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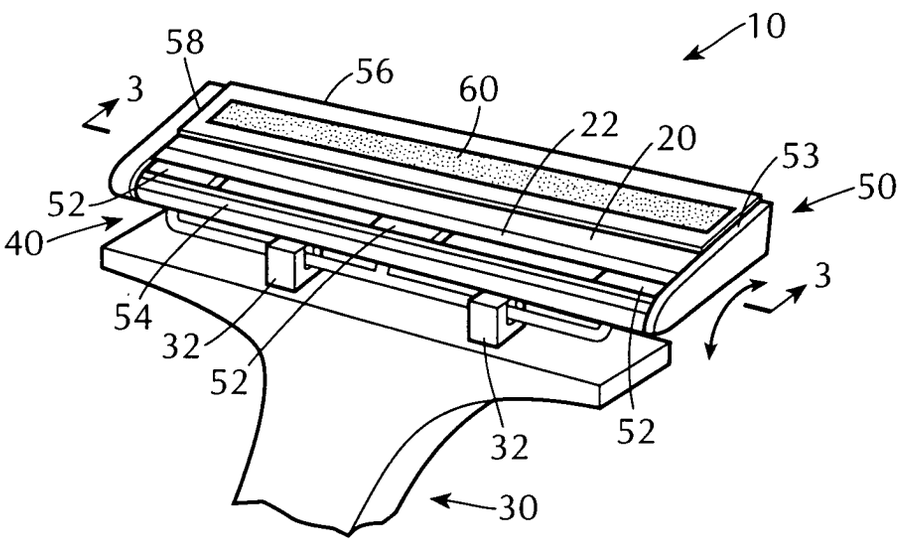
(54) Shaving system which actively flex a blade

(57) Wet shaving systems having a flexible blade housing which is linked to a support by a linkage (40) comprising a plurality of links which actively flex the blade (20), i.e., cause portions of the blade edge to move upwardly in response to shaving forces exerted downwardly on other portions of blade. This shaving system redistributes shaving forces along the cutting edge (22) of the blade. In illustrated embodiments, the blade housing is linked to a razor by two four-bar linkages which are either overlapping or separate.

FIG. 1



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Description

[0001] The present invention is directed to wet shaving systems, and more particularly, to wet shaving systems having means for linking a blade to a support so that the blade is actively flexed in response to shaving forces to redistribute shaving forces along a cutting edge of the blade.

BACKGROUND OF THE INVENTION

[0002] Shaving systems such as safety razors have found widespread use for providing close and comfortable shaves. Safety razors typically include one or two blades disposed between a guard and a cap. Traditionally, each of these elements was rigidly fixed relative to one another and disposed in skin-engaging contact during shaving. In recent years, dynamic shaving systems have been introduced which permit one or more of the skin-engaging elements of the shaving system to move or flex in response to forces encountered during shaving. Such systems are generally designed to conform to the shape of the surface being shaved. Since forces directed on one element of some dynamic systems could move other skin-engaging elements or change the manner in which other skin-engaging elements contact the skin, uneven shaving could occur at different blades.

[0003] It would, therefore, be desirable to provide shaving systems which actively flex at least one blade in response to shaving forces to redistribute shaving forces along a cutting edge of the blade in order to achieve greater uniformity of shaving forces, comfort, closeness, and to extend the life of the blade(s).

SUMMARY OF THE INVENTION

[0004] Various embodiments of the present invention provide wet shaving systems which comprise a blade comprising a cutting edge, a support, and at least one attachment mechanism for connecting the blade to the support. The attachment mechanism is operable to actively flex the blade in response to shaving forces to redistribute cutting forces along a cutting edge of the blade.

[0005] Other embodiments of the present invention provide wet shaving systems comprising a blade having a cutting edge, a support, and an attaching mechanism for linking the blade to the support which is operable to actively flex the blade in response to shaving forces to conform the blade to the contours of a skin surface and a connecting mechanism for connecting the attaching mechanism to the support so that the blade is self-orientating to the skin surface independent from the angle at which the razor is held.

[0006] These and other embodiments of the present invention are described below with reference to the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007]

FIG. 1 is a perspective view of one embodiment of a wet shaving system according to the present invention.

FIG. 2 is an enlarged elevational end view of the wet shaving system shown in FIG. 1.

FIG. 3 is a cross-sectional view taken along line 3-3 in FIG. 1.

FIG. 4 is a diagrammatic view corresponding to FIG. 3 in which the blade illustrates a concave flex.

FIG. 5 is a diagrammatic view corresponding to FIG. 3 in which the blade illustrates a convex flex.

FIG. 6 is a diagrammatic cross-sectional view of an alternative embodiment of a wet shaving system according to the present invention.

FIG. 7 is a cross-sectional view taken along line 7-7 in FIG. 6.

FIG. 8 is a diagrammatic cross-sectional view corresponding to FIG. 6 in which the blade illustrates a compound flex.

DETAILED DESCRIPTION

[0008] The present invention is directed to wet shaving systems comprising at least one blade which is actively flexed during shaving to conform to the contours of a surface being shaved to provide close and comfortable shaves.

[0009] One illustrated embodiment of the present invention is shown in FIGS. 1 and 2, and comprises a razor head 10 comprising a flexible blade 20, a razor 30, and a linkage 40 for linking blade 20 to razor 30. Linkage 40 is operable to actively flex blade 20 in response to shaving forces to redistribute shaving forces across a cutting edge 22 of blade 20 (FIG. 1).

[0010] As used herein, the term "razor head" is meant to include cartridges adapted to be connected to a separate razor as well as the operative cutting portion of a disposable razor wherein the handle and cutting portion are formed as a single unit. Also, as used herein, the term "actively flex" is used to indicate movement of one portion of the blade in one direction in response to a shaving force directed in the opposite direction on a different portion of the same blade. As such, the movement of the blade of the present invention differs from that of generally rigid blades which may deflect vertically or angularly in response to shaving forces, and from that of flexible blades which exhibit simple downward flexing

about their end portions.

[0011] As shown in FIGS. 1 and 3, flexible blade 20 is attachable to a blade housing 50 which comprises a seat 52, a flexible guard 54, a flexible cap 56, and sidewalls 58. The illustrated razor 30 which forms a rigid support comprises two upwardly extending supports 32 which attach to linkage 40 as explained in greater detail below.

[0012] As shown in FIG. 3, the illustrated linkage 40 extends between and attaches blade housing 50 to razor 30. In this embodiment, linkage 40 comprises a plurality of linking members which, in response to shaving forces, actively flex blade housing 50 and blade 20. This active flexing redistributes shaving forces between the skin surface and blade housing 50 and blade 20, and in doing so, redistributes cutting forces along cutting edge 22 of blade 20. Desirably, linkage 40 conforms blade 20 to a skin surface to evenly distribute cutting forces along cutting edge 22 of blade 20 thereby optimizing the life of blade 20.

[0013] More particularly, shaving forces directed along a portion of blade 20 cause adjacent portions of blade 20 to move upwardly to engage adjacent portions of a skin surface being shaved. In this illustrated embodiment, linkage 40 comprises a first vertically extending link 42, a second vertically extending centrally disposed link 44, and a third vertically extending link 46. Upper end portions of links 42, 44, and 46 attach to seat 52 of blade housing 50. Attached to and extending between the lower end portions of links 42, 44, and 46 is a cross-link 48. Central portions of cross-link 48, i.e., between links 42 and 44, and 44 and 46, are supported by supports 32 of razor 30. Cross-link 48 of this illustrated embodiment is formed of a single flexible material, however, from the present description those skilled in the art will appreciate that the cross-link can also be formed a plurality of relatively pivotal segments. It will also be appreciated that links 44, 46, and 48, and cross-links 48 can be molded as a unit, or fastened, e.g., by pivotal attachments or attached as otherwise known in the art.

[0014] As shown in FIGS. 4 and 5, blade housing 50 is linked to razor 30 via linkage 40, which defines two overlapping side-by-side four-bar linkages providing a three-point attachment to blade housing 50 and a two-point attachment to razor 30. When blade housing 50 and blade 20 are pressed against a curved surface such as a chin, or a shin bone area, blade housing 50 and blade 20 are made to actively flex to the curvature of the contacted surface to redistribute the shaving forces thereon. Specifically, cross-links 48 are pivoted about respective supports 32 in the directions of the curved double-headed arrows illustrated in FIGS. 4 and 5. For example, as illustrated in FIG. 4, when blade 20 and blade housing 50 is pressed against a chin, a localized shaving force represented by downwardly directed arrow A will move link 44 downward and in doing so, links 42 and 46 will move upwardly to engage adjacent skin surfaces of the chin along the end portions of blade 20. If the forces on the end portions of the blade housing 50 and blade 20 exceed those on a central portion, such as when shaving under arms as illustrated in FIG. 5, in which the shaving forces are represented by downwardly directed arrows B, the central portion will move upwardly to engage the skin surface.

[0015] From the present description, it will be appreciated by those skilled in the art that by positioning links 44 and 46 at the end portions of blade housing 50, blade housing 50 and blade 20 will be actively flexed across their entire lengths. As illustrated, supports 32 provide sufficient height so that cross-link(s) 48 does not contact razor 30 thereby preventing the blade from actively flexing. It may be desirable to limit the permissible extent of active flexing by providing stops (not shown) which limit the movement of one or more links, e.g., links 48, and thereby restrict the degree of blade flexing to a predetermined range.

[0016] When such shaving forces are removed, the inherent resiliency of blade 20, blade housing 50, and linkage 40 is preferably sufficient to return blade 20, blade housing 50, and linkage 40 to an original position. In addition, from the present description it will be appreciated by those skilled in the art that the blade, the blade housing and the linkage can be designed to provide a predetermined stiffness along the length of blade.

[0017] It will also be appreciated that the attachment of linkage 40 to supports 32 of razor 30 can be configured to allow blade 20 to be self-orientating to the skin surface, i.e., blade housing 50 can be pivotally attached to the razor.

[0018] An alternative embodiment of the present invention, illustrated in FIGS. 6-8, provides a razor head 110 which comprises two separate linkage arrangements such that the system will conform to complex surface shapes as shown in FIG. 8.

[0019] In this illustrated embodiment, linkage 140 extends between and attaches a blade 120 via a blade housing 150 to a razor 130. Linkage 140 comprises a plurality of links which actively flex blade 120 and blade housing 150 in response to shaving forces to distribute shaving forces exerted on the blade and blade housing 150, and in doing so, redistribute cutting forces along a cutting edge of blade 120. In this illustrated embodiment, linkage 140 comprises a plurality of links which define two separate four-bar linkages which are attached at an upper end to blade housing 150, e.g., vertically extending links 142 and cross-links 148. Each four-bar linkage is attached at a central portion of cross-link 148 to the top of an upwardly connecting link 145, the bottoms of which are attached to opposite leaf springs 147 which are cantilevered from a support 132.

[0020] In this illustrated embodiment, leaf springs 147 maintain blade housing 150 in a position normal to the handle when no load is applied. However, leaf springs 147 allow blade 120 and blade housing 150 to flex to the angles of the shaved surface to advantageously maintain a generally constant pressure across blade

120 for shaving surfaces with complex shapes.

[0021] Blade housing 150 can also be self-orienting to a skin surface independent of the angle of razor 130, i.e., blade housing 150 is adjustable in the directions of the double-headed arrow shown in FIG. 7. For example, this can be accomplished by internal or external pivot attachments known in the art or by a rocking-type pivot structure 170 as shown in FIG. 7. This illustrated configuration can be arranged to place the pivot point in a location that would optimize the pivot location to cause the blade(s) to stay on a curved shaving surface. In addition, the pivot point could be positioned to eliminate any rotational torque due to shaving forces so that the pivot action only reacts to the surface shape. Advantageously, this configuration optimizes the position of the blade against a shaved surface to provide close and comfortable shaves.

[0022] From the present description it will be appreciated by those skilled in the art that the illustrated razors and linkages of the present invention can be made of individual components that are subsequently assembled or integrally formed as a unit by an insert molding process. The upper portion of the linkage can be releasably attachable to the blade housing. It will also be appreciated that the razor head can comprise one or more blades, and the blade and blade housing can comprise wire or foil wrapped blades.

[0023] Another preferred embodiment of the present invention comprises a wet shaving system as described above, in which the blade housing further comprises a skin-engaging shaving aid material. For example, as shown in FIG. 1, razor head 10 comprises a shaving aid material 60 attached to cap 56 of blade housing 50.

[0024] A number of different materials have been suggested for use as shaving aids. The term "shaving aid," as used herein, refers equally either to the active ingredient combined within a delivery system, such as a water-insoluble microporous matrix structure or to the active ingredient alone. Previously suggested active ingredients include those disclosed in U.S. Patent No. 4,170,821 to Booth, which is hereby incorporated by reference. A shaving aid may comprise one or various combinations of the following:

A. A lubricating agent for reducing the frictional forces between the razor and the skin, e.g., a microencapsulated silicone oil.

B. An agent which reduces the drag between the razor parts and the shaver's face, e.g., a polyethylene oxide in the range of molecular weights between 100,000 and 6,000,000; a non-ionic polyacrylamide; and/or a natural polysaccharide derived from plant materials such as "guar gum."

C. An agent which modifies the chemical structure of the hair to allow the razor blade to pass through the whiskers very easily, e.g., a depilatory agent is one example.

D. A cleaning agent which allows the whisker and skin debris to be washed more easily from the razor parts during shaving, e.g., a silicon polyethylene oxide block copolymer and detergent such as sodium lauryl sulphate.

E. A medicinal agent for killing bacteria, or repairing skin damage and abrasions.

F. A cosmetic agent for softening, smoothing, conditioning or improving the skin.

G. A blood coagulant for the suppression of bleeding that occurs from nicks and cuts.

H. An astringent for constricting blood vessels thereby stemming the flow of bodily fluids such as lymph, which may exude from skin which has been irritated during shaving.

Alternatively, the shaving aid may comprise one or more of the shaving aids disclosed in U.S. Patent No. 5,056,221 to Thoene, U.S. Patent No. 4,044,120 to Rowsell et al., U.S. Patent No. 5,095,619 to Davis et al., or Japanese Patent Application No. Hei 7 [1995] - 24156 to Miyazaki, et al. which are also hereby incorporated by reference.

[0025] Other active ingredients may include various pigments, e.g., titanium dioxide, fragrances, aloe vera, flavoring agents, mineral oils, essential oils and other oils derived from plants. In addition to one or more active ingredients, the shaving aids of the present invention may also comprise other compounds or blends of compounds such as water-insoluble polymers such as polystyrene and polypropylene.

Claims

1. A shaving system comprising:

a blade housing and a blade comprising a cutting edge;

a support; and

means for linking said blade housing to said support wherein said linking means actively flexes said blade in response to shaving forces to distribute cutting forces along said cutting edge of said blade.

2. A shaving system according to claim 1 wherein said linking means provides a three-point attachment to said blade housing and a two-point attachment to said support.

3. A shaving system according to claim 2 wherein said linking means comprises two overlapping side-by-side four-bar linkages.

4. A shaving system according to claim 1 wherein said linking means comprises a plurality of generally vertically extending links attached at one end portion to said blade housing, and at least one generally

horizontally extending cross-link attached to and extending between a cross-link which is attached to an opposite end portion of said plurality of links.

5. A shaving system according to claim 4 wherein a central portion of said cross-link between opposite end portions of said plurality of links is attached to said support.

6. A shaving system according to claim 5 wherein said cross-link is pivotal about said support so that said blade housing and said blade are concavely and convexly flexible to a skin surface.

7. A shaving system according to claim 6 wherein said cross-link is pivotal about said support so that said blade housing and said blade are self-orientating to a skin surface.

8. A shaving system according to claim 5 wherein said cross-link comprises a plurality of segments.

9. A shaving system according to claim 1 wherein said flexible blade housing comprises a flexible guard and a flexible cap.

10. A shaving system according to claim 1 further comprising a shaving aid selected from the group consisting of a lubricating agent, a medicinal agent, a vitamin, a cosmetic agent, a coagulant, an astringent, a cleaning agent, a skin conditioner, and blends thereof.

11. A shaving system comprising:

a blade housing and a blade comprising a cutting edge;
a support; and
means for linking said blade housing to said support wherein said linking means actively flexes said blade in response to shaving forces to distribute cutting forces along said cutting edge of said blade, said linking means comprising a four-point attachment to said blade housing and a two-point attachment to said support.

12. A shaving system according to claim 11 wherein said linking means comprises two separate four-bar linkages.

13. A shaving system according to claim 11 wherein said linking means comprises a plurality of pairs of generally vertically extending links attached at one end portion to said blade housing, and a generally horizontally extending cross-link attached to and extending between opposite end portion of each of said pairs of links.

14. A shaving system according to claim 13 wherein said linking means comprises at least two vertically extending connecting links, each of which is attached at one end portion to one of said cross-links and opposite end attached to a leaf spring which is cantilevered from said support.

15. A shaving system according to claim 14 wherein said cross-link is pivotal about said connecting link so that said blade housing and said blade are concavely and convexly flexible to a skin surface.

FIG. 1

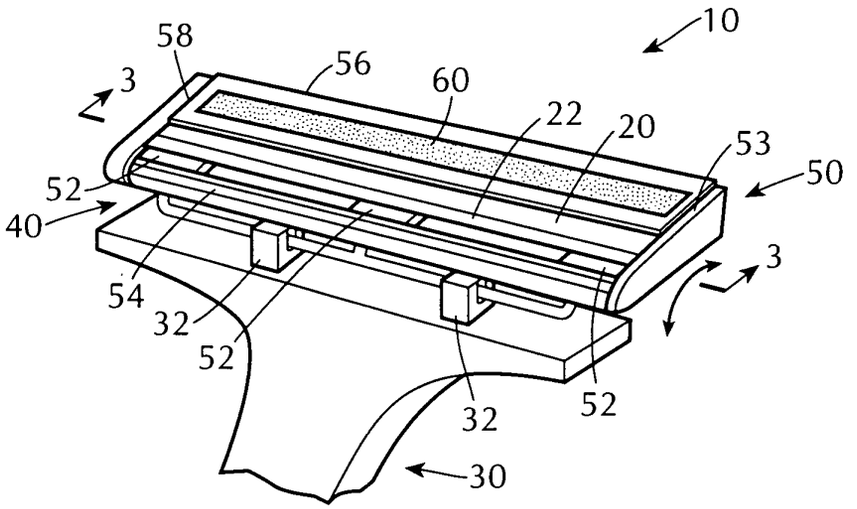

FIG. 2

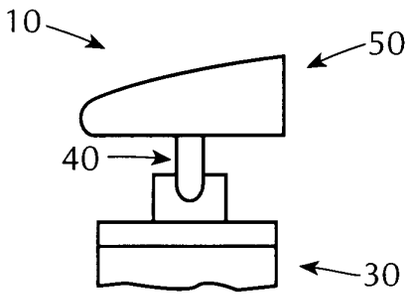

FIG. 3

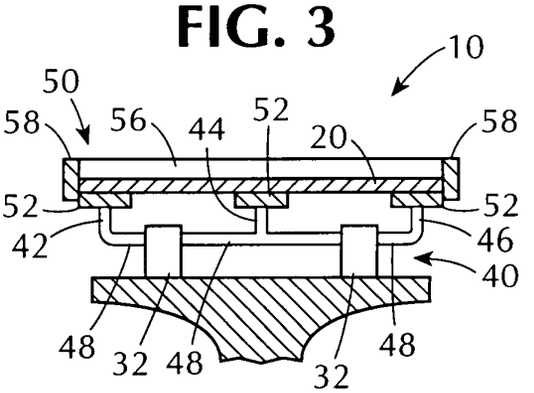

FIG. 4

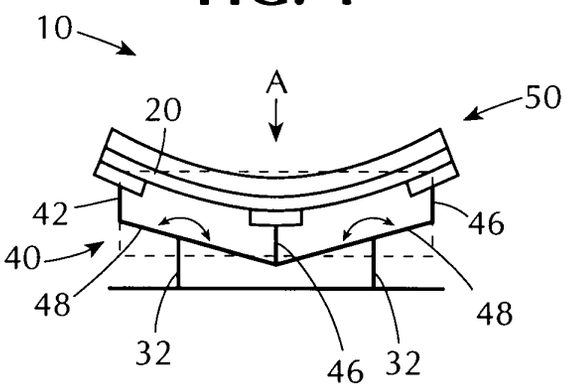

FIG. 5

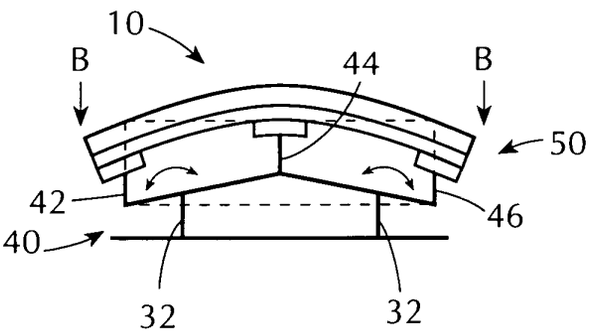

FIG. 6

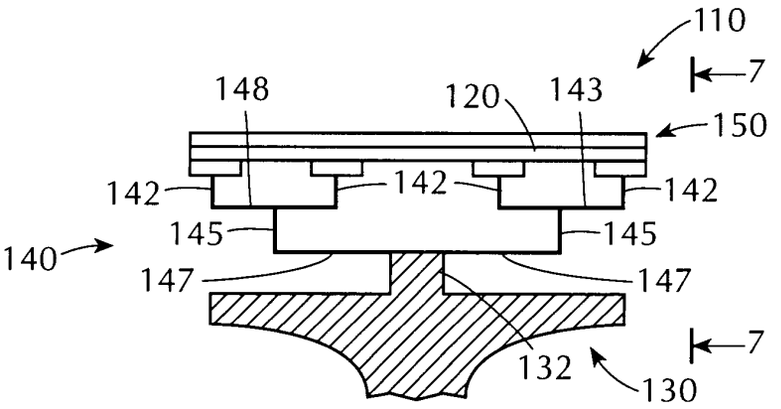

FIG. 7

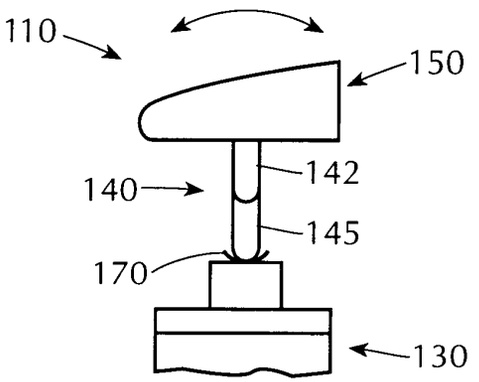

FIG. 8