United States Patent

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RAZOR WITH GUARDED RAZOR EDGE

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ABSTRACT

A razor has a guarded razor edge which includes a substantially flat flank and a profiled flank. The profiled flank comprises a multiplicity of alternating relatively narrow panels separated by much narrower guard ribs spaced along the razor edge. The panels converge with the flat flank to form short, spaced apart sharp cutting edges between the guard ribs. The guard ribs protrude above the plane of the panels and forward of the cutting edges, and are integral portions of the razor body.

9 Claims, 13 Drawing Figures
1. Field of the Invention

This invention relates to razors, and more particularly to a razor with a guarded razor edge which reduces the chance of cutting the skin during shaving.

2. Description of the Prior Art

In the past, safety guards have been applied to the cutting edge of razors to reduce the chance of cutting the skin during shaving. One prior art safety guard includes small guard members disposed around the razor cutting edge and arranged in series along the cutting edge for shielding the skin from the cutting edge during shaving. These guard members are usually secured to the razor by mechanical means (e.g., wound around the razor, clamped to the razor blade, etc.), by bonding, or by welding. To produce a reasonably smooth shave, these guard members must be small, which renders them structurally rather fragile. They tend to shift their position along the cutting edge, which in some places increases their mutual spacing. Some of these guard members also are made of such structurally weak material that they are prone to being severed by the cutting edge. Both of these phenomena tend to reduce the effectiveness of such guard members.

Another type of a prior art guarded razor edge includes guard members which are integral portions of the razor edge, and which protrude above, below, and forward of the cutting edge. This arrangement is structurally superior to the ones described above but, unfortunately, very expensive to manufacture. To produce a smooth shave, the cutting edge must be sharp, and that portion of the cutting edge blocked by the guard members must be short. Such a cutting edge practically can be manufactured only by grinding with profiled grinding wheels. These profiled grinding wheels must be very accurate. Also, each blade must be positioned very precisely in order to prevent excessive mismatch between the upper and the lower portions of the guard members, since a mismatch increases the effective width of the guard members. Furthermore, the initially sharp edges of the grinding wheel tend to become rounded during operation, which tends to increase the fillet radius between the cutting edge and the guard member. This phenomenon also increases the effective width of the guard ribs. To alleviate this problem, the profiled grinding wheels must be frequently dressed. Therefore, the cost to manufacture such a razor edge is comparatively high.

Other prior art guard members function merely as spacers for maintaining a space between the cutting edge of the blade and the skin. They keep the blade edge spaced a slight distance away from the skin during use, but cutting still can result rather easily when holding the blade at certain angles relative to the skin, or when the motion of the blade over the skin contains a component parallel to the cutting edge.

SUMMARY OF THE INVENTION

This invention concerns a razor having a guarded razor edge that significantly reduces the chances of injury to the skin while at the same time being relatively inexpensive to manufacture.

Briefly, the guarded razor edge includes a substantially flat flank and a profiled flank, both flanks extending along the razor edge. The profiled flank includes a multiplicity of alternating, relatively narrow panels separated by much narrower guard ribs spaced along the razor edge. The panels converge with the flat flank to form spaced apart, relatively short, sharp cutting edges between the guard ribs. The guard ribs protrude above the panels and forward of the cutting edges, and are integral portions of the razor body.

In a preferred form of the invention, the profiled flank is produced by a metal working process such as rolling or forging. The flat flank is subsequently produced by grinding and honing. Both of these operations are relatively simple and inexpensive. Expensive profiled grinding wheels are not required to produce the profiled flank. The metal working process produces integral guard ribs which are very small, yet structurally sound. Moreover, the guard ribs may be manufactured at a cost not very much higher than the cost of a comparable plain razor edge.

The edges of the panels between the guard ribs may be planar, or they may be angular. A planar panel converging with the flat flank creates a straight cutting edge. The angular panel is oriented such that the profile of the profiled flank does not change. This creates an angular cutting edge when the profiled flank converges with the planar flank. The preferred angular panel is a concave V which results in a V-shaped cutting edge opening outwardly toward the ends of the guard members. The cutting capability of the razor is enhanced by the V-shaped cutting edge, because the majority of whiskers are cut off when a substantial component of the relative motion between a whisker and the cutting edge is in a direction tangential to the cutting edge.

The guarded razor edge of this invention may be used such that either the flat flank or the profiled flank slides on the skin during shaving. In the first case the cutting edges slide directly on the skin, which gives a very smooth shave. The guard rib tips which protrude forward of the cutting edges prevent the edges from puncturing into the skin, unless an excessive shaving pressure is applied. However, even in this instance the skin is not cut deeply. Instead, only minute particles of it may be scraped off. To what extent this happens, if at all, depends on the skill of the individual shaver.

In the second case the guard ribs slide on the skin. They hold the cutting edges at a small distance away from the skin, the distance corresponding to the thickness of the guard ribs. The skin between the guard ribs bulges toward the cutting edges and may barely touch the edges, or not at all, depending on the shaving pressure. If excessive shaving pressure is applied, the scraped-off skin particles, if any, will be much smaller than the ones in the first case. Thus, the method described for the second case provides a shave which is safer than in the first case, but the resulting shave has slightly reduced smoothness.

BRIEF DESCRIPTION OF THE DRAWINGS

The features of specific embodiments of the best mode contemplated of carrying out the invention are illustrated in the accompanying drawings, in which:

FIG. 1 is a fragmentary and partially sectional end elevation view showing a guarded razor blade clamped in a conventional razor blade holder;

FIGS. 2A and 2B are a fragmentary plan elevation views showing different embodiments of the guarded razor blade;
FIG. 3 is an enlarged fragmentary plan elevation view of the razor edge structure shown within the circle 3 of FIG. 2.

FIG. 4 is a fragmentary perspective view, partly in section, of the guarded razor blade of FIG. 2.

FIG. 5 is a fragmentary elevation view taken on line 5—5 of FIG. 3.

FIG. 6 is an enlarged fragmentary plan elevation view of an alternate embodiment of a guarded razor blade.

FIG. 7 is a fragmentary sectional elevation view taken on line 7—7 of FIG. 6.

FIG. 8 is a fragmentary elevation view taken on line 8—8 of FIG. 6.

FIG. 9 is a perspective view, partly in section, showing the use of a pair of rollers to form the guarded razor.

FIG. 10 is a schematic fragmentary elevation view showing a method of grinding the cutting edges of the guarded razor.

FIG. 11 is an enlarged fragmentary elevation view of an alternate embodiment of a roller used to form the profiled edge of the guarded razor; and

FIG. 12 is a schematic fragmentary perspective view showing an alternate method of forming the guarded razor.

### Detailed Description of the Specific Embodiments

Referring to FIG. 1, a razor blade 20 has a guarded razor edge 22. The razor blade is held in a conventional razor blade holder 24 comprising a bottom clamping member 26, a top clamping member 28 with a guard bar 30, and a handle 32. The blade is shown being drawn across the skin 34 for shaving a whisker 36.

As shown best in FIGS. 2A and 2B, razor blade 20 comprises a flat base structure 38, with the guarded razor edge 22 of this invention extending along substantially the whole length of each edge of the blade. The invention is described in conjunction with a razor blade, the type which is readily fitted in a conventional razor holder. However, the razor blade is shown by way of example only, since the guarded razor edge of this invention also may be applied to injector razor blades, band razor blades, straight-edged razors, and the like.

FIGS. 3, 4, and 5 show the structural details of guarded razor edge 22 of razor blade 20. The guarded edge includes a substantially flat flank 40 and a profiled flank 42. The latter comprises a multiplicity of alternating relatively narrow panels 44 separated by much narrower guard ribs 46 spaced apart along razor edge 22. Panels 44 converge with flat flank 40 to form short, spaced apart sharp cutting edges 48 between the guard ribs. The guard ribs protrude above panels 44 and forward of cutting edges 48. The guard ribs are integral parts of the blade base structure, as will become more clear from the detailed description below. Each of the guard ribs has a rounded tip 50 to facilitate the sliding of the guard ribs over the skin.

In the embodiment of the invention shown in FIGS. 3 through 5, panels 44 are flat, which produces straight cutting edges 48, as shown best in FIG. 3. When this guarded razor edge slides over the skin, the majority of whiskers are cut off by cutting edges 48. However, a few of them will be bent by tips 50 of guard ribs 46, instead of being cut off. Since guard ribs 46 are integral portions of razor edge 22, they can be made very narrow, which results in only a small number of whiskers being bent instead of being cut off.

One of the major advantages of the guarded razor edge of this invention is that the apparently complex guarded razor edge can be manufactured rather inexpensively. FIGS. 9 and 10 show a method of manufacturing razor blade 20. An elongated steel strip 52 is rolled between an upper roller 54 and a lower roller 56. Upper roller 54 has a cylindrical surface with spaced apart and parallel circumferential grooves 58 which form a profiled surface 60 on the upper face of the strip. Profiled surface 60 has parallel, upwardly protruding elongated ribs 62 separated by wider elongated panel sections 64. Lower roller 56 has a smooth cylindrical surface which forms a flat surface 66 on the bottom face of the strip.

The profiled strip is then disposed over a die 68 having an opening 70 shaped as a razor blade. Strip 52 passes between the punch 72 and die 68, and the punch stamps a blade-shaped piece 74 out of the strip. Piece 74 is then heat-treated in a non-oxidizing environment. The heat-treated piece is then ground and honed by a grinding wheel 76 (shown in phantom line in FIG. 10) to produce a razor 78 having a flat bottom flank 80 converging with profiled surface 58 to form spaced apart sharp cutting edges 82 between upwardly protruding and outwardly extending guard ribs 84. The pointed tips of guard ribs 84 are finally rounded to produce a completed razor blade having a cross-sectional configuration shown best in FIG. 4.

Strip 52 may be rolled such that the profile runs parallel to the strip or perpendicular to it. In the first case, upper roller 54 has the circumferential grooves described above for creation of the guard ribs. In the second case, the upper roller has axial grooves (not shown). When axial grooves are used, they are preferably at the ends of the roller only. Such a roller creates a profile at the edges of the blade only, as shown in the left half of FIG. 2. Full-length grooves produce a profile extending across the whole blade, as shown in the right half of FIG. 2.

It does not cost significantly more to roll a profiled strip in mass fabrication than to roll a flat strip of comparable size. Also, the grinding and honing of flat flank 80 (FIG. 10) and the rounding of the tips of ribs 84 is not forbiddingly expensive, since one flank only is ground. Furthermore, since this one flank is flat, no expensive profiled grinding wheels are required. The life of the roller for rolling the profiled side of the strip is very much longer than the life of a comparable profiled grinding wheel, which must be dressed frequently to continually avoid exceeding the small fillet radius 85 (see FIG. 5) between the panels 44 and guard ribs 46. The small radius is necessary for good performance of the blade. The only limitation is that since only one flank of the razor edge is ground, the material of the razor edge must be sufficiently brittle so as not to form a burr at the cutting edges 48 during grinding and honing. This requirement is fulfilled by most heat-treated steels.

Another advantage of the flat flank of the guarded cutting edge is that the razor edge can be easily resharpened, an advantage not possessed by razor edges where the guard members pass around the cutting edge.
FIG. 12 shows an alternate method of manufacturing razor blade 20 (left side of FIG. 2). The blade is stamped out in a fashion similar to blade 74 in FIG. 9 without the prior step of profile rolling. The profile of the guarded edge 22 is produced by coining the blade edge 22 between a flat die 86 and a profiled die 87. The profiled die 87 forges alternating guard ribs 46 and panels 44 in the blade body to form the profiled flanks of the razor. Subsequently, the blade is heat-treated and a bottom flat flank is finish-ground and honed as shown in FIG. 10.

FIGS. 6, 7, and 8 show the structural details of an alternate guarded razor edge 89, which is similar to the one shown in FIGS. 3 through 5, except that panels 90 of the razor edge 89 are not planar. They are slightly V-shaped, with an apex 92 of the V pointing toward flat flank 94, as shown best in FIG. 8. This causes cutting edges 96 to be V-shaped too with the opening of the V pointing in the cutting direction of the razor edge as indicated by arrow 97 in FIG. 6. Basically, the contour of the cutting edge 96 is the same as that of panel 90, except that it is much steeper, the increase in steepness being approximately inversely proportional to the angle of convergence between the panels 90 and flat flank 94. Thus a slightly V-shaped panel 90 results in a rather steeply V-shaped cutting edge 96 when the angle of convergence is small. The contour of cutting edge 96 does not need to be precisely V-shaped, the criterion being that a major portion of the cutting edge 96 is sloped with respect to the direction of motion 97 of the razor edge 89.

The advantage of such a V-shaped cutting edge is that, although it is not significantly more expensive to manufacture than a straight one, its cutting capability is very much enhanced, since each whisker is cut with a substantial component of the relative motion between it and the cutting edge being in a direction tangential to the cutting edge. For illustration, to cut a loaf of bread by trying to force a knife through it in a direction perpendicular to the knife's cutting edge is more difficult and does not cut as well as when super-imposing a simultaneous forward or backward motion of the knife.

Preferably, the profiled razor edge shown in FIG. 6 is manufactured by a rolling process similar to that shown in FIG. 9, except that upper roller 54 is replaced with a roller 98 shown in FIG. 11. Roller 98 has spaced apart and parallel circumferential grooves 99a separated by sections formed as pairs of opposed truncated cones which converge to define spaced apart and parallel circumferential rims 99b.

As shown best in FIG. 1, a guarded razor edge 22 is preferably used with flat flank 40 sliding on the skin 34 during shaving. The tips 50 of guard ribs 46 are rounded at the side facing the skin so as to prevent injury to the skin. When flat flank 40 slides on the skin, cutting edges 48 also slide directly on the skin, which results in a very smooth shave. The rounded tips 50 of guard ribs 46 prevent cutting edges 48 from penetrating into the skin, unless an excessive shaving pressure is applied. However, even when excessive pressure is applied, cutting edges 48 do not penetrate deeply into the skin. Instead, they scrape off minute particles of the skin only, the size of these particles depending on the applied pressure, length of the cutting edges, and their shape. Thus, cutting of the skin is substantially prevented during shaving.

FIG. 7 shows guarded razor blade 88 with its guard ribs 100 sliding on the skin 102 during shaving. Tips 104 of guard ribs 100 are bent away from the skin to prevent injury to the skin. To further reduce the chance of injury to the skin, the profile 106 of guard ribs 100 has no sharp corners, as shown best in FIG. 8.

When guard ribs 100 slide on the skin, cutting edges 96 are held a small distance away from the skin, the distance corresponding to the thickness of the guard ribs. The skin bulges between the guard ribs toward cutting edges 96. Depending on the shaving pressure, the cutting edges only lightly touch the skin, or even not at all, as shown best in FIG. 8. When an excessive shaving pressure is applied, the scraped-off skin particles, if any, are much smaller than the ones in the case of the flat flank sliding on the skin, although the resulting shave is slightly less smooth. However, the chance of cutting the skin during shaving is substantially eliminated.

In manufacturing blade 88, the blade is stamped from a steel strip. It is bent along a transverse axis 108. The profile represented by guard ribs 100 and panels 90 is forged. This results in a raw blade edge shown in phantom lines 110. Subsequently, flat flank 96 is pre-ground and tips 104 of the guard ribs are bent upward. Finally, the blade is heat-treated and flat flank 96 is finish-ground and honed.

When using an unguarded razor, the angle of attack between the razor and the skin may vary to a considerable extent, e.g., from approximately 0° (one flank of the razor laying flat on the skin) to 30°, and still be able to provide a satisfactory shave. The guarded razor edge of this invention does not permit such a large leeway. Generally speaking, it should be held at such an attitude that the flank that slides on the skin is approximately coplanar with the skin. A large angle of attack would cause the guarded razor edge to ride on the tips of the guard ribs, which would result in an unsatisfactory shave. To facilitate the proper positioning of the razor edge 89 with respect to the skin, the razor edge is bent upward along axis 108, as shown best in FIG. 7. This permits the convenient use of a bottom clamping member 112, without its interfering with the skin when guard ribs 100 are in coplanar contact with the skin.

Referring again to FIG. 1, a razor blade 20 is provided with two longitudinal bends 114. The bends are shaped to bring flat flank 40 into optimum contact with the skin, when the razor blade is clamped in blade holder 24.

As shown best in FIG. 2, the extreme guard ribs 116 are much wider than the other guard ribs, which provides extra protection for the skin during shaving.

Guard ribs 46 are relatively narrow, and the length of cutting edges 48 is relatively short. This is not readily apparent from the drawings because, for clarity, the drawings are not shown to scale. In particular, the guard ribs are shown greatly exaggerated in size and reduced in numbers. An appreciation for the dimension of the elements of the guarded razor edge of this invention may be had by realizing that an average whisker of a beard is approximately only 0.004 inch thick. A practical range for the width and height of guard ribs 46 is about 0.0015 to 0.0060 inch, and 0.060 inch for the length of cutting edges 48.

I claim:
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1. A razor having a body with a guarded razor edge comprising a substantially flat flank forming a lower portion of the razor edge and extending continuously for a major portion of the length of the razor body, and a profiled flank forming an upper portion of the razor edge, the profiled flank comprising a multiplicity of alternating relatively narrow panels and substantially narrower guard ribs spaced along the razor edge, the guard ribs being integral portions of the razor body, the panels converging with the flat flank to form relatively short cutting edges lying in a common plane and spaced along the razor edge between the guard ribs, the guard ribs protruding above the panels and in front of the cutting edges to provide rounded face-engaging ends located only above the plane of the cutting edges, the guard ribs being rounded outwardly away from the plane of the cutting edges and spaced apart sufficiently to engage the skin of the user and reduce the chance of the cutting edges cutting the skin of the user during shaving.

2. Apparatus according to claim 1 in which the width of each cutting edge is between about 0.015 and 0.060 inch.

3. Apparatus according to claim 1 in which the width of each guard rib is between about 0.0015 and 0.0060 inch.

4. Apparatus according to claim 1 in which each guard rib protrudes between about 0.0015 and 0.006 inch above the panels.

5. A razor blade shaped to fit means for holding the razor blade, the blade comprising a flat base structure and a guarded razor edge, the guarded razor edge including a substantially flat flank forming a power portion of the razor edge and extending continuously for a major portion of the length of the razor edge, and a profiled flank forming an upper portion of the razor edge, the profiled flank comprising a multiplicity of alternating, relatively narrow panels and substantially narrower guard ribs spaced along the razor edge, the guard ribs being integral portions of the razor blade base structure, the panels converging with the flat flank to form relatively short cutting edges spaced along the razor edge between the guard ribs, the guard ribs protruding above the panels and in front of the cutting edges to provide rounded face-engaging ends located only above the plane of the cutting edges, the guard ribs being rounded outwardly away from the plane of the cutting edges and spaced apart sufficiently to engage the skin of the user and reduce the chance of the cutting edges cutting the skin of the user during shaving, a longitudinal bend being formed between the guarded razor edge and the flat base structure to enable mounting of the razor blade in the holding means.

6. Apparatus according to claim 5 in which the blade includes a second longitudinal bend spaced from the other longitudinal bend.

7. Apparatus according to claim 1 in which each cutting edge is substantially V-shaped, with the apex of the V extending inwardly into the body of the razor blade.

8. Apparatus according to claim 1 in which each cutting edge is recessed so as to extend inwardly into the body of the razor blade away from the ends of the guard ribs.

9. Apparatus according to claim 1 in which the ends of the guard ribs are bent away from the skin when the blade is held in an orientation in which the remaining portions of the guard ribs engage the skin of the user.