Feb. 26, 1946. T. J. MURPHY 2,395,495

DRY SHAVER

Filed July 5, 1943

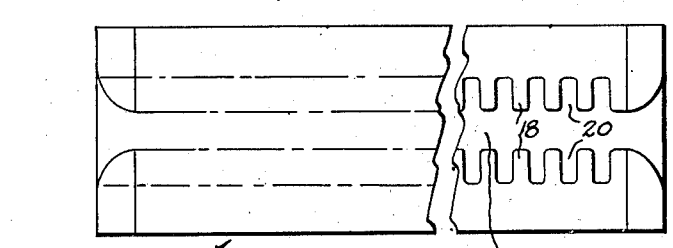


Fig. 2.

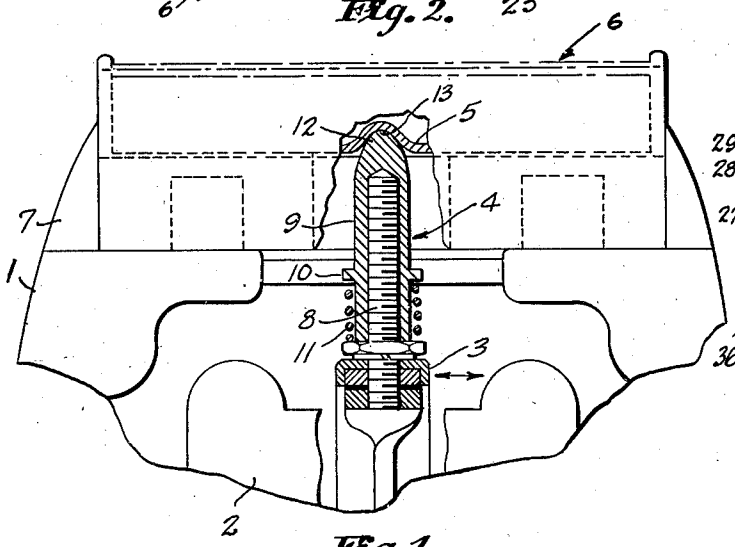


Fig. 1.

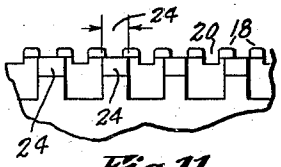


Fig. 11.

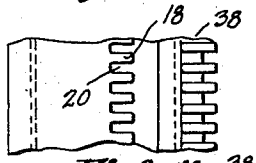


Fig. 8.

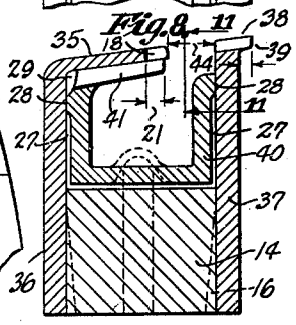


Fig. 7.

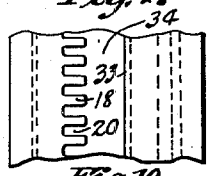


Fig. 10.

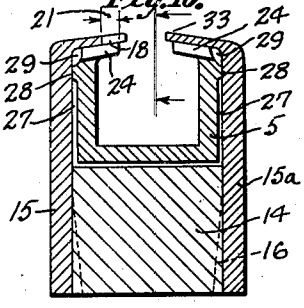


Fig. 9.

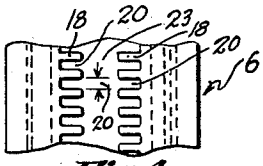


Fig. 4.

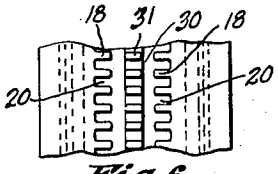


Fig. 6.

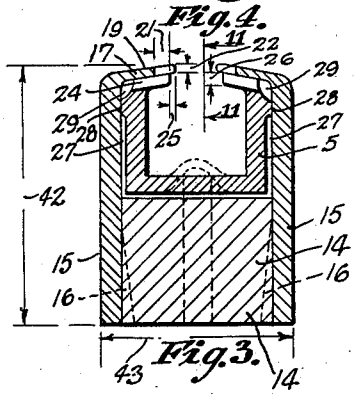


Fig. 3.

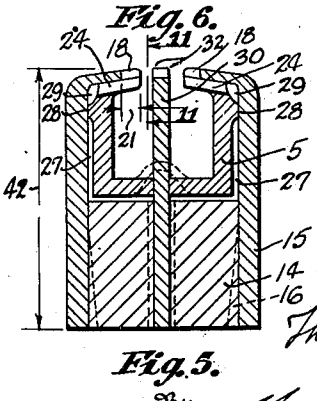


Fig. 5.

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UNITED STATES PATENT OFFICE

2,395,495

DRY SHAVER

Thomas J. Murphy, Stamford, Conn.

Application July 5, 1943, Serial No. 493,543

8 Claims. (Cl. 30—43)

This invention relates to dry shaving devices of the type including one or more rows of cooperating shearing teeth constructed and mounted in a head comprising a row of guard teeth movable over the surface of the skin and an inner movable cutter cooperating with the guard teeth to perform the cutting operation, the movable teeth being driven by an electric motor mounted in a casing forming the operating handle and on which the cutter head is mounted.

It is an object of the invention to provide an improved construction and arrangement of the teeth whereby extremely strong rigid guard or outer cutter teeth may be secured with a minimum thickness whereby the device will operate more effectively and efficiently in rapidly cutting the hairs close to the skin surface without injuring or irritating the skin, or causing other discomfort.

Most dry shaving devices of this general character include outer guard members or outer shear members which are provided with transverse hair passages through which the hairs must pass to the shaving position as the implement is passed over the skin surface. These teeth have been made relatively long in order to secure sufficient cutting edge and to insure that the hairs are brought to a cutting edge as the implement moves over the face, and to prevent the hairs moving past or beyond and off the cutting edges as the implement is moved over the surface during the long dwell at the opposite ends of or reversal of the reciprocating movement of the reciprocating cutter, which is involved in the operation by the motors commonly employed, before the movable cutter has a chance to grip or shear them. However, in order to secure a close shave it is necessary that the teeth be very thin, but when the thickness of such long teeth is reduced they are necessarily rendered less rigid and are therefore apt to yield under pressure against the skin to press too tightly against the movable cutter, and are also apt to yield in the shearing operation so that the cutting edges of the stationary and movable teeth may separate slightly, interfering with the proper shearing operation and giving very unsatisfactory shaving as well as causing pull on the hairs and severe irritation and discomfort. To overcome these objections a compromise had to be reached by making the teeth thicker so as to give them sufficient rigidity and stiffness to retain their position. This meant that the shearing edges are necessarily moved outward away from the surface of the skin so that it is impossible to secure the desired close shave required to be at all comparable to that possible with the standard straight razor blade.

I have found that if the free length of the teeth, that is the length of the cuting edge of the teeth or hair passage, is approximately that of the diameter of the hair or only slightly greater, the thickness of the guard teeth may be greatly reduced and still retain the required rigidity and stiffness so that the teeth remain in their proper position and are not forced out of this position during the cutting operation. I have also found that if the dwell of the movable cutter at the opposite ends or reversing positions of its stroke is greatly reduced and brought to a minimum, preferably practically zero, the hairs can be effectively cut with these short teeth even with relatively rapid movement of the head over the surface of the skin because the dwell or period of time when the inner cutter is not moving is not sufficient to permit them to pass through the passages without being cut. With this structure and arrangement the passages, or more strictly the shearing zone, will contain only one hair at a time, greatly decreasing the power required for operating the movable cutter and at the same time reducing the resistance which must be overcome by a guard or stationary tooth at any given shearing operation, thus still further reducing the tendency of the shearing operation to force the guard or stationary tooth out of position or reducing the tendency to separate them, and thus reducing the pulling and irritation of the skin. This construction and arrangement also permits the use of much thinner teeth, permitting bringing of the shearing edges closer to the surface of the skin and therefore giving a much closer shave with less irritation. In fact the thickness of the teeth can be of the order of that of the standard straight razor blade.

These and other features and advantages of the invention will be more clearly understood from the following description in connection with the devices illustrated in the accompanying drawing forming a part of this specification. It is, however, to be understood that I am not limited to the specific details shown but may employ various changes and modifications within the scope of the invention.

In this drawing:

Fig. 1 is a side elevation on an enlarged scale of one section of the casing showing a portion of the motor and the cutter head in elevation, but with parts of the driving connection to the movable cutter broken away to more clearly show the construction;

Fig. 2 is a top plan view of one form of the cutter head;

Fig. 3 is a transverse section through the cutter head;

Fig. 4 is a top plan view of a portion thereof;

Fig. 5 is a section similar to Fig. 3 showing a modified arrangement;

Fig. 6 is a top plan view of a portion of the arrangement of Fig. 5;

Fig. 7 is a section similar to Figs. 3 and 5 showing another modification;

Fig. 8 is a top plan view of a portion of the arrangement of Fig. 7;

Fig. 9 is a section showing still another modification;

Fig. 10 is a top plan view of a portion of the arrangement of Fig. 9, and

Fig. 11 is a detail view looking toward the edge of a row of shearing teeth of each of the forms shown, the view being taken as indicated by line 11—11 of Figs. 3, 5, 7 and 9.

The device comprises a casing or housing 1 enclosing an electric operating motor 2. I prefer to use a motor of the type disclosed in my prior patents, No. 2,203,695, June 10, 1940, and No. 2,288,203, June 30, 1942, as such a motor gives a relatively long stroke with a minimum dwell, the dwell being practically zero at the opposite ends of the reciprocating movement, or that is at the point of reversal of this movement. The stroke given to the movable cutter should be greater than the pitch of the outer stationary teeth, and the greater the better. With the motors mentioned a stroke of one-eighth of an inch or even more can be secured. This motor has a reciprocating or oscillating driving element 3 from which there is any suitable type of drive connection 4 to the reciprocating cutter 5 of the cutter head 6 mounted in any suitable manner in the end of the housing 1, as for example in a suitable transversely extending groove 7 in which it is held by suitable securing means (not shown). I am not limited to the specific driving connection 4 shown, but that indicated comprises a threaded stud 8 mounted on the reciprocating driving element 3 and embraced by a hollow pin 9 slidable on the stud 8 and provided with a flange 10 against which a spring 11 may react tending to shift the pin 9 against the cutter 5, this pin being provided with a rounded end 12 seating in a recess 13 formed in the lower wall of the cutter by pressing inwardly or upwardly a portion of this wall, there being left sufficient clearance or play between the sides of the pin and the recess to permit limited rocking movement of the rounded end of the pin in the cutter required by the reciprocating movement. The action of the spring 11 and the pin also tends to hold the movable cutter against the inner or under sides of the outer guard teeth of the head to maintain the teeth on the movable cutter in proper cutting or shearing relation to the teeth of the outer or stationary cutter.

The cutter head shown comprises a pair of longitudinally spaced mounting or supporting blocks 14 to the opposite sides of which are secured the side members or plates 15. After being finished these plates 15 are clamped against the opposite sides of the blocks 14, which at this time may be connected by an integral connecting strap (shown in my prior application Serial No. 412,055, filed September 24, 1941, now Patent No. 2,325,267 issued July 27, 1943), and then secured to the blocks by suitable solder or other means, but are preferably soldered to the blocks, and to insure sufficient solder for the operation tapered pockets 16 may be provided in the sides of the blocks 14 into which the solder may run and from which it may pass to the contacting surfaces between the side plates and the blocks. After this operation is completed, the connecting strip may be sawed or cut away as described in the prior patent above noted.

At the upper or outer edges of the side members or plates 15 are laterally and inwardly extending portions 17 on the free edges of which are formed the guard or stationary cutter teeth 18, the outer surface 19 being the skin contacting surface during the shaving operation, and as indicated, it is preferred that these surfaces 19 be slightly backward or downwardly inclined from the free ends of the teeth 18, as it is found this gives a better shaving effect with less irritation than where the skin contacting surfaces are flat or straight across. This inclination of the surfaces is preferably about ten degrees, although it is not limited to this, and the inclination permits a certain amount of rocking of the cutter head on the skin surfaces during its back and forth movement on this surface during the shaving operation without removing either set of cutter teeth from the surface of the skin and thus interfering with the shaving operation.

The teeth 18 of the outer or stationary member are made very short, the depth of the notches 20 being such that the length of the cutting edge of the teeth, indicated at 21, is substantially the average diameter of the hairs, which is from about .0035 in. to .006 in. so that the teeth may be made very thin, it being possible to make this thickness indicated at 22 of the order of that of the edge portion of a standard straight razor blade. In an arrangement such as that shown in Figs. 3 and 4, where there are two sets of teeth 18 separated by a longitudinal slot 23 with the free ends of the teeth extending toward each other so the device will shave in both directions as it is moved back and forth over the surface of the skin, it is preferred that the free ends of the outer stationary teeth 18 overhang the free ends of the inner movable cutter teeth 24 on the inner cutter 5 by a slight amount, as indicated at 25, this overhang being preferably about .003 in. or .004 in., so as to prevent irritation of the skin by the free ends of the movable teeth 24. That is, the full depth of the slots will be approximately the average diameter of the hairs which is from about .0035 in. to .006 in. plus the slight overhang of about .001 in. or a little more to insure the hair is fully entered into the slot so that the full diameter is severed and the possibility of partial cutting and consequent irritation or pulling is eliminated. The slots between the teeth 24 in the movable cutter are preferably extended the full length of the teeth as indicated. The slot 20 between the outer or stationary teeth is preferably about .015 to .018 in. wide and the width of the teeth 18 is preferably not less than about .012 in. to .015 in. so they will not stick into the skin or irritate it. The width of the slot 23 between the free ends of the two sets of teeth 18 is preferably about .060 in.

By using the type of motor indicated in my prior patents as above noted, the length of the stroke of the inner cutter 5 can be made relatively long, that is about one-eighth of an inch or even more, with a minimum dwell at the opposite ends of its reciprocating movement. The movement is therefore about four or five times the pitch of

the outer teeth 18. However, if the dwell is very short, a shorter stroke may be used, but it should not be less than the pitch of the outer teeth and it is a great advantage to use a long stroke as by this a greater velocity is secured with a better cutting effect as when the cutter gets up to a good speed in its movement it has a much better cutting effect than where there is a slow speed. The width of the inner movable cutter teeth 24 is preferably wider than the space or slots 20 between the outer or stationary teeth as indicated in Fig. 11. It is also preferred that the spacing of these cutter teeth or their pitch is not a multiple of the spacing of the outer teeth so that they do not all cut at the same time but cut in succession, as this reduces the power required, thus reducing the size of the motor and also gives a better and more reliable cutting effect. The thickness of the inner or cutter teeth, indicated at 26, Fig. 3, is preferably about .025 in., although this may vary. It is preferred that the side walls of the inner cutter 5 be relieved as shown at 27, leaving a longitudinal bearing rib or strip 28 to engage and be guided by the inner walls of the side plates 15. It is also preferred that these guide strips 28 be located adjacent the top edges of the sides of the cutter and that there be only one of these strips on each side, the remainder of the side walls below these strips and the bottom wall of the cutter being spaced a slight distance from the side plates 15 and the mounting blocks 14 as shown. This permits the movable teeth 24 to properly engage and seat themselves against the inner or under surfaces of the outer of stationary teeth 18 to insure the proper coaction to secure the most effective cutting or shearing operation, as this construction and arrangement permits slight lateral rocking movement of the inner cutter 5 so that the teeth 24 can properly seat against the outer teeth. It is also preferred to cut away the longitudinal upper edges or corners of the inner cutter as shown at 29 so that should the cut hairs get in between the two cutters they cannot pass down between the bearing surfaces between the inner and outer cutters and cause binding. The bearing surfaces or ribs 28 seal the sides between the members and prevent the cuttings getting down between the sides of the inner and outer cutters, as well as keep the tips of the inner cutter teeth in line back of the outer teeth. That is, these ribs prevent any lateral or side movement during shaving while absence of such ribs at the lower part of the inner cutter will permit all teeth to contact properly and perfectly because of the clearances at the lower part of the inner cutter. This arrangement is very important with the very short teeth of the cutter head of this invention as with such short teeth the inner element or cutter must fit the outer element accurately.

In the form shown in Figs. 5 and 6 there is a stationary guard or comb 30 mounted between the two laterally spaced sets or rows of cutter teeth. This guard prevents the flesh entering between the ends of the teeth and prevents irritation of the skin. With this guard it is unnecessary to provide the overhang 25 of the free ends of the outer teeth 18 over the free ends of the inner teeth 24 although they may overhang a slight amount if desired. The free edge of the guard 30 may be plain or provided with a series of transverse teeth 31. The teeth if used are preferably spaced to correspond with the spacing of the outer teeth 18, although the space between the teeth could be less than that of teeth 18. The corners 32 of the guard are preferably left substantially square, although they would be given a slight rounding by the buffing operation, as when square they are more effective in raising the hairs from the surface of the skin so that they are more nearly at right angles to the surface as they enter the notches between the teeth 18 and therefore are in the best position for the shearing operation. There is a definite new combination and special coaction between the stationary guard and the short outer teeth 18 as the guard prevents the thin teeth from sticking into or irritating the skin and the closeness of the shave may be determined by the relative positions of the outer surface of teeth 18 and the free edge of the guard, as for example by the amount the free edge of the guard is extended above the skin contacting outer face of the teeth 18. Thus by relative location of the free edge of the guard with respect to the outer or skin contacting surface of the teeth 18 the smoothness of the shave can be governed. The guard is preferably from about .020 to .025 in. thick.

In the form shown in Figs. 9 and 10 the inner cutter 5 is substantially the same as that in Figs. 3 and 5 but instead of having two rows of outer stationary teeth 18 the overhanging free edge portion 33 of one of the side plates 15a is left plain and smooth with no teeth but is spaced from the free ends of the teeth 18 on the other side of the separating slot 34. Thus the plain edge portion 33 really acts as a guide and guard for the set of operating teeth similar in effect to the intermediate guard 30 of Fig. 5, and it also helps to determine and maintain the proper angle of the head on the skin as does each set of cutters with respect to the other set of the arrangements of Figs. 3 and 5.

In Figs. 7 and 8 the overhanging edge 35 of one side plate 36 is wider than in the previous forms but at its free edge is provided with short cutter teeth 18 as in the other forms. However, the opposite side plate 37 is provided with either a plain or toothed edge 38 corresponding to that of the guard 30 of Fig. 5 and it may be given a slight overhang as indicated at 39 equal in amount to about $\frac{1}{32}$ of an inch or even more if desired. This helps to raise the hairs from the skin to the proper cutting position. If teeth are provided they are preferably of the same pitch as the stationary cutter teeth 18 with the depth of slot or notch between them from about .025 to .030 in. This functions substantially the same as the guard 30 except it is used with only a single row of cutter teeth and it has the same effect of raising the hairs to the cutting position and preventing irritation of the skin by the thin teeth 18. It also may be used to control the closeness of the shave depending on the relation of its outer or free surface to the outer surface of the teeth 18, that is by making it higher or lower it can govern the closeness of the shave and the smoothness of the shaving operation. In this case the inner movable cutter 40 is shaped somewhat different from cutter 5 of the other form, although the function and operation is practically the same. In this cutter there are teeth 41 only on one side but the sides of the substantially U-shaped cutter member are relieved as shown at 27 the same as in the other form to provide the two bearing ribs or strips 28. There may or may not be a slight overhang of the free ends of the outer teeth 18 over the free ends of the inner or movable teeth 41, but with this guard an overhang is unnecessary.

It will be evident the drawing is enlarged and not to scale. Some of the dimensions that may be used although the device is not limited to them, is to make the height **42** of the head about three-eights of an inch, the width **43** about one-fourth of an inch and the thickness of plates **15** about one-thirty-second inch, the slot **44** (Fig. 7) is preferably about .015 to .025 inch wide. The walls of the inner cutter **5** could be about $\frac{1}{32}$ in. thick and the relief **27** approximately .005 in.

It will be understood from the above the shorter the outer or stationary teeth the greater will be their strength and rigidity with a given thickness and therefore with a short tooth the same strength and rigidity can be secured with a much thinner tooth, permitting much closer shaving. Theoretically the depth of the slots between the teeth in the outer cutter, or that is, the length of the working or cutting edge, need not be greater than the diameter of the hair or whisker being cut which by measurement has been determined to be from about .0035 to about .006 in., but it is preferred to make it slightly greater to insure the whisker is wholly in the slot when cut so the full diameter is cut and pulling or irritation by partial cutting is eliminated. For best results these short teeth should be combined with a minimum dwell or rest of the inner or movable cutter at the opposite ends of its reciprocating movement, and a relatively long stroke of the inner cutter gives still further improved and more efficient operation.

Another advantage of the very short teeth in the outer cutter is the beard raising function of the bottom or base of the slots between the teeth while moving the cutter against the beard. At the same time considerable discomfort is eliminated for the following reason. If the teeth are short, that is substantially the average diameter of the hairs of the beard, the thickness of the outer tooth at its base may be made substantially the same as that of the rest of the cutting length of the tooth. Consequently the hairs raised to a vertical position by the base of the slots will be cut off at the surface of the skin leaving no stubble to further impinge against the bases of the slots to cause discomfort as the shaving is continued.

Having thus set forth the nature of my invention, what I claim is:

1. A dry shaver comprising an outer shear member provided with a series of thin overhanging teeth at its outer edge spaced by notches of sufficient width for passage of hairs between the teeth, an inner movable shear member having teeth at the inner sides of the first teeth and movable transversely thereof to cooperate with the first teeth to cut the hairs, and the length of the zone of cutting of cooperating teeth comprising the distance from the bottom of the notch between outer stationary teeth to the tip of the inner movable tooth of the respective shear members being only slightly greater than the diameter of the hairs.

2. A dry shaver comprising an outer shear member provided with a series of thin overhanging teeth at its outer edge to move over the surface of the skin, said teeth being spaced by notches of sufficient width for passage of hairs between the teeth, an inner movable shear member having a series of laterally spaced teeth at the inner sides of the first teeth and movable transversely thereof to cooperate with the first teeth to cut hairs, the length of the zone of cutting of cooperating teeth comprising the distance from the bottom of the notch between outer stationary teeth to the tip of the inner movable tooth of the respective shear members, and the length of the outer teeth, being only slightly greater than the diameter of the hairs to increase the rigidity of the thin outer tooth, and a stationary guard extending parallel to said edge of the outer shear member and spaced a short distance from the free ends of the outer teeth.

3. A dry shaver comprising a mounting member, plates secured to the opposite side of said member and extending above the top thereof, said extending portions having overhanging edges provided with a series of spaced thin teeth extending transversely of said edges and with their outer surfaces inclined downwardly and outwardly from the free ends of the teeth, said teeth being arranged with the free ends of those on one plate extending inwardly toward those on the other plate and spaced therefrom to provide a longitudinal slot between the series of teeth, said teeth in each plate being spaced by notches of sufficient width for passage of hairs between the teeth, an inner movable cutter having a series of laterally spaced teeth at the inner side of each series of outer teeth and movable transversely thereof to cooperate with the first teeth to cut hairs, and the zone of cutting of cooperating teeth comprising the distance from the bottom of the notch between outer stationary teeth to the tip of the inner movable tooth being only slightly longer than the diameter of the hairs to give increased rigidity to the thin outer tooth and minimum of irritation.

4. A dry shaver comprising an outer shear member provided with a series of thin overhanging teeth at its outer edge of substantially .012 to .015 in. in width spaced by notches of substantially .012 in. to .018 in. wide, an inner movable cutter having a series of laterally spaced teeth at the inner sides of the first teeth and movable transversely thereof to cooperate with the first teeth to cut hairs, and the length of the zone of cutting of cooperating teeth comprising the distance from the bottom of the notches between the outer stationary teeth to the tips of the inner movable teeth being only slightly longer than the diameter of the hairs, viz. .0035 to .006 inch.

5. In a hair cutter, a skin contacting member adapted to pass over the skin for cutting hair therefrom, said member being provided with sets of opposed thin teeth having free ends extending toward but not reaching each other and separated by slots of sufficient width for passage of hairs between the teeth, an inner movable cutter provided with spaced sets of similarly opposed teeth having free ends extending toward each other operating at the inner sides of the other teeth and cooperating therewith to cut hair from the skin as the cutter is passed thereover, and the length of the cutting zone of cooperating teeth comprising the distance from the bottom of the slots between outer stationary teeth to the tip of the inner movable tooth being only slightly greater than the diameter of the hairs.

6. A cutter head of the character described comprising a mounting member, side members in the form of plates secured to the opposite sides of the mounting member and extending laterally therefrom, the free edge of at least one of said extensions being provided with a series of thin overhanging teeth spaced by notches of sufficient width for passage of hairs between the teeth, a movable cutter member of generally rectangular U-shape mounted to reciprocate between said

side members and having narrow bearing strips adjacent the upper edges of its side arms bearing on the side plates, the outer surface of said movable cutter member being relieved below said bearing strips around said member from one strip to the other so as to be spaced from the side plates and the mounting member, and the free edge portion of one of the sides of the movable member having a row of cutter teeth at the inner sides of the row of first mentioned teeth and cooperating therewith, the length of the cutting zone of cooperating teeth comprising the distance from the bottom of the notches between the outer stationary teeth to the tip of the inner movable tooth being only slightly longer than the diameter of the hairs.

7. In a cutter head, a body having a pair of spaced toothed edges arranged with the free ends of the teeth extending toward but not reaching each other and separated by notches of sufficient width for passage of hairs between the teeth, a cutter in the body movable relative thereto in a direction transversely of the teeth and provided with cutter teeth to cooperate with the first teeth for cutting hair, the length of the cutting zone of cooperating teeth comprising the distance from the bottom of the notch between outer stationary teeth to the tip of the inner movabe tooth, and the length of the outer teeth, being only slightly longer than the diameter of the hairs to give increased rigidity to the thin outer teeth, and a guard between said toothed edges and spaced therefrom to prevent the flesh of the user entering between the spaced toothed edges of the body.

8. A dry shaver comprising an outer shear member provided with a series of thin teeth at its outer edge spaced by notches of sufficient width for passage of hairs between the teeth, an inner movable shear member at the inner sides of said teeth and movable transversely thereof to cooperate with the teeth to cut the hairs, and the length of the cutting zone of the cooperating members comprising the distance from the bottom of notches between teeth in the outer member and the tip of the movable inner member being only slightly longer than the diameter of the hairs, viz. .0035 to .006 inch.

THOMAS J. MURPHY.