Jan. 6, 1942. G. R. ERICSON ET AL 2,269,358

MOTOR DRIVEN RAZOR

Filed July 16, 1938

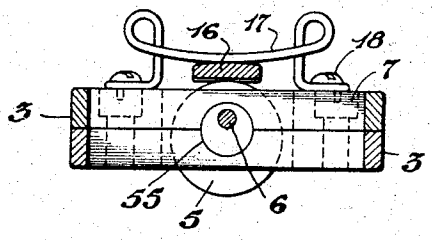



Fig. 5.

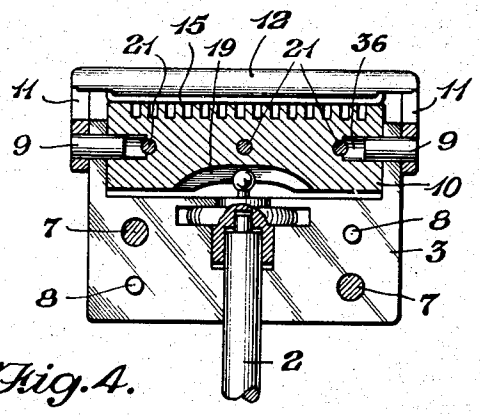



Fig. 4.

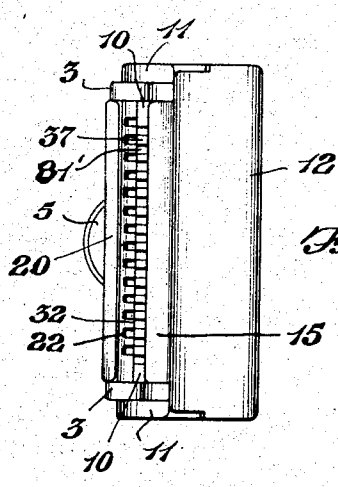



Fig. 3.

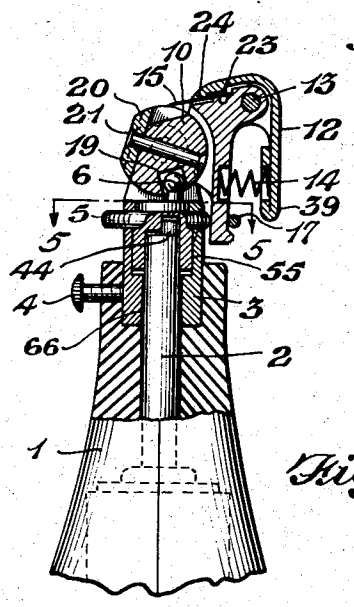



Fig. 2.

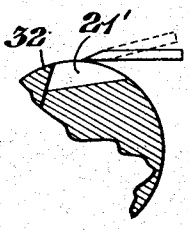



Fig. 6.

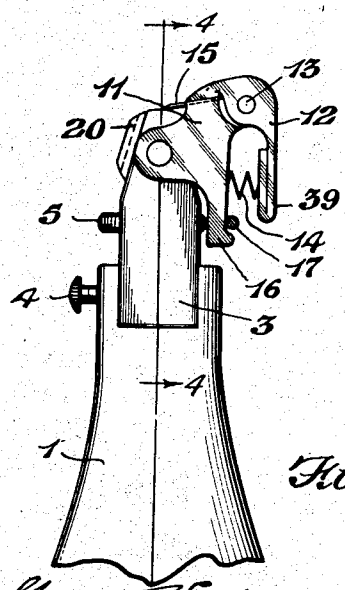



Fig. 1.

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2,269,358

## MOTOR DRIVEN RAZOR

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Application July 16, 1938, Serial No. 219,634

12 Claims. (Cl. 30—43)

This invention relates to motor driven razors and particularly to means for controlling the movements of the cutter bar or blade or both. In the construction of the razor according to my invention I use a rotating or oscillating cutter bar having a surface which is partly cylindrical and in this cylindrical surface I form a multiplicity of recesses which terminate in the cylindrical portion of the surface, the ends of the recesses being preferably formed at an acute angle so as to form something approaching a cutting edge which not only assists in the cutting action but tends to provide a clearance for dirt, grease and whiskers during the operation. These recesses are separated by thin walls which serve as a support for the blade so that its edge may have a constantly dragging action against the cylindrical surface of the cutter bar and so that the cutting edge on the blade meets the cutting edge on the cutter bar in perfect shearing action.

The blade is preferably of special construction and may be formed of a strip of hard razor steel 10 to 20 thousandths of an inch in thickness and from $\frac{3}{16}$ to $\frac{1}{16}$ of an inch in width. The length is comparatively unimportant but 1 inch to 1½ inches has been found to be convenient. The blade is preferably sharpened from one side only in order to give maximum clearance to enable the cutting edge to be brought close to the skin without pressure. The beveled side of the blade is for this reason placed outwardly, while the unbeveled side rests against the cutter bar. The razor is held in a holder which is held concentrically with the cutter bar so as to permit it to oscillate; the cutter bar is also constructed and arranged to oscillate about the same axis. The cutter bar and blade holder are mounted on a frame or handle which contains a motor of conventional construction. The motor is connected to oscillate the cutter bar and blade simultaneously, although the movement of the cutter bar is preferably greater than that of the blade. The actual degree of movement of the blade back and forth is in the order of $\frac{1}{32}$ of an inch, although the movement is small as $\frac{1}{100}$ of an inch will give satisfactory results. The greater movements may be used if desired. The cutter bar is preferably in the order of $\frac{1}{16}$ to $\frac{1}{8}$ of an inch, although some variation is permissible.

The purpose of the double oscillating arrangement may be briefly described as follows:

Assume that the razor is being drawn across the face in a forward direction, that is with the sharp edge of the blade pointed in the same direction as the razor is moving, and assume that the cutter bar only is oscillating and that the whiskers are prominently $\frac{1}{32}$ of an inch long when the edge of the blade approaches to within less than $\frac{1}{32}$ of an inch of the base of the whisker, say for instance within $\frac{20}{1000}$, the oscillating cutter bends the whisker up against the edge of the blade and cuts off the top leaving it $\frac{20}{1000}$ of an inch long, the cutter bar passing over the edge of the blade also tucks the end of the whisker under the blade, and the blade then slides over it leaving no opportunity to have the rest of the whisker to be cut off, thus the razor has to be passed over the face several times in order to get the whiskers down to the proper length.

If the razor is drawn across the face in the opposite direction the whiskers are bent over in the direction that the razor is moving and only get a chance to spring up and be cut off after the edge of the blade has passed over the end of the whisker, which means that the edge of the blade must be nearly the complete length of the whisker away from that point where it joins the skin, that is to say the base of the whisker. Obviously in such case the amount of whisker which is to be cut off at each passage of the blade over the skin depends on the flexibility of the skin and the amount of shifting which can be done by the cutter bar.

From the above description it will be seen that there is a substantial difficulty with razors of this type in which already one cutter bar and blade members are oscillated, and it will also be understood that this difficulty would exist regardless of which of these members is oscillated. By withdrawing the blade slightly as the oscillating cutter bar is also withdrawn in the opposite direction the whisker becomes unhooked and has an opportunity to spring up from under the edge of the blade and to extend into the notch of the cutter bar so that as the blade and cutter bar simultaneously return to the cutting position the whisker is in position to be cut off again, and this operation may be repeated several times while passing over a single whisker due to the high speed at which the blade and cutter bar are oscillated.

In order to further reduce the number of times the razor must be passed over the face, I form the cutter bar in two parts each part carrying a set of slots equally spaced, but staggered with relation to each other so that the guards or partitions on one of the members are the cutting edges for the slots, in the other mem-

ber this gives substantially full coverage of the face as the razor passes over it.

By the above arrangement which provides for two lines of cutting edges at the termination of the recesses of 81 and 22 it will be noted that the cutting takes place at two definite points in the oscillation of the cutter bar and blade holder. This arrangement gives the operator a better chance to get a close shave by passing the razor several times over the face, as there is more freedom of variation in the angle at which he may hold the razor with respect to the skin.

Another feature of this razor is that the surfaces of the cutter bar and blade which are straight and unbroken when the slots are covered provide a surface which may be pressed up firmly against the face and since the blade is tangent to the cylindrical surface of the cutter bar, the outside angle of junction, that is to say, the angle at which the skin must bend in order to lie closely against the junction of the surfaces, is only reduced from 180 degrees by the angle at which the cutting edge of the blade is formed. This edge should never be more than 30 degrees and may be as thin as 5 or 10 degrees if the blade is made of steel of sufficient quality. An angle of approximately 10 degrees is preferred. For that reason the outside angle of junction is somewhere in the order of 170 degrees and not more than 150 degrees at the most. This greatly assists in bringing the line of junction of the cutting members close to the root of the hair.

The object of the invention is to produce a generally new and improved razor of the type above indicated and the invention will be better understood from the following description and accompanying drawing referring to which:

Fig. 1 shows a side elevation of a razor built according to my invention together with a part of the handle.

Fig. 2 is a sectional elevation somewhat similar to Fig. 1, except that parts are shown in section and others broken away.

Fig. 3 is a plan view of the device shown in Figs. 1 and 2.

Fig. 4 is a sectional elevation of parts of the razor taken along the lines B—B of Fig. 1 looking in the direction of the arrows.

Fig. 5 is a sectional elevation of parts of the razor taken along the lines A—A of Fig. 2 looking in the direction of the arrows.

Fig. 6 is a diagram showing the formation of the edge of the blade and the relation of the blade to the cutter bar.

In constructing the razor any suitable form of motor may be used and may be conveniently carried in the handle. If an electrical motor is used it may be connected to ordinary house current by means of a cord, plug and socket in the usual manner of connecting electrical appliances. As the specific construction of the motor and the source of power supply are well known in the art and have no particular importance in connection of the present invention they are not shown.

The numeral 1 indicates a handle containing any suitable type of motor for driving the shaft 2, the motor is indicated in dotted lines in Fig. 2 and the operating speed is preferably in the order of 3 to 5 thousand R. P. M.

The handle which is preferably made of fiber, Bakelite, hard rubber or some other heat insulating compound, is provided with a transverse slot at one end in which is mounted the frame 3 of the razor head, this frame being detachably held in place by the thumb screw 4. The end of the shaft 2 is provided with an eccentric projection 44 which engages a corresponding eccentric recess in the cam member 5 which is also provided with another bore of different eccentricity which is fitted over the end of the shaft 2. The cam member 5 is journaled at 55 in the frame 3 and thus forms a bearing or support for the end of the shaft 2 which is loosely fitted in the bore 66 which extends through the member 3.

The upper side of the cam member 5 is provided with an eccentric projection terminating in a ball 6. The eccentricity of this ball is in the order of $\frac{1}{32}$ of an inch or slightly more whereas the eccentricity of the cam 5 is in the order of $\frac{1}{64}$ of an inch so that the total throw or oscillation of the cutter bar 10 will be slightly more than $\frac{1}{16}$ of an inch and the oscillation of the edge of the blade will be less than half as much. The cams 5 and 6 are oppositely arranged so as to properly time movements of the parts which they control. This arrangement also assists in counter-balancing the arrangement for smooth operation.

The frame 3 is made up in two halves as indicated in Fig. 5 and these halves are fitted together and securely located with respect to each other by means of dowels 8 and screws 7, the heads of the screws being counter-sunk as indicated by the dotted lines of Fig. 5 so as not to interfere with the frame.

The frame is provided with a pair of stub shafts or pins 9 upon which the cutter bar 10 and the blade holder 11 are mounted. Any suitable means may be provided for retaining the stub shafts 9 in position, but I prefer to use stub shafts sufficiently large so that they will be held in position by the clamping action of the two halves of the frame 3 when bolted together by the bolts or screws 7. The blade holder 11 is provided with a cap 12 hingedly mounted thereon by means of the pins or rod 13. The blade holder is provided with a shelf 23 having surfaces to support the rear part of the lower side and also the rear edge of the blade. The cap 12 is provided with a blade contacting portion as indicated at 24 which rests against the middle portion of the blade 15, the front or cutting edge of which rests on the cutter bar and the rear edge or surface which rests on the blade holder at 23. One or more compression springs 14, of sufficient strength to hold the blade firmly in position without pressing it forcibly enough to cause excessive wear, are mounted between the lower edge of the cap and the blade holder and the projection 16 on the blade holder. The blade holder 11 is normally biased in clockwise direction with respect to Figs. 1 and 2, and the projection 16 firmly held against the surface of the cam 5, by means of the spring 17 which is attached to the frame by means of the screws 18. The spring 17 may, if desired, take forms other than that shown as it will be understood that its function is merely to hold the projection 16 against the surface of the cam 5.

The cutter bar is formed in two separate portions 10 and 20 which are held together by rivets 21. The member 10 is provided with a flat surface for contact with the member 20 and these surfaces are preferably ground after hardening so as to secure a perfect fit. The member 10 is also provided with a multiplicity of parallel slots 31 separated by partitions 37. The member 20

is also provided with a number of transverse hair receiving recesses or slots 22 separated by partitions 32. By this arrangement it will be seen that the end of the partitions 32 which are formed at an acute angle, as indicated Figs. 2 and 6, serve as shearing edges at the ends of the slots 21 while the bottoms of the slots 22 being formed at a slightly more acute angle also serve as shearing edges at the ends of the hair receiving recesses 22.

The cutter bar 10 is provided with a longitudinal slot 19 to receive the cam 6 so that the rotation of the cam causes oscillation of the cutter bar on the pins 9.

The blade may be formed with a smooth cutting edge ground at an angle of approximately 15 degrees, although some variation of this angle is permissible. It may in some instances be desirable to form the blade with an outer rough ground surface to facilitate the shearing function. The lower surface of the blade is tangent to the cylindrical surface of the cutter bar. The grinding is done on the outside of the blade only. By so grinding the blade, the skin clearance is increased from that indicated by the dotted lines in Fig. 6 to that shown in solid lines. The sharpened edge is held lightly but firmly against the cylindrical surface by means of the spring 14, the positioning of the blade being such that the lower surface forms a right angle with a radius drawn to the point where the edge of the blade contacts the cutter bar. This is for the purpose of securing minimum frictional area with maximum clearance space for the cutting edge to contact the skin.

In forming the cutter bar the best procedure is to rough machine the members 10 and 20 to harden these members, then to surface grind the contacting surfaces, next to rivet the members together by means of the rivets 21 and finally to cylinder grind (lapping if necessary) the assembled cutter bar. If the inside of the holes 36 which receive the stub shafts 9 are found to be roughened during the hardening process, these holes should be lapped before the cylinder grinding is done.

The diameter of the cutter bar should be kept as small as consistent with convenience in machining, a diameter of $\frac{1}{4}$ to $\frac{3}{8}$ of an inch is quite satisfactory, the other parts, of course being made in proportion.

In operation the cams 5 and 6 are rotated by the motor shaft 2 and speed of 3 to 5 thousand R. P. M. imparting oscillations at a corresponding rate to the blade holder and to the cutter bar. The degree of oscillation of the cutter bar, however, is at least two to three times as great as the degree of oscillation of the blade. The razor is operated to shave in the ordinary manner except that a backward stroke of the blade with respect to the skin has been found to give a quicker shave in some instances. The blades may be conveniently changed from time to time merely by pressing on the extension 39, the lower side of the cap 12 thereby compressing the springs 14 and releasing the blade. The cutter bar may be cleaned with an ordinary brush and completely removed from the motor and handle by means of thumb screw 4, if desired.

We claim:

1. In a dry shaver, a pivoted cutter bar having a plurality of hair receiving recesses therein, each of said recesses having sides formed at an acute angle defining an interrupted rectilinear cutting edge extending from end to end of said bar, a blade having a cutting edge traversing said recesses and cooperating with said sides to provide a shearing action, and means for moving both said cutter bar and said blade, to effect a shearing action.

2. In a dry shaver, a cutter bar having a plurality of hair receiving recesses formed therein, each of said recesses having a shearing edge at one side thereof and said shearing edges being in alignment and extending from end to end of said cutter bar, a blade resting on the surface of said bar and passing over said recesses, and shearing edges and motor driven means for imparting an oscillating motion to both said blade and said cutter bar.

3. In a dry shaver, a cutter bar formed of two members, recesses in both of said members having sides forming shearing faces, said recesses being staggered with relation to each other, and a cutting blade traversing said recesses and cooperating with said shearing faces.

4. In a dry shaver, a recessed rapidly oscillatable cutter bar including a plurality of shearing faces, a relatively slowly shiftable blade holder, a blade having its cutting edge resting on said cutter bar and its rear edge supported by said blade holder, and a cap for said blade holder, said cap having means for contacting said blade at a point between the portions which are supported by the cutter bar and the blade holder.

5. A cutter bar for dry shavers comprising a pair of members secured in fixed relation and contacting each other along a finished surface, at least one of said members being recessed, the finished surface on the other member forming a wall for said recesses.

6. In a dry shaver, a cutter bar formed of two members, one of said members being recessed and the other forming shearing walls at the ends of said recesses, a blade member, and means for moving the shearing walls with respect to said blade to provide a shearing operation.

7. In a dry shaver, a frame, a cutter bar pivotally mounted in said frame, a blade holder concentrically pivotally mounted on an axis coincident with the pivotal axis of the cutter bar, a power driven rotary shaft supported in said frame, and drive means between said shaft and said cutter bar and blade holder whereby the latter is caused to be oscillated by an amplitude less than the amplitude of oscillation of said cutter bar.

8. In a dry shaver, an oscillating cutter bar, a blade holder, said blade holder comprising a shelf for the support of one edge of a blade, and the cutter bar comprising a support to the other edge, a cap for said blade holder, said cap having means for contacting the central portion of the blade and holding in contact with said cutter bar and said blade holder, displaceable spring means for holding said cap in position, said cap being displaceable to release the pressure of the blade against the cutter bar and permitting ready removal thereof from the razor.

9. In a dry shaver, a pivoted cutter bar having a plurality of hair receiving recesses therein, each of said recesses having sides formed at an acute angle, a blade having a cutting edge traversing said recesses and cooperating with said sides to provide a shearing action, a pivoted blade holder for said blade, and means for moving said cutter bar and said blade holder on their pivots whereby said shearing action is effected, said means including a drive shaft, an eccentric projection at the end of said drive shaft for actu-

ating said cutter bar, and a cam on said drive shaft for actuating said blade holder.

10. In a dry shaver, a frame, a cutter bar pivotally mounted in said frame, a pivoted blade holder carried by said frame, a blade carrier in said blade holder, yieldable means for holding said blade in contact with said cutter bar, and means for oscillating said cutter bar and blade holder including a power driven element and cams on said power driven element, said cams being so constructed and arranged as to oscillate said cutter bar and blade holder simultaneously in opposite directions, whereby the action of the parts will be counterbalanced.

11. In a dry shaver, a pivotally mounted oscillating cutter bar formed of two members, one of said members being recessed and the other forming shearing walls at the end of said recesses, a blade cooperating with said walls to effect a shearing operation, said blade having a continuous rectilinear cutting edge extending from end to end of said bar, an oscillating holder for said blade mounted on pivots coincident with the pivotal axis of said bar, and means for oscillating said bar and blade holder.

12. In a dry shaver, a pivotally mounted oscillating cutter bar formed of two members, one of said members being recessed and the other forming shearing walls at the end of said recesses, a blade cooperating with said walls to effect a shearing operation, said blade having a continuous rectilinear cutting edge extending from end to end of said bar, an oscillating holder for said blade mounted on pivots coincident with the pivotal axis of said bar, and means for oscillating said bar and blade holder including a rotating shaft, and oppositely arranged cams.

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