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MOTOR DRIVEN RAZOR

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This invention relates to razors of the so called electric type wherein a manipulating hand grip is adapted to carry a motor, a rotatable cutting element operatively connected to and rotated by the motor and a guard member encircling the cutting elements having an opening or openings for the engagement of the beard or hair and with which the rotatable cutting element co-operates to shave off the beard or hair.

It is an object of the present invention to provide in a razor of this character improved cutting means for shaving off the beard or hair, comprising a revoluble cutter element having a spirally arranged cutter or cutters with the cutting faces disposed in stepped relation, and a tubular guard loosely supported by the cutter element in enclosing relation to the cutting faces of the cutter element and having a series of axially and circularly aligned rows of openings of greater length than width and of less width than the cutting faces of the cutter or cutters and arranged whereby the openings of one row of openings intersect the separating walls of the openings of adjacent rows of openings, and said openings adapted for the engagement of the beard or hair and with which the cutting faces of the cutter or cutters co-operate to shave off the beard or hair.

It is another object of the invention to provide in a razor of this character including a manipulating hand grip of separable like sections arranged to carry an electric motor therein, means to rotatably support the carrier for the cutter element mounted at one end in and projecting from the hand grip with the cutter carrier in operative connection with the drive shaft of the motor and arranged to loosely support the guard in operative relation to the cutter, and the provision of means movably mounted on the hand grip adapted to rotatably support the outer end of the cutter carrier and retain the cutter carrier in operative connection with the motor shaft and the guard in operative relation to the cutter.

Other objects and advantages of the invention will hereinafter appear.

In the drawing accompanying and forming a part of this application, Figure 1 is a side elevation of a razor illustrating an embodiment of the invention with a portion of the manipulating hand grip broken away to show the operative connection of the cutter carrier with the drive shaft of the motor and showing the parts in normal operative position.

Figure 2 is a side elevation of the forward portion of the manipulating hand grip showing the movable means for supporting the outer end of the cutter carrier in another position of said means to permit removing the guard and the cutter with the cutter carrier from the hand grip.

Figure 3 is a longitudinal sectional view taken on the line 3—3 of Figure 1 looking in the direction of the arrows.

Figure 4 is a side elevation, on an enlarged scale, of the cutter and guard and showing the guard in partly disassembled relation to the cutter.

Figure 5 is a side elevation, on an enlarged scale, of a member of the cutter mounted on its carrier and showing the guard in cross section in relation thereto; and

Figure 6 is a diagrammatic view, on an enlarged scale, of a portion of the guard to show the arrangement of the openings of one row of openings therein relative to the adjacent rows of openings and in dot and dash lines the relation of the cutting faces of the cutter to said openings.

The embodiment of the invention illustrated comprises a manipulating hand grip or handle 7 including a pair of separable sections secured together by bolts 8, the sections being hollowed out to provide a chamber between the sections to constitute an enclosing housing for an electric motor the drive shaft 9 of which motor is extended into a bore 10 of larger diameter than the shaft formed by and extending into an end of the handle, and the shaft rotatably supported by a bearing member 11 at the end of said bore. The opposite end of the sections are arranged to provide an opening for the passage of electric current conductors connected to the motor within the handle.

The cutter or cutting implement to shave off the beard or hair comprises a series of like flat members including a perforated circular body 12 having blades 13 extending radially from and equidistantly spaced about the same, and shown as three in number although the body may be provided with a less or greater number of said blades. The peripheral edges of the blades are in the arc of a circle having the same radius and the radial edges of the blades are preferably of concave form at the juncture thereof with the peripheral edges, as shown in Figure 5, whereby the peripheral edges with said radial faces form thin and keen cutting edges of wedge shape

at the opposite ends of the peripheral edges, as at 14.

The cutter members 12 are mounted in contiguous sidewise assembled relation upon a carrier therefor comprising a shaft 15 having two diameters and the cutter members 12 mounted on the portion of larger diameter with the end cutter member abutting an annular flange 16 at the end of the shaft. The cutter members 12 are assembled on the shaft with the radial edges and cutting edges of the successive blades 13 offset circumferentially about the cutter relative to the cutting edges of preceding blades with the adjacent ends of the cutting faces of successive cutter members extending in the same plane circumferentially of the cutter and thus arranging the radial and cutting faces of the blades in spiral stepped formation longitudinally of the shaft, as clearly shown at 17 in Figures 4 and 5. To facilitate mounting and assembling the cutter members 12 on the shaft the shaft may be provided with a longitudinal spiral recess or keyway corresponding to the desired offsetting or stepping of the radial and cutting faces of the cutter members, and the body 12 of the cutter members provided with an integral key or tooth projecting radially inwardly from the wall of the perforation or opening in the body 12 to slidably engage in the recess or keyway in the shaft, as shown at 15' in Figure 5. As shown, the cutter members are clamped in assembled position on the shaft 15 between the flange 16 at the end of the shaft and a washer 18 loosely engaged on the shaft at the end of the cutter members opposite the shaft flange 16 by the end of a hollow shaft 19 abutting the washer 18, the bore of the hollow shaft having two diameters corresponding to the two diameters of the shaft 15 and the portion of the shaft of larger diameter having screw threaded connection with the portion of larger diameter of the shaft 15 at the juncture of said portion with the portion of smaller diameter, as shown at 20 in Figure 3. The portion of smaller diameter of the hollow shaft 19 is of greater length than the corresponding portion of and projects beyond the shaft 15 and is provided with diametrically opposite slots in the end adapted for engagement of the ends of a pin extending transversely through the motor shaft 9, as shown at 21 in Figures 1 and 3. To rotatably support the shafts 15, 19 with one end engaging in an opening in one end of the handle and the hollow shaft 19 in operative connection with the motor shaft 9 there is provided a sleeve 22 of a length slightly less than the length of the hollow shaft 19 and in which sleeve said shaft 19 is rotatably supported at the end at which it is connected to the motor shaft and supported at the opposite end upon a collar 23 interposed between the shaft 19 and the sleeve, the collar having a laterally extending annular flange engaging between the end of the sleeve and the washer 18. The collar 23 is yieldingly urged outwardly from the sleeve by a spring 24 coiled about the shaft 19 and interposed between the collar and an internal shoulder on the sleeve.

A tubular or cylindrical member 25 having openings or perforations in the wall thereof and having an internal diameter slightly larger than the circle circumscribed by the arcuate peripheral edges of the blades 13 of the cutter members 12 is loosely engaged at the ends upon the shaft flange 16 and the washer 18 which are of slightly less diameter than the circle circum-

scribed by the blades 13 of the cutter members, and said cylinder serving as a shear element and guard for the cutter and the cutter adapted to be rotated as it is engaged with and moved relative to the skin to be shaved and cause hair to engage in the openings therein by the rotation thereof co-operating with edges of the openings in said cylinder to sever hair engaging in the openings of the shear element. The openings in the cylindrical member are of oblong form and of greater length than the thickness of the cutter members 12 and of a width less than the extent of the arcuate peripheral edges of said cutter members, as shown in Figure 5. These openings are arranged in rows 26 extending longitudinally and circularly about the cylinder with alternate rows of openings, as 26', arranged so that the openings of one row will intersect the end separating walls of openings of adjacent rows, as clearly shown in Figure 6. The cylindrical member 25 is mounted on the shaft flange 16 and washer 18 so that the openings of rows 26 will be in alignment with the cutter members 12, shown diagrammatically in dot and dash lines relative to the openings in Figure 6, with the opposite ends of the cutter members extending beyond the opposite ends of said openings, and the openings of rows 26' intersecting the contiguous cutter members.

To rotatably support the outer end of the carrier or shaft 15 for the cutter members 12 and retain the cutter member in operative connection with the motor shaft and the guard 25 assembled on the cutter with the inner end abutting the flange of collar 23 the members of the handle are provided with portions 7' to extend parallelly of the cutter carrier with the opposed faces of said portions undercut and a lateral projecting portion at the ends arranged to engage an external annular enlargement of the sleeve 22, as at 22', when the sleeve is engaged in the end of the handle and thus serve as a support therefor and for the cutter carrier intermediate the ends thereof. The support for the end of the shaft 15 comprises an arm 27 having a portion conforming in shape to the extensions 7' of the sections of the handle and of a thickness substantially equal to the space between and formed by the undercut opposed faces of said extensions, the arm being arranged with spaced cam openings 28 engaged by pins 29 fixed at the ends in the handle extensions 7' and extending transversely of the space between said extensions. The free end of the arm 27 is extended laterally substantially at a right angle to the body of the arm, as at 30, and has fixed therein a pivot pin 31 extending substantially at a right angle to said arm extension 30 adapted to engage in a tubular bearing member 32 mounted in a socket at the end of the shaft 15 with an annular flange of said bearing member engaging the end of the shaft, as shown in Figure 3. The arm extension 30 within the pivot pin 31 is arranged to engage the end of the cylindrical guard 25 when the arm is in shaft supporting position, as shown in Figure 1, and retain said guard in position relative to the cutter between the extension 30 of arm 27 and the flange of the collar 23, the pins 29 in said position of the parts engaging at the forward end of the cam slots 28 in the arm and retained in said position by a pin 33 removably engaging in an opening 34 in the arm and openings 35 in the extensions 7' of the handle in register therewith in said position of the parts. In the

shaft supporting position of the arm 27 the edge of the portion at which it is connected to the extensions 7' of the handle members is arranged to engage the sleeve 22 to serve as a supporting brace for the sleeve 22 and thereby for the cutter carrier rotatably supported by the sleeve.

By the arrangement of the cam slots 28 in the arm 27 and the pins 29 engaging therein by the removal of the pin 33 from the registering openings 34, 35 the arm 27 is adapted to have longitudinal movement imparted thereto parallelly of the axis of the cutter carrier to disengage the pivot pin 31 from the bearing 32 and then have movement laterally away from the cutter carrier to the position shown in Figure 2 to permit the guard 25 to be removed from the cutter and the cutter carrying shaft to be disengaged from the motor shaft and removed with the sleeve from the manipulating handle. It will be obvious that after the parts have again been assembled that the arm 27 may be moved laterally toward the cutter carrier and then longitudinally to engage the pin 31 in the bearing member 32 in the end of shaft 15 and retained in said position by engaging the pin 33 in the openings 34, 35 which are in register in said position of the arm. To reduce friction between the shaft 19 and the sleeve 22 said shaft intermediate the ends is reduced in diameter whereby the shaft only has a bearing support at the opposite ends. However, to provide a lubricant carrying chamber between said shaft 19 and the sleeve the shaft may be reduced intermediate the ends to a greater extent, as at 37 in Figure 3, in which a lubricant, such as grease, may be packed.

By the arrangement of the cutting faces 14 at the opposite ends of the peripheral edges of the blades of the cutter members 12 the cutter is operative to shave off the beard or hair in either direction of rotation of the cutter. To permit of rotation of the cutter in either direction there is provided a motor of a type that will rotate in either direction when connected with a source of electric energy, and to effect rotation of the motor there is provided a peripherally knurled wheel 36 which is fixed on the motor shaft 9 with peripheral portions of said wheel projecting through openings in both of the sections of the handle 7. By engaging the thumb with the knurled edge of the wheel rotative movement may be imparted to the wheel in either direction and thereby to the motor shaft. By the provision of the spring 24 the flange of the collar 23 is urged into engagement with the end of the guard 25 and thereby the guard is urged to engage the opposite end with the laterally extended end of the arm 27 and thereby the guard 25 yieldingly held against rotation with the cutter. However, as the guard is pressed against and moved along the face rotative movement is imparted to the guard causing the hair to engage the openings therein, and as the wall of the guard for its entire length caused to engage the peripheral surface of the blades 13 of the cutter members 12 and the cutting faces 14 of the blades co-operate with the walls of the openings to shear the hair engaging in the openings. To hold the sleeve 22 against rotation with the shaft 19 it is provided with a projection adapted to engage in a longitudinal recess in the handle, as shown at 38 in Figure 1.

It will be obvious that various modifications may be made in the construction and arrangement of the parts without departing from the scope of the invention, and that portions of the

invention may be used without others and come within the scope of the invention.

Having described my invention, I claim:

1. In a motor operated razor, a rotatable hollow shaft arranged at one end for operative connection with the drive shaft of the motor, a shaft secured in and projecting from the opposite end of the hollow shaft, and a cutter element including a series of like flat members, each cutter member comprising a circular body having blades extending radially from, in the plane of and spaced about the body and arranged with arcuate peripheral edges having the same radius and at the juncture thereof with the radial edges of the blades forming peripheral cutting faces, and said cutter members mounted and secured on the end of the second shaft projecting from the hollow shaft with the body and blades in contiguous sidewise relation and the cutting faces of the blades arranged to extend parallelly of the axis of the cutter element in stepped spiral relation longitudinally of said shaft.

2. In a motor operated razor, a handle adapted to carry a motor therein, a shaft having an annular flange at one end, a cutter comprising a series of flat members arranged with radially spaced blades the peripheral edges of which blades are in arcs of a circle having the same radius and in conjunction with the radial faces of the blades forming cutting edges at the ends of the arcuate edges, and said members mounted in contiguous sidewise relation on said shaft with the end member abutting the shaft flange and the cutting faces of the blades arranged in stepped relation, a washer loose on the shaft at the end of the cutter members opposite the shaft flange, said washer and the shaft flange being of a diameter slightly greater than the diameter of the circle circumscribed by the arcuate edges of the blades, a hollow shaft engaged upon and having an adjustable connection with the first shaft and the end thereof in abutting relation to the washer and retaining the cutter members assembled in contiguous relation and the opposite end arranged for operative connection with the drive shaft of the motor, and a cylindrical shear member having openings in the peripheral wall disposed about the assembled cutter members and loosely supported at the ends upon the shaft flange and washer to serve as a guard and co-operate with the cutter to shave off the beard or hair.

3. In a motor operated razor as claimed in claim 2, a sleeve supported at one end in and projecting from the handle rotatably supporting the hollow shaft therein.

4. In a motor operated razor as claimed in claim 2, a member carried by the handle to have adjustment longitudinally and laterally of the cutter carrying shaft and adapted in one position of adjustment to extend from the handle parallel to the cutter carrying shaft and rotatably support the outer end of and retain the cutter carrying shaft in operative connection with the motor shaft and the cylindrical shear member in operative relation to the cutter and in another position of adjustment release and permit removal of the cutter carrying shaft and shear member from the handle.

5. In a motor operated razor as claimed in claim 2, a sleeve supported at one end in and projecting from the handle rotatably supporting the hollow shaft therein, a flanged collar slidably mounted on the hollow shaft with the flange thereof disposed between the end of the sleeve

and washer and urged in a direction toward the washer, and an arm having one end flanged laterally and mounted at the opposite end upon the handle to have adjustment longitudinally and laterally of the cutter carrying shaft, said arm in one position of adjustment adapted to extend parallelly of the cutter carrying shaft and the flanged end rotatably support and retain said shaft in operative connection with the motor shaft and in connection with the collar flange retain the cylindrical shear member in operative relation to the cutter, and in another position of adjustment release and permit the removal of the cutter carrying shaft and shear member from the handle.

6. In a motor operated razor, a revoluble cutting implement comprising a series of cutter members each having a series of peripheral cutting faces and said cutter members disposed in sidewise relation with the cutting faces of the cutter members offset equal distances circumferentially relative to the cutting faces of preceding cutter members and arranging the cutting faces in stepped spiral form, and a tubular shearing member encircling and loosely supported at the ends of the cutting implement, said shearing member having rows of oblong openings extending longitudinally of the shearing member and of less length than the width of the stepped cutting faces and the openings of alternate rows of openings intersecting the separating end walls of the openings of the rows and adjacent stepped cutting faces of adjacent cutter members, said shear member being adapted to be engaged with and moved relative to the skin to be shaved and thereby cause hair to engage in the openings and engaged with and rotated relative to the cutting faces of the cutter members and said cutting faces by the rotation of the cutting implement co-operating with the edges of the openings to shear said hair.

7. In a motor operated razor, a revoluble cutter element including a plurality of like flat cutter members, each cutter member comprising an axially perforated circular body having spaced radial blades extending in the plane of the body and arranged with arcuate peripheral edges having the same radius and forming cutting faces at the juncture thereof with the radial edges of the blades, and a carrier on which said cutter members are secured in contiguous sidewise relation with the blades and cutting faces of successive cutter members offset circumferentially of the cutter element relative to the cutter members and cutting faces of preceding blades and the cutting faces in continuous stepped spiral form longitudinally of the cutter element.

8. In a motor operated razor as claimed in claim 1, a perforated tubular shear member encircling the element and loosely supported at the ends on the second shaft, the internal diameter of said tubular member being slightly larger than the diameter of the circle circumscribed by the peripheral edges of the blades of the cutter members, and said shear member adapted to be rotated relative to the element by the engagement and movement thereof relative to the skin to be shaved and thereby cause hair to engage in the perforations therein and contact the arcuate edges of the blades, and the cutting faces of the blades by the rotation of the cutter element co-operating with the edges of the perforations in said shear member to sever hair engaged in the perforations therein.

9. In an electric razor, a manipulating handle

carrying an electric motor, a cutter element comprising a series of flat members having radial blades the peripheral and radial edges of which blades are arranged to form cutting faces at the ends of the peripheral edges, a rotatable carrier on which said cutter members are mounted in contiguous sidewise relation with the cutting edges of the blades of the successive cutter members disposed in spiral stepped relation, a cylindrical shear element having rows of rectangular openings extending parallelly of the axis of the shear element with the openings of alternate rows intersecting the separating walls of the openings of adjacent rows, and said shear element loosely supported by the carrier in encircling relation to the cutter element to serve as a guard and adapted when engaged and moved relative to the skin to be shaved to cause hair to engage in the openings therein and be rotated relative to the cutter blades, and the cutting faces of the cutter blades co-operating with the openings to sever said hair, and means adjustably mounted on the handle and arranged to rotatably and removably support the cutter carrier at the opposite ends from the handle in operative connection with the drive shaft of the motor and retain the shear element in operative relation to the cutter element.

10. In a motor operated razor, a manipulating hand grip including separable like sections arranged to carry a motor therein, a shaft adapted to be operatively connected to and rotated by the motor shaft rotatably carried at one end by and projecting from the hand grip, a cutting implement comprising a series of like flat cutter members each including a body with blades projecting radially from and spaced about the body, the blades extending in the plane of the body and arranged with arcuate peripheral edges having the same radius, and said peripheral edges at the juncture thereof with the radial edges of the blades forming cutting faces at the opposite ends of the peripheral edges of the blades, and said cutter members mounted in contiguous sidewise relation on the shaft with the cutting faces of the blades of successive cutter members offset in the same direction circumferentially of the cutting implement relative to the cutting faces of preceding cutter members and arranging the cutting faces in spiral stepped form longitudinally of the shaft, and a tubular shear member having openings in the peripheral wall encircling said cutter blades and loosely supported at the ends of the cutting implement on the shafts, and said shear member adapted to be engaged with and rotated relative to the peripheral edges of the blades of the cutter members and cause hair to engage in the openings therein and be severed by the cutting faces of the cutter blades co-operating with an edge of the openings in the shear member by the rotation of the cutting element by pressing said shear member against and moving it relative to the skin to be shaved.

11. In a motor operated razor, a revoluble cutting implement comprising a series of flat cutter members each having a series of peripheral cutting faces, and said cutter members disposed in juxtaposed sidewise relation with the cutting faces of successive cutter members offset circumferentially relative to the cutting faces of preceding cutter members and arranging the cutting faces in stepped spiral form longitudinally of the cutting implement.