RAZOR HAVING A STATIONARY GUARD AND AN AXIALLY SHIFTABLE GUARD

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ABSTRACT
A safety razor having blade support means, fixed guard means defining a maximum blade exposure and adjustable guard means intermediate the above two defining an operating blade exposure. The adjustable guard means is moveable up or down by a gear assembly housed in the handle, the assembly including in a particular embodiment a gear rack connected to the adjustable guard means and moved vertically by rotation of a worm gear about the handle axis. A worm gear control arm extends out of the razor through an opening in the side of the handle, and means are provided to restrict accidental changes in the blade exposure setting.

15 Claims, 6 Drawing Figures
A RAZOR HAVING A STATIONARY GUARD AND AN AXIALLY SHIFTABLE GUARD

BACKGROUND OF THE INVENTION

This invention relates to adjustable safety razors, and more particularly to safety razors having arrangements for adjusting the shaving geometry of the razors.

Several kinds of adjustable safety razors are presently available that adjust the shaving geometry by moving either the guard member or a blade platform relative to the other. Adjustments are frequently made by a form of detent control which, while generally providing a usable range of blade exposures, may not satisfy the consumer’s desire for a finer control than is available with a limited number of detent positions. In addition, many current adjustable razors employ rotary control knobs girding the razor handle that require the use of both hands for an adjustment to be made, thereby inconveniencing the user if he wants to adjust the setting for different areas of his face while shaving. A popular way of adjusting the moveable element in such razors involves a cam track and cam follower arrangement in which detent adjustment is attained by revolving the cam follower in conjunction with the rotary control knob. Because the moveable elements must follow the undulations of the cam track, the distance actually traveled during a transition from one setting to another may be considerably greater than the nominal distance separating the two settings.

SUMMARY OF THE INVENTION

The present invention satisfies the above considerations with the provision of an adjustable safety razor having a simplified adjustment control mechanism that can be economically mass produced.

It is an object of this invention to provide a novel and improved adjustable safety razor that may be set to any desired blade exposure over the entire range of adjustment.

Another object of this invention is the provision of a novel and improved adjustable safety razor having a protected adjustment member.

Another object of this invention is the provision of a novel and improved adjustable safety razor that requires only one hand to effect an adjustment in blade exposure.

A further object is the provision of a novel and improved adjustable safety razor with an adjustment mechanism that operates independently of the blade support mechanism.

Still another object is the provision of a novel and improved adjustable safety razor in which the total travel of the adjustable member between settings is equal to the ultimate change of position of the member for those settings.

Another object is the provision of a novel and improved adjustable safety razor with an adjustment mechanism that is simple to operate and pleasing in appearance.

In the accomplishment of these and other objects an adjustable safety razor is provided which employs a tubular handle carrying razor blade support means. An adjustable guard member located between a fixed auxiliary guard member and the blade support means is adjustable to provide a range of shaving geometries for a supported blade, with a clearance provided below the blade of sufficient magnitude to permit movement of the adjustable guard member corresponding to a desired range of blade exposures. A rotatable adjustment actuating member is housed in the handle and engages receiver means connected to the adjustable guard member to move the receiver means axially when the actuating member is rotated, thereby adjusting the position of the adjustable guard member.

In a particular embodiment the blade support means includes a blade platform above the fixed guard member and a cap section cooperating with the blade platform to clamp a razor blade at a cutting angle. In that embodiment, the receiver means includes an axially disposed inside threaded gear rack curved in an arc about the handle axis, and the actuating member is a cooperating worm gear provided on the exterior of a hollow cylindrical member. A plurality of arms held against rotation within the handle connect the adjustable guard member to the gear rack, rotation of the worm gear serving to shift the rack up or down and thereby adjust the axial position of the adjustable guard member. The gear pitch is preferably sufficiently large to move the adjustable guard member through a desired adjustment range with less than half a rotation of the actuating member.

A control grip is provided to rotate the actuating member, the grip projecting outwardly through an opening in the side of the handle. In a related feature free rotation of the actuating member is restricted by the provision of a resiliently compressible portion, the razor handle including means bearing against the compressible portion to restrict such rotation. In a particular embodiment the compressible portion comprises a split member with a transverse slot, the member compressed by an adapter fitted into the handle wall so that the notch is at least partially closed.

Other objects, features and advantages will occur to one skilled in the art from the following description of a particular embodiment of the invention, taken together with the attached drawings thereof, in which:

FIG. 1 is an exploded perspective view of a safety razor incorporating the features of the present invention;

FIG. 2 is an enlarged cross-sectional view of the upper portion of the razor shown in FIG. 1 after assembly and clamping a double edge razor blade;

FIG. 3 is a fragmentary cross-sectional view of the lower portion of the razor shown in FIG. 1;

FIGS. 4 and 5 are cross-sectional views respectively taken along the lines 4—4 and 5—5 of FIG. 2; and

FIG. 6 is an enlarged fragmentary cross-sectional view of the razor in the vicinity of a razor blade cutting edge.

DESCRIPTION OF A PARTICULAR EMBODIMENT

Referring first to FIG. 1, the major components of an adjustable double edge safety razor embodying the present invention are shown in exploded relation and include a spider and a cap assembly generally indicated at 10, razor blade platform assembly 12, an adjustable guard assembly 14, and spacer 16 adapted for reception in a fixed guard assembly 18. Also included are an adjustment actuating member 20 mounted by adapter 22 through a side of the guard assembly 18, and adjustment receiver means 24. A tubular razor handle includes a tube 26 and the lower portion of guard assembly 18. Tube 26 houses a plug 28, a coil spring 30 compressed between plug 28 and a collar 32, and a collar
3,871,076

retainer 34. Clamping knob 36 is press fit onto the lower portion of collar 32 and houses lock nut 38 to limit the upward travel of the spider and cap assembly 10.

The spider and cap assembly 10 includes a spider stem 40 which has a threaded lower end 42 with a fitting 44 for lock nut 38 and which is attached at its upper end to a spider 46. A pair of cap sections 48 and 50 are of identical construction and are mounted on transverse spider arms 52 and 54 by pivots 56 and 58 on spider arm 52 and a corresponding pair of pivots on spider arm 54, each pivot being provided at its lower end with a downwardly extending (as viewed in Fig. 1) cam follower portion 59. Cooperating camming elements 61 are formed on guard assembly 18. When the razor is assembled, opening and closing of the cap sections 48 and 50 is effected in a conventional manner by raising and lowering the spider 46 by means of the spider stem 40.

The blade platform assembly 12 includes a blade platform 60 shaped to support a double edge razor blade with its edges at a cutting angle when sections 48 and 50 are closed, and a hollow stem 62 large enough for spider stem 40 to fit through. Spider guide grooves 64 and 66 are provided on the transverse sides of the blade platform 60 to receive vertical plate portions 65 and 67 extending inwardly from spider arms 52 and 54 and guide upward and downward movement of the spider 46 when the cap sections 48 and 50 are open and closed. The longitudinal sides 68 and 70 of the blade platform 60 are each provided with a series of notches which serve as a guide for upward and downward movement of the adjustable guard 14 when it is adjusted to vary the blade edge geometry. Upward and downward shifting of the spider 46 causes cam follower portions 59 to engage surfaces of camming elements 61 to open and close the cap sections 48, 50.

The adjustable guard 14 includes a pair of guard bars 72 and 74 extending upward from opposite longitudinal sides of adjustable guard plate 76, the upper ends of which define an exposure for a clamped razor blade as shown in FIGS. 2 and 6. Along the inside of the adjustable guard bars 72 and 74 a row of teeth 78 and 80 project upward from the adjustable guard plate 76 to match with the notches 68 and 70 on blade platforms 60 and guide the adjustable guard 14 when it is moved up or down. An opening 82 in the middle of adjustable guard plate 76 is larger than the outer diameter of platform stem 62, allowing the stem 62 to fit through the opening when the razor is assembled. Guide grooves 84 and 86 in the transverse sides of adjustable guard plate 76 function in a manner similar to grooves 64 and 66 of the blade platform 60 to guide vertical movement of spider 46. A shallow cylinder 88, best seen in FIGS. 2 and 6, is formed on the underside of adjustable guard plate 76 and has an interior opening forming a continuation of adjustable guard plate opening 82. A pair of opposed arms 90 and 92 extend downward from the cylinder 88 and provide a connection for raising and lowering the adjustable guard 14, as will be described hereinafter.

The fixed guard assembly 18 includes a fixed guard plate 94 having an interior opening 96 that accommodates, in outward concentric order, spider stem 40, platform stem 62 and adjustable guard arms 90 and 92. Slots 98 on either side of the fixed guard plate 94 receive projections 99 provided on the underside of adjustable guard plate 76 and thereby provide additional guidance for vertical travel of the adjustable guard 14. Fixed pairs of longitudinal guard bars 100 and 102 and transverse guard bars 104 and 106 surround the fixed guard floor 94 and protect the adjustable guard, fixed guard bars 100 and 102 in addition defining a maximum blade exposure for the razor irrespective of the adjustable guard 14. The fixed guard assembly 18 also includes a hollow cylindrical extension 108 having an upward facing interior annular ledge 110, shown in FIG. 2. Annular ring 112 on spacer 16 sits on ledge 110 when the razor is assembled, an upper tubular portion 114 of the spacer 16 extending through adjustable guard opening 82 and abutting the bottom of blade platform 60, and adjustable guard arms 90 and 92 slidingly lodged in slots 113 and 115, respectively, in annular spacer ring 112. The blade platform 60 is thereby spaced above the guard assembly 18 by an amount that provides adequate upper and lower clearances for movement of the adjustable guard 14. Adjustable guard extension 108 is further provided with an opening 116 in its side, within which adapter 22 is mounted to hold the adjustment actuating member 20.

Adjustment actuating member 20 includes a central hollow cylindrical portion 118 centered on the razor handle axis and cut approximately halfway through by a narrow transverse slot 120 slightly below the top of the cylinder 118, a grip to control rotation of the cylinder 118 consisting of arm 122 extending outward from one side of the cylinder with an upturned portion 124 for easy handling by the user and an outward facing worm gear section 126 on the other side of the cylinder. In a particular embodiment the cylinder 118 is 0.33 inch in outside diameter with a wall thickness of 0.04 inch, slot 120 being 0.015 inch wide, and worm gear 126 having 40 threads per inch. Adapter 22 has an opening 128 for arm 122 and a series of vertical indentations 130 on the exterior surface above opening 128 to provide a visual background for selecting a razor adjustment. As best seen in FIG. 2, the adapter 22 is provided with an upward facing flange 132 and a lower inward facing flange 134 to hold cylinder 118, the spacing between the two flanges being slightly less than the height of the cylinder. When mounted, the cylinder 118, which is preferably formed from a slightly resilient plastic, is compressed and the slot 120 at least partially closed, thereby creating a force to restrain unintentional rotation of the adjustment actuating assembly 20. The side walls of adapter 22 limit the rotation of control arm 122 to a predetermined range of less than half a revolution.

Adjustment receiver 24 includes a lower ring 136 having outer grooves 138 and 140 on opposite sides to receive adjustable guard arms 90 and 92, and an upper cylindrically curved portion having an inward facing gear rack 142 that mates with worm gear 126 on the actuating assembly. The intermediate portions of the grooves 138 and 140 are enlarged somewhat and the adjustable guard arms 90, 92 heat staked securely to the assembly. By moving the operating arm 122 to rotate the actuating member 20, adjustment receiver 24 is shifted axially up or down, at the same time raising or lowering the adjustable guard 14 through arms 90 and 92. Adjustable guard 14 can be moved to any location between the upper position shown in solid lines in Fig. 6 and a lower position shown in dot-dash lines. Ac-
Tuating member 20 is held in place between adapter flanges 132 and 134 while an adjustment is made. In the embodiment shown, actuating worm gear 126 and gear rack 142 have spiral threads of pitch sufficient to move the adjustable guard 14 approximately 0.012 inch over the course of adjustment. The adjustment range may be varied by changing the gear pitch or the size of the arc through which actuating member 20 is rotated. Other gear features such as the number of threads employed may be varied and the length of the threads on one or the other of the gears may be reduced to a point at which each thread comprises a narrow tooth.

The remaining components shown in FIG. 1 are involved in clamping a razor blade onto the razor. Tube 26 narrows from a larger diameter at the bottom to a smaller diameter at the top and houses plug 28, which in turn encloses the lower end of platform stem 62. Plug 28 is smaller in diameter than the bottom of the tube 26 but slightly larger than the top of the tube. Coiled spring 30 is held between the top of collar 32 and a recess 143 in the lower portion of plug 28 and urges plug 28 upward to wedge within tube 26. Retainer 34 is press-fit into the bottom of tube 26 and is provided with an inward directed annular bead 144 that mates with an annular groove 146 in the side of collar 32, thereby holding the collar freely rotatable in the bottom of tube 26. An interior threaded portion 148 on collar 32 engages the threaded spider stem portion 42 so that the spider stem 40 can be lifted or lowered by rotating the collar 32, thereby opening or closing caps 48 and 50 to release or clamp a blade in the razor. Lock nut 38 crimped onto the bottom spider stem tip 44 limits the amount of upward travel available to the stem 40. Clamping knob 36 is tightly press-fit about the lower, larger diameter portion 150 of collar 32 to form the bottom of the razor handle and facilitate rotation of the collar.

In operation, a razor blade 152 is clamped between cap sections 48 and 50 and blade platform 60, the clearance between the blade edges and the upper ends of adjustable guard bars 72 and 74 defining the shaving geometry for a particular setting of the adjustable guard 14. The adjustable guard is raised or lowered to respectively decrease or increase the blade exposure by moving the adjustment actuating arm 122 laterally to rotate the actuating member 20, worm gear 126 geared with gear rack 142 to axially shift the adjustment receiver 24 and impart a similar shift to the adjustable guard 14 through attached arms 90 and 92. Movement of the adjustable guard 14 is guided by teeth 78 meshing with blade platform notches 70, lower projections 99 on adjustable guard plate 76 passing through fixed guard floor slots 98, lower adjustable guard cylinder 88 concentrically moving with respect to spacing cylinder 114, adjustable guard arms 90 and 92 passing through spacer ring slots 113 and 115, and the adjustment receiver ring 138 concentrically moving with respect to platform stem 62. The operator can easily use his or her thumb to make an adjustment while holding the razor in the same hand, guiding on adapter markings 130 to reach the desired blade exposure without having to open the cap assembly. A razor blade is clamped or unclamped by rotating the clamping knob 36 to actuate the cap assembly.

While a particular embodiment of the invention has been shown and described there are modifications thereof which will be apparent to those skilled in the art, and therefore it is not intended that the invention be limited to the disclosed embodiment or to the details thereof, and departures may be made therefrom within the spirit and scope of the invention as defined in the claims.

What is claimed is:
1. A safety razor comprising a tubular handle, blade support means to position a razor blade in shaving position, adjustable guard means positioned below said blade support means, the axial position of said adjustable guard means defining a shaving geometry, fixed guard means lateral to and below said adjustable guard means, said fixed guard means held in fixed relation to said handle, adjustment receiver means housed in said handle, said receiver means rigidly connected to said adjustable guard means, a rotatable actuating member housed in said handle, said actuating member mating with said receiver means to move said receiver means when said actuating member is rotated and thereby adjust the axial position of said adjustable guard means, said tubular handle having a side wall, an opening in said side wall extending around less than the full perimeter of said handle, and a control grip for rotating said actuating member, said control grip extending outwardly from said handle through said opening.
2. The razor of claim 1 including means restricting the free rotation of said actuating member.
3. The razor of claim 2 wherein said rotation restriction means comprises the combination of a resiliently compressible portion mounted to said actuating member and means associated with the handle bearing against and compressing said compressible portion.
4. A safety razor comprising a tubular handle, blade support means to position a razor blade in shaving position, adjustable guard means positioned below said blade support means, the axial position of said adjustable guard means defining a shaving geometry, a rack gear housed in said handle, said rack gear rigidly connected to said adjustable guard means, a worm gear housed in said handle and rotatable about the handle axis, said worm gear mating with said rack gear to move said rack gear when said worm gear is rotated and thereby adjust the axial position of said adjustable guard means, said tubular handle having a side wall, an opening in said side wall extending around less than the full perimeter of said handle, and a control grip for rotating said worm gear, said control grip extending outwardly from said handle through said opening.
5. The razor of claim 4 wherein said worm gear is carried by a hollow cylindrical member, said cylindrical member housed in said handle and mounting said worm gear on the side away from said handle opening, and further mounting said control grip on the side toward said handle opening.
6. A safety razor comprising a tubular handle, blade support means to position a razor blade in shaving position, adjustable guard means positioned below said blade support means, the axial position of said adjustable guard means defining a shaving geometry, a spacing member carried by said handle, said spacing member holding said blade support means above said adjustable guard means to provide a clearance for axial adjustment of said adjustable guard means, said adjustable guard means including an opening for said spacing member, adjustment receiver means housed in said handle, said receiver means rigidly connected to said
7. An adjustable safety razor comprising a tubular handle, blade support means to position a razor blade in shaving position, adjustable guard means positioned below said blade support means, the axial position of said adjustable guard means defining a shaving geometry, means to adjust the axial position of said adjustable guard means, said guide means adapted to prevent said adjustable guard means from rotating, adjustment receiver means housed in said handle, said receiver means rigidly connected to said adjustable guard means, a rotatable actuating member housed in said handle, said actuating member mating with said receiver means to move said receiver means when said actuating member is rotated and thereby adjust the axial position of said adjustable guard means, said tubular handle having a side wall, an opening in said side wall extending around less than the full perimeter of said handle, and a control grip for rotating said actuating member, said control grip extending outwardly from said handle through said opening.

8. An adjustable safety razor comprising a tubular handle, an opening in a side wall of said handle, blade support means carried by said handle to position a razor blade in shaving position, adjustable guard means positioned below said blade support means, the axial position of said adjustable guard means defining a shaving geometry, means to adjust the position of said adjustable guard means and thereby vary the shaving geometry, said adjusting means including an extension projecting into said handle from said adjustable guard means, an adjustment actuating gear housed in said handle, and a control for said actuating gear extending out of said handle opening, said adjustable guard means extension including gear means mating with said adjustment actuating gear to move said adjustable guard means extension and thereby adjust the position of said adjustable guard means when said adjustment actuating gear control is operated, and fixed guard means lateral to and below said adjustable guard means defining a maximum blade exposure, said fixed guard means held in fixed relation to said handle.

9. An adjustable safety razor comprising a tubular handle, blade support means carried by said handle to position a razor blade in shaving position, said blade support means including a blade platform and a cap section cooperating with said blade platform to clamp a razor blade in shaving position, fixed guard means lateral to and below said blade platform defining a maximum blade exposure, axially adjustable guard means between said fixed guard means and said blade platform defining an operating blade exposure by the separation between said adjustable guard means and the blade platform, an axial travel clearance for said adjustable guard means below said blade platform of sufficient magnitude to permit an adjustment of said adjustable guard means corresponding to a desired range of blade exposures, and means housed in said handle to adjust the axial position of said adjustable guard means, said adjustment means including an actuating member rotatable about the handle axis, means holding said actuating member against axial movement, receiver means connected to said adjustable guard member, and a control grip extending outside of said handle to rotate said actuating member, said receiver means engaging with said actuating member to move axially when said actuating member is rotated and thereby adjust the position of said adjustable guard means.

10. The razor of claim 9 further characterized by an opening in a wall of said handle, said actuating control grip extending from said actuating member through said opening, and means bearing against said actuating member to restrict the free rotation thereof.

11. The razor of claim 10 wherein said actuating member includes a resiliently compressible portion rotatable with said actuating member, said portion having upper and lower surfaces and a transverse slot intermediate said surfaces, and wherein said bearing means comprises an adapter fitted into said wall opening, said adapter having upper and lower flanges bearing respectively against said upper and lower compressible portion surfaces to compress said portion and at least partially close said slot.

12. The razor of claim 9 wherein said actuating member comprises worm gear means mounted on a hollow cylindrical member, said cylindrical member rotatable about the handle axis, and said receiver means comprises an axially moveable gear rack mating with said worm gear means at a pitch sufficient to produce an axial adjustment of said adjustable guard means corresponding to said desired range of blade exposures during an actuating member rotation of less than one-half revolution.

13. The razor of claim 12 including a plurality of rigid axially disposed arms connecting said adjustable guard means to said gear rack, and guide means provided in said handle to prevent rotation of said arms.

14. The razor of claim 12 wherein said gear rack includes an inside threaded member, said threaded member curved in an arc centered on the handle axis, and said worm gear means is provided on an exterior portion of said hollow cylindrical member to mate with said inside threaded gear rack member.

15. The razor of claim 14 wherein said worm gear means are provided on one side only of said hollow cylindrical member, and wherein an opening is provided in a side wall of said handle on the other side from said worm gear means, said actuating control grip comprising an arm extending from said hollow cylindrical member through said handle opening whereby said worm gear means may be rotated by moving said arm laterally within said opening.

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