie dans l'une quelconque des revendications précédentes, **caractérisée en ce que** les lames (32, 34) sont fixées en place de manière permanente et immobile entre ledit chapeau (8) et l'organe de protection (20) par plusieurs rivets (80) qui s'étendent vers le bas depuis le chapeau (8) en passant à travers la partie arrière des lames (32, 34), l'élément intercalaire (6) et le plateau (2).

6. Tête à lames flexibles telle que définie dans l'une quelconque des revendications précédentes, **caractérisée par** de multiples colliers d'extrémité (82) qui couvrent les coins des parties avant des première et seconde lames (32, 34) et qui empêchent un mouvement vers le haut desdits coins.

7. Tête à lames flexibles telle que définie dans la revendication 6, **caractérisée en ce que** les multiples colliers d'extrémité (82) qui couvrent les bords extérieurs des parties avant des première et seconde lames (32, 34) sont revêtus d'un agent réducteur de friction qui réduit des forces de frottement des colliers sur la peau occasionnées lors du rasage.

8. Tête à lames flexibles telle que définie dans la revendication 7, **caractérisée en ce que** l'agent réducteur de friction est lié à une ou des surfaces des colliers d'extrémité (82) à un niveau moléculaire, et **en ce que** l'agent est un poly(acétate de vinyle) (PVA), du Nylon 515, un polyimide, un polyester imide, un polyamide, un polyester ou du Téflon.

9. Tête à lames flexibles telle que définie dans l'une quelconque des revendications précédentes, **caractérisée en ce que** le plateau comporte une ou des lèvres (60) qui viennent en contact avec la première lame (32) après un degré prédéterminé de flexion vers le bas, afin de limiter l'importance de l'angle de rasage agressif.

10. Tête à lames flexibles telle que définie dans l'une quelconque des revendications précédentes, **caractérisée en ce que** l'élément intercalaire (6) comporte des patins (7) s'étendant vers le bas qui viennent en contact avec la surface supérieure de la première lame (32) lorsque la première lame (32) est dans une position de repos non fléchie, et empêche une flexion vers le haut de la première lame dans une direction augmentant l'angle de rasage agressif de celle-ci.

11. Tête à lames flexibles telle que définie dans l'une quelconque des revendications précédentes, **caractérisée en ce que** le chapeau (8) comporte des patins (78) s'étendant vers le bas qui viennent en contact avec la surface supérieure de la seconde lame (34) lorsque la seconde lame (34) est dans une position de repos non fléchie, et empêche une flexion vers le haut de la seconde lame dans une direction augmentant l'angle de rasage agressif de celle-ci.

12. Tête à lames flexibles telle que définie dans l'une quelconque des revendications précédentes, **caractérisée en ce que** les première et seconde lames (32, 34) comportent des trous/ouvertures (42, 43) qui permettent le passage de l'eau pour chasser des débris de rasage, et **en ce que** les trous/ouvertures (42, 43) contribuent à la flexibilité des première et seconde lames (32, 34) qui permet une flexion vers le bas des lames pour qu'elles adoptent leurs angles de rasage moins agressif respectifs.

FIG. 1

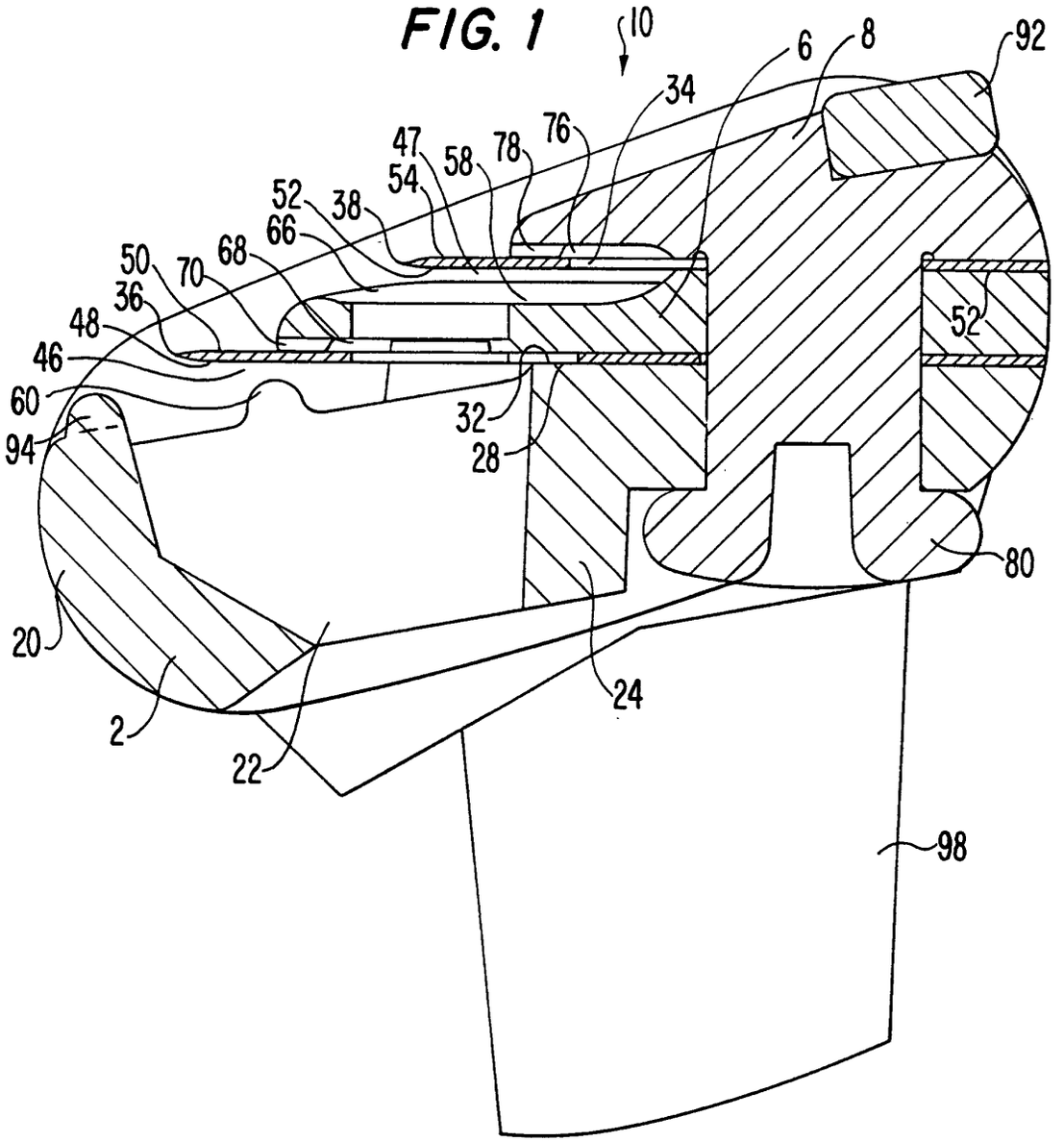

10
6
8
92
34
47
58
78
76
54
52
38
66
50
70
68
36
48
46
60
94
32
28
52
80
20
2
22
24
98

FIG. 2

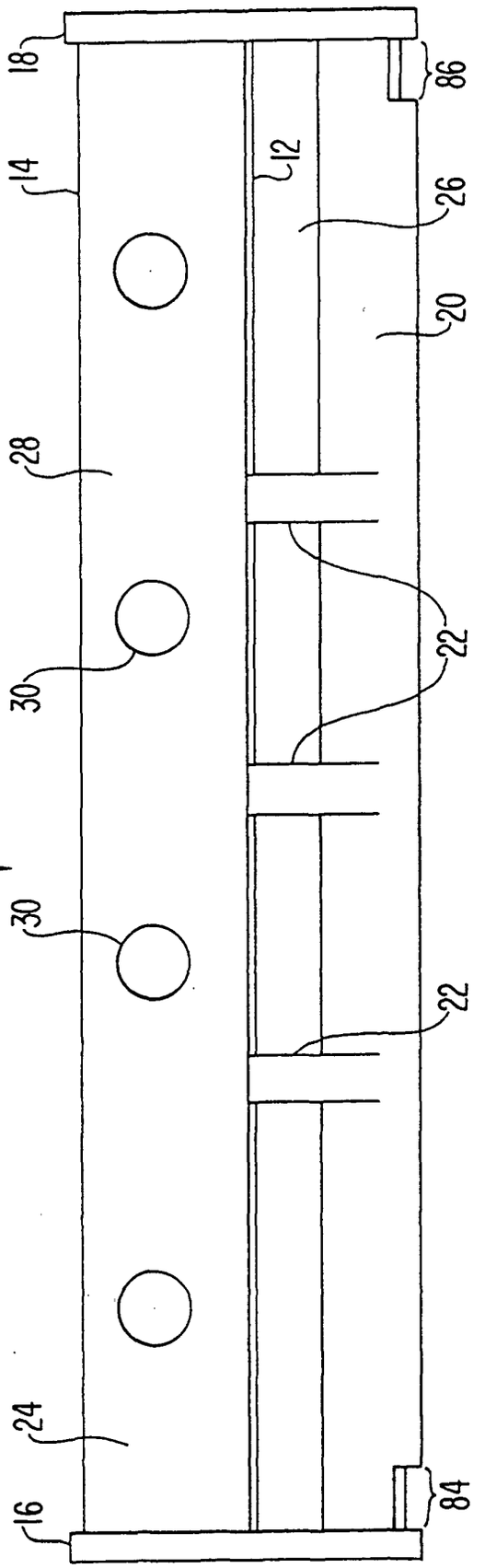


FIG. 3

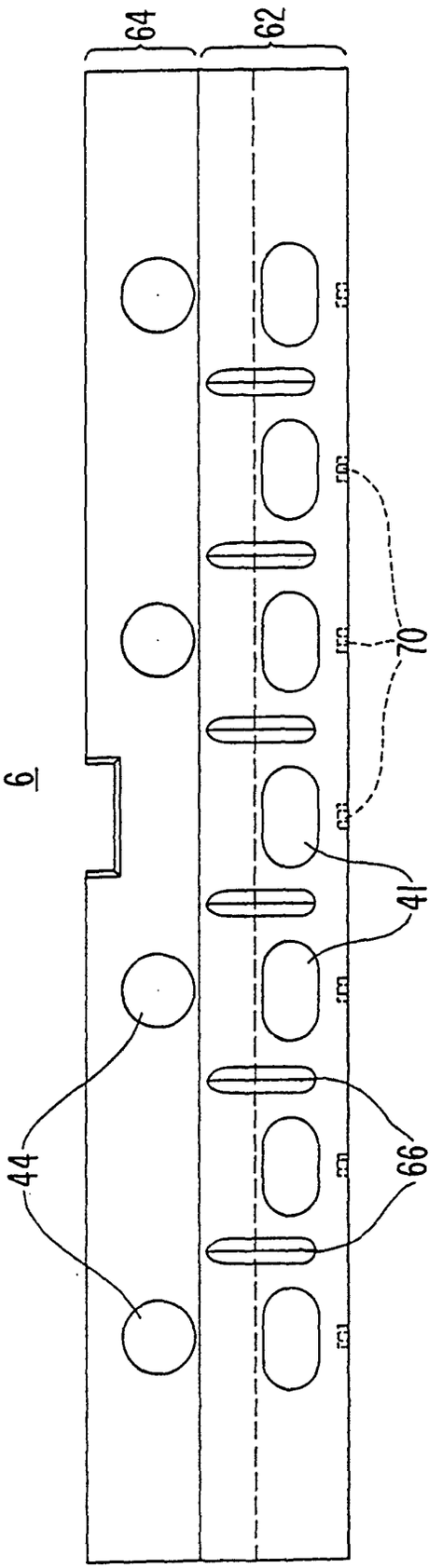


FIG. 4

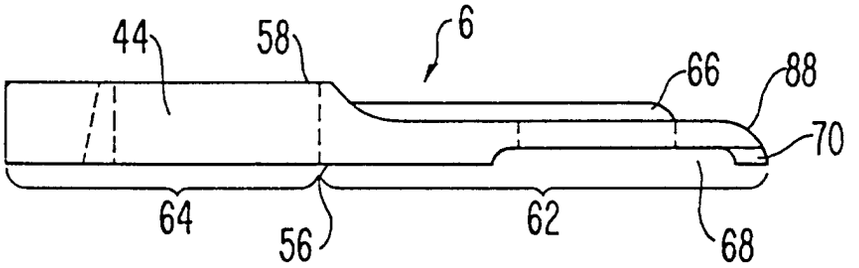


FIG. 13

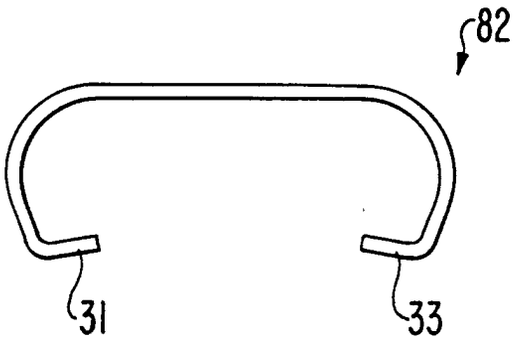


FIG. 5

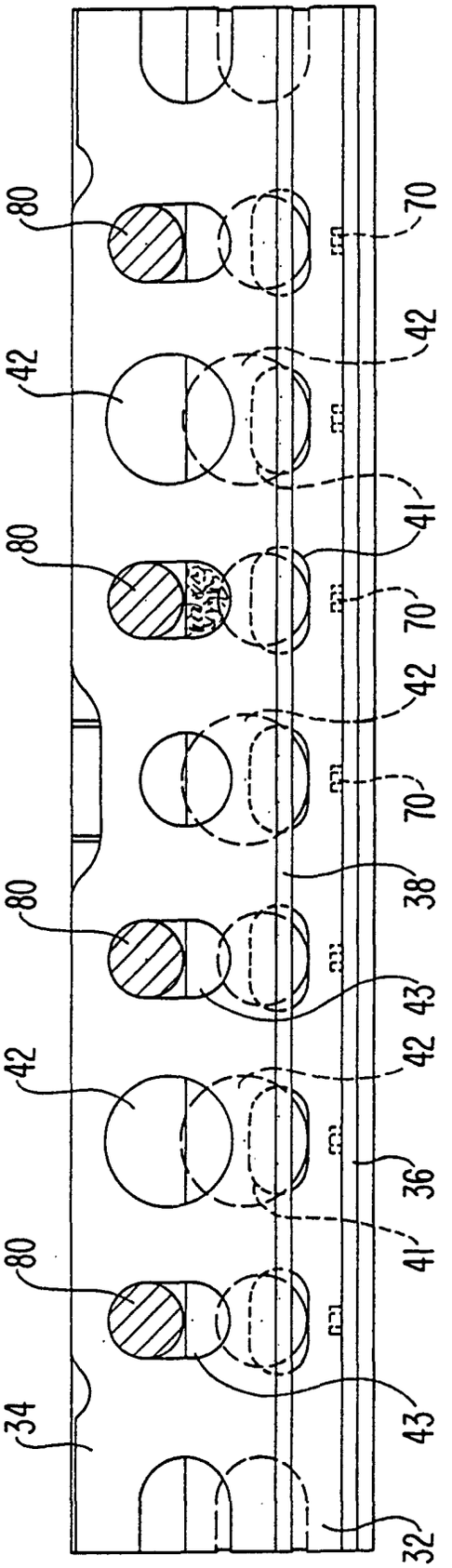


FIG. 6

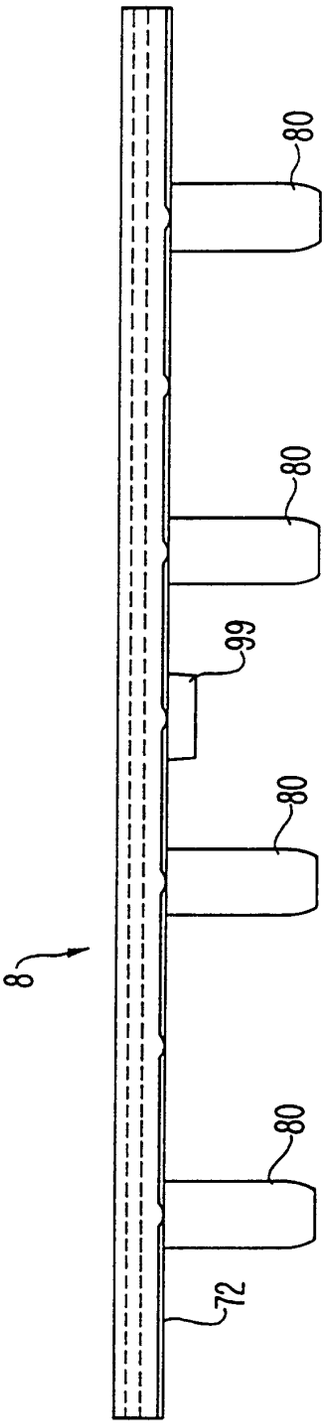


FIG. 7

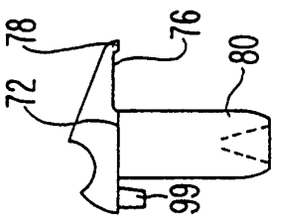


FIG. 8

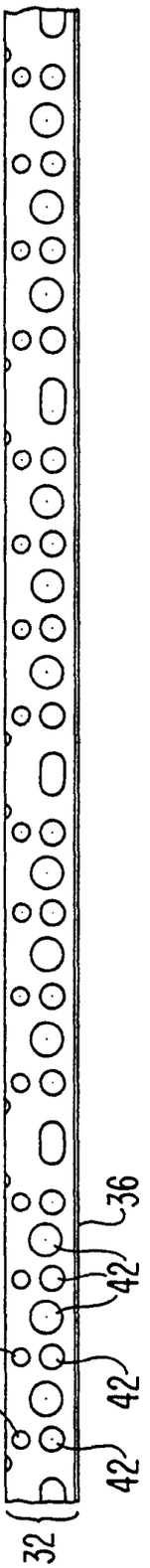
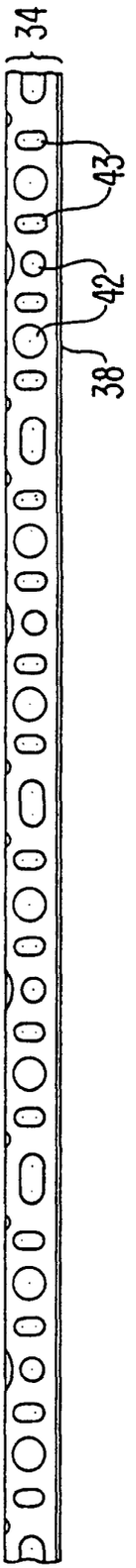


FIG. 9



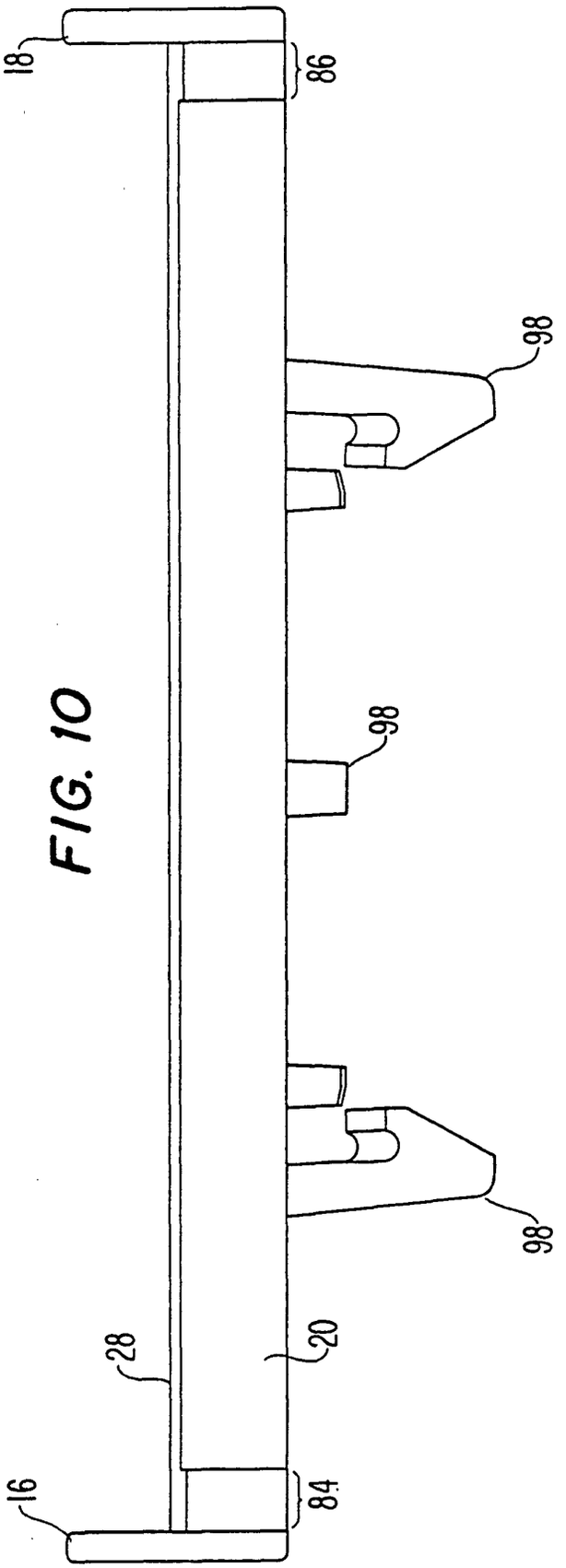


FIG. 10

FIG. 11

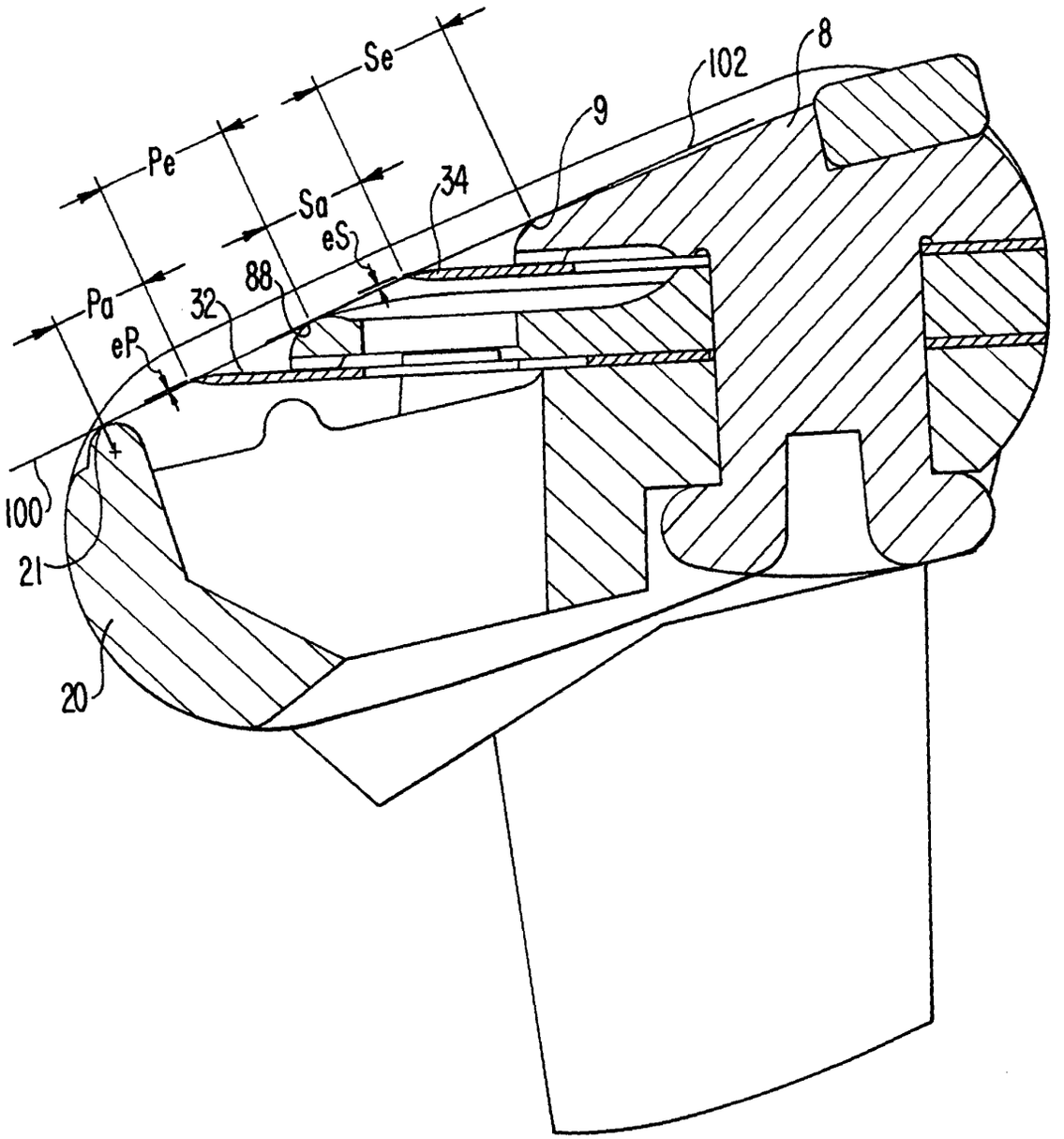


FIG. 12

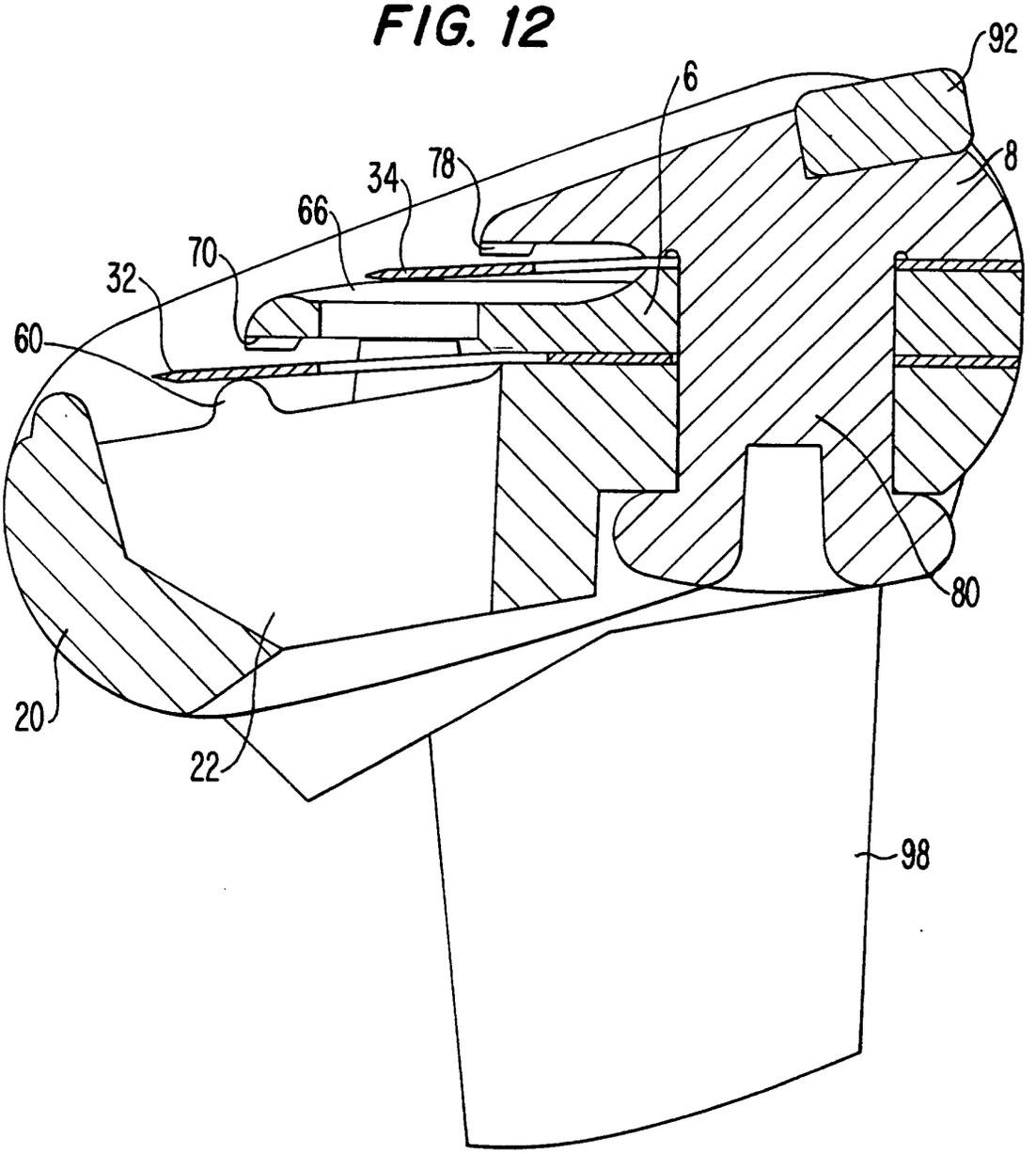
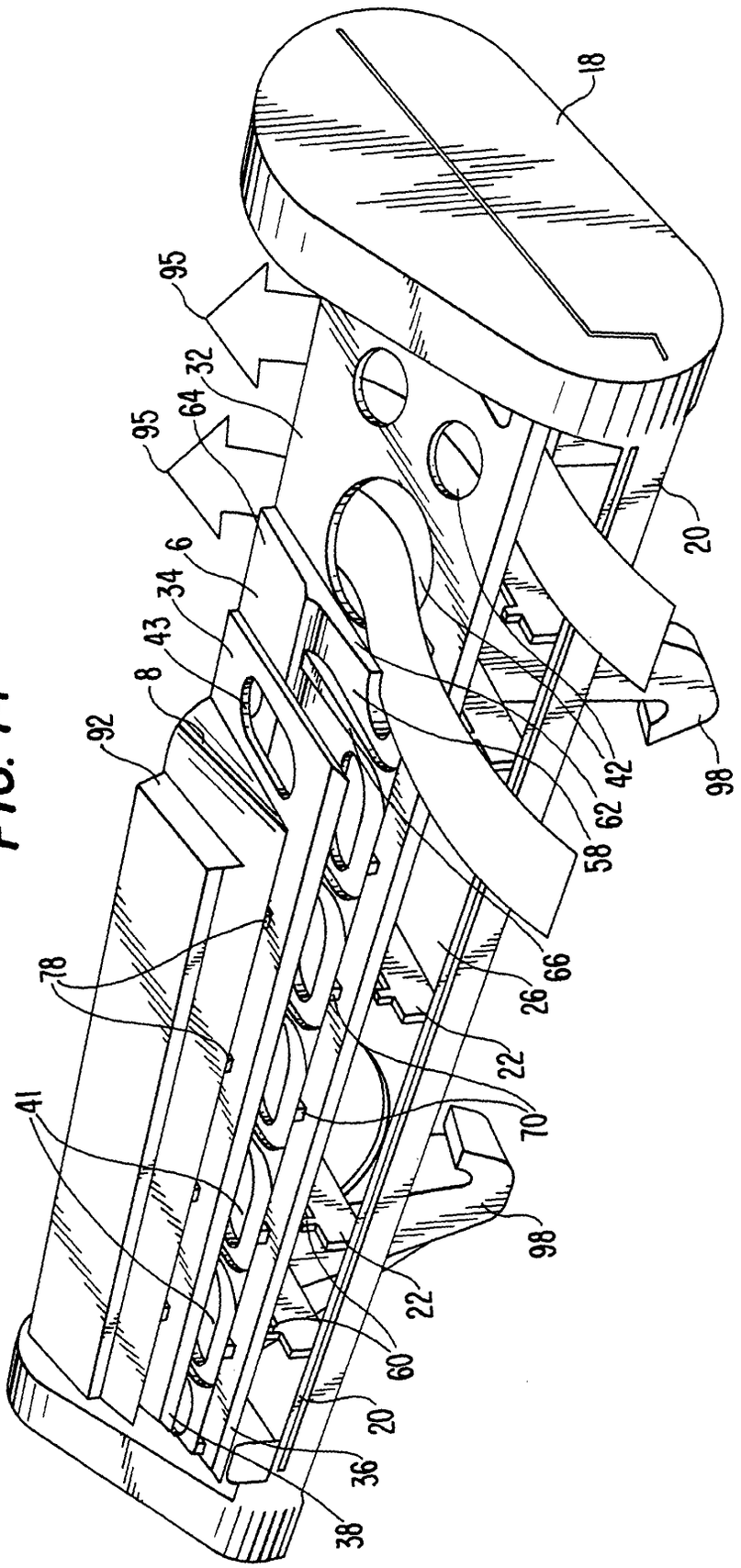


FIG. 14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