

Sept. 7, 1954

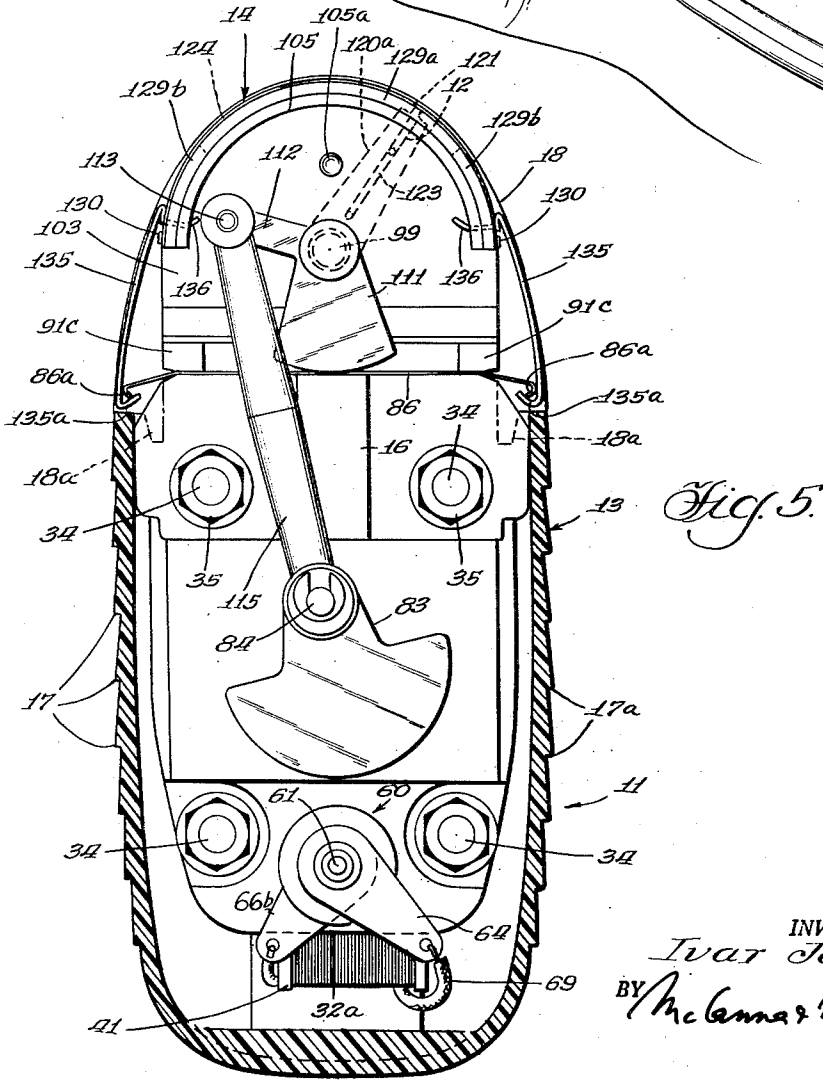
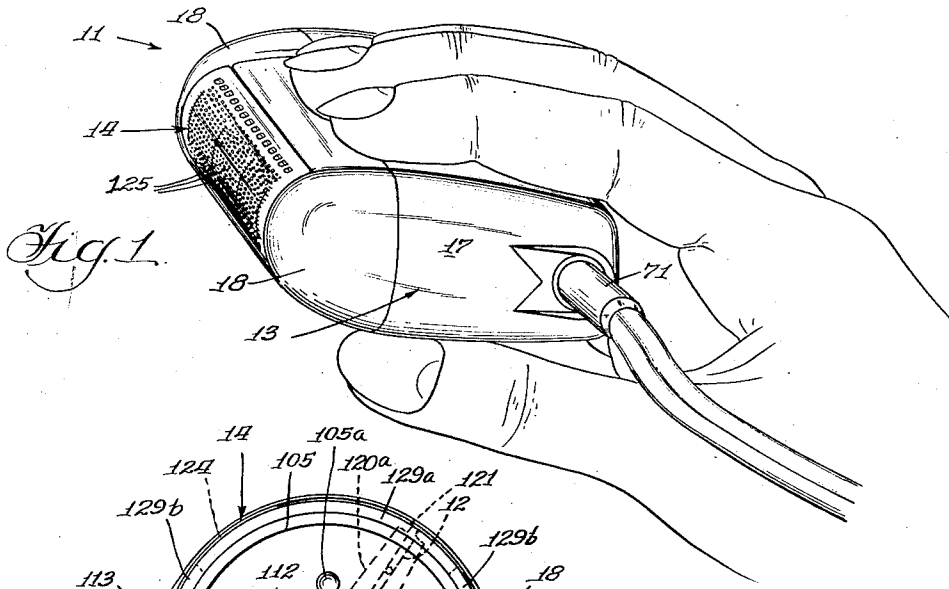
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2,688,184

ELECTRIC DRY SHAVER

Filed Jan. 21, 1949

4 Sheets-Sheet 1



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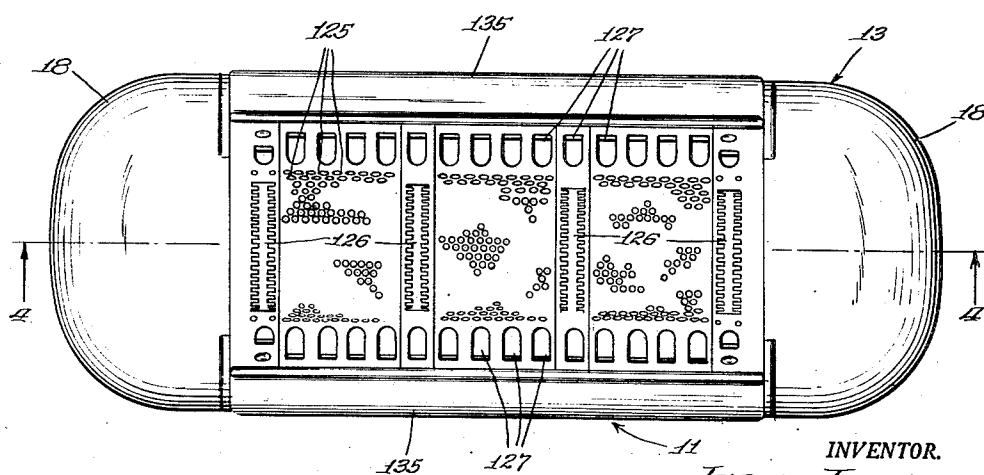
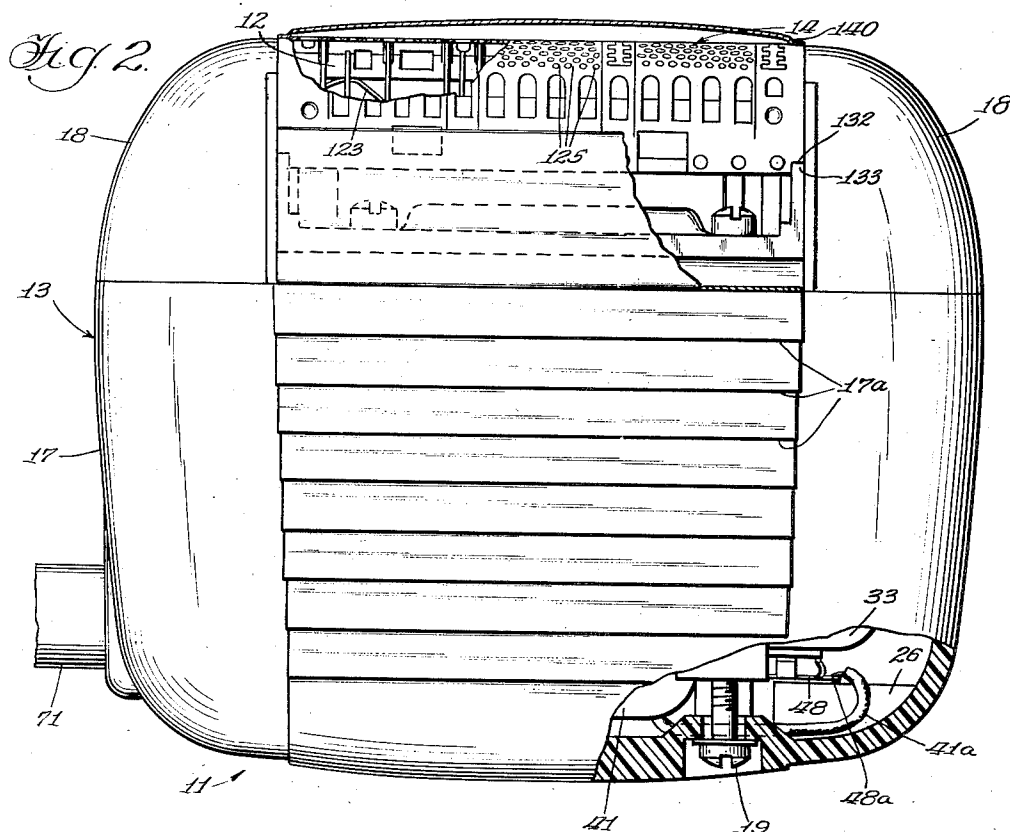
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ELECTRIC DRY SHAVER

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4 Sheets-Sheet 2



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ELECTRIC DRY SHAVER

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4 Sheets-Sheet 3

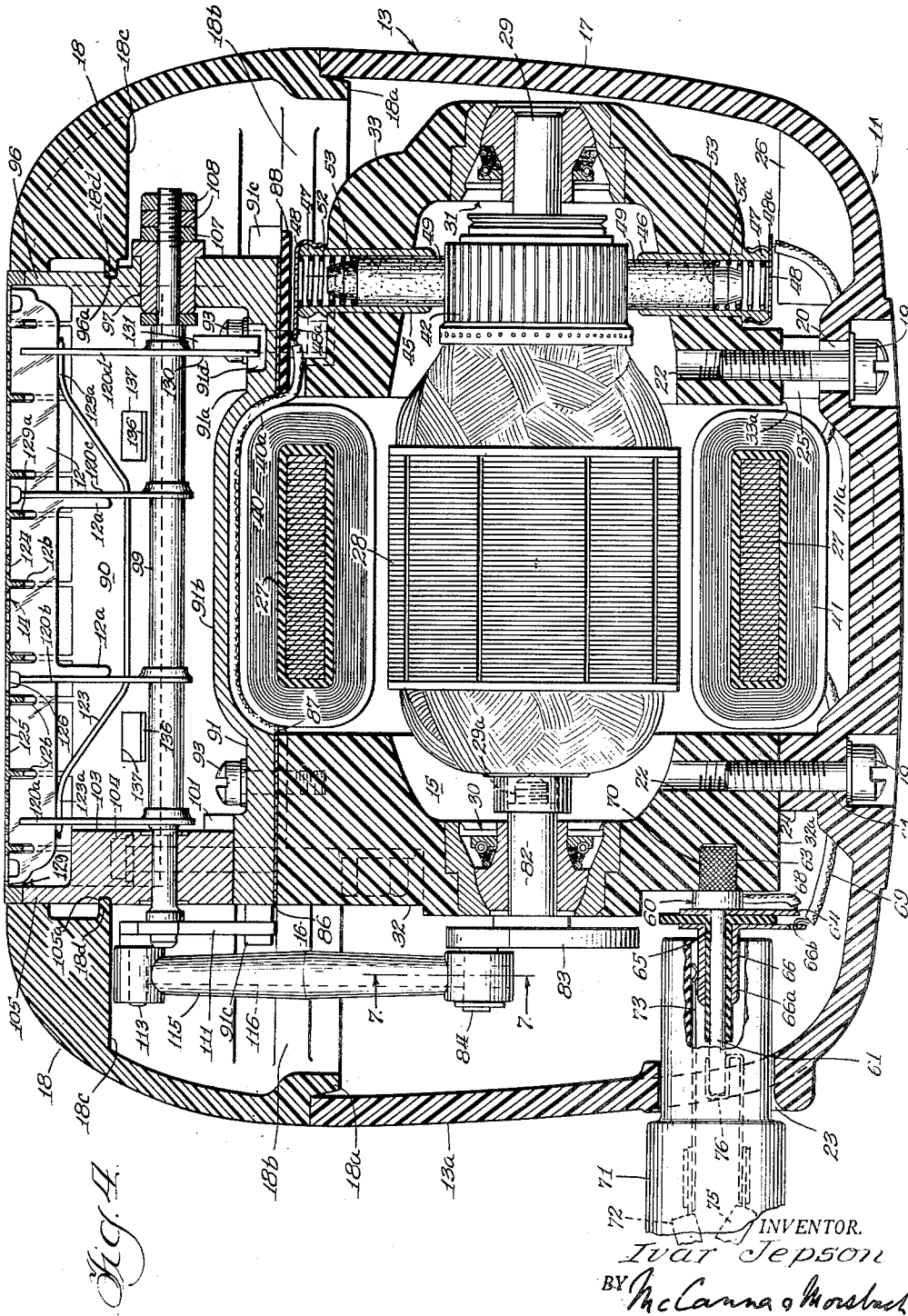


Fig. A

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4 Sheets—Sheet 4

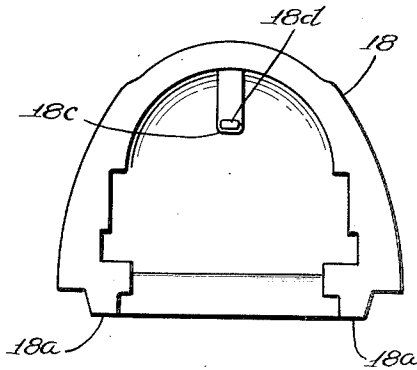


Fig. 6.

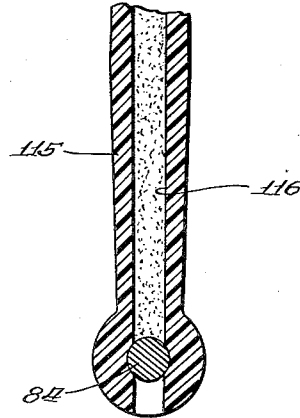


Fig. 7.

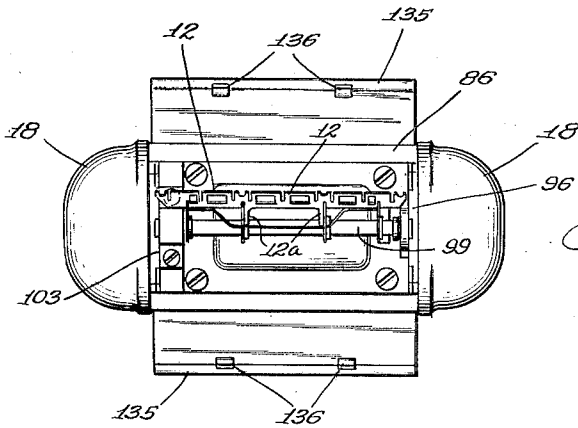


Fig. 8.

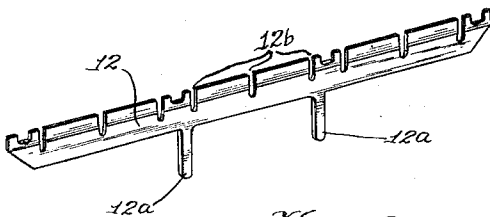


Fig. 9.

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UNITED STATES PATENT OFFICE

2,688,184

ELECTRIC DRY SHAVER

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Application January 21, 1949, Serial No. 71,927

11 Claims. (Cl. 30-43)

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This invention relates to electric dry shavers, that is apparatus for use in removing beards or face hair as well as effecting depilation of hair on the arms, legs and other portions of the human body. More particularly the present invention is in the nature of an improvement on the electric dry shaver disclosed and claimed in my copending application, Serial No. 782,761 filed October 29, 1947 and assigned to the same assignee as the present invention.

In recent years electric dry shavers have been extensively employed and at present a substantial percentage of those who shave use electric dry shavers exclusively for this purpose. It would be desirable in connection with such electric dry shavers to reduce the shaving time required by a substantial amount while still obtaining a satisfactory shave. It would also be desirable to provide an electric dry shaver which is designed so that it may be held comfortably and conveniently in the hand of the operator in such a position that shaving may be accomplished with a loose and natural position of the hand and without any physical strain on the operator in shaving any desired part of the face. In electric dry shavers which have been on the market heretofore it has generally been necessary to grip rather tightly an elongated shaver body which furthermore requires the operator's hand to be in a somewhat awkward position. The combination of the awkwardness of the position and the tightness of the grip required mitigates against easy manipulation of the device and maximum comfort in using such a device.

In electric shavers of the type wherein a mechanism of some kind is required to change rotational motion of the motor to an oscillatory movement of the cutter blade, tremendous strains are encountered, particularly when it is desirable to have the motor rotate at about 8,000 revolutions per minute. It would be desirable to provide an arrangement for converting such rotatable motion of the motor shaft to oscillatory movement of the cutter blade by a mechanism which is substantially more efficient than devices employed heretofore and which furthermore has a substantially longer life. It is furthermore essential that such means together with the driving motor and the cutter bar can be disposed in a small casing or housing as was mentioned above, which can readily be grasped in an easy and comfortable manner by the operator and which provides an arrangement with a much larger cutting area than has heretofore been provided in

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order substantially to reduce the shaving time involved.

Accordingly it is an object of the present invention to provide a new and improved electric dry shaver.

It is another object of the present invention to provide an electric dry shaver having a greatly increased cutting area over dry shavers heretofore available so as to reduce the shaving time by as much as fifty percent or more.

It is a further object of the present invention to provide an electric dry shaver comprising an improved mechanism disposed in a housing which can be comfortably and conveniently held in the hand in such a position that shaving may be accomplished without any strain or unnatural positioning of the hand.

A feature of the present invention comprises the provision of a dry shaver having a substantially rectangular shaped housing which may readily be grasped by the operator in a loose and comfortable manner wherein the motor shaft and cutter blade shaft are disposed in substantially coextensive spaced parallel relationship within the housing.

It is another object of the present invention to provide an electric dry shaver having a rectangular casing with substantially square front and rear walls wherein a substantial area of the surface of said casing comprises a cutting area.

It is a further object of the present invention to provide a new and improved electric dry shaver in which the component parts can readily be assembled, which shaver is of sturdy and foolproof construction having a trouble-free life many times that of similar devices available, and which is relatively inexpensive to manufacture.

Still a further object of the present invention comprises a new and improved arrangement for converting rotary motion of an electric motor to oscillating movement of a cutter blade which arrangement has an efficiency and useful life many times that of similar devices employed heretofore.

Further objects and advantages of the present invention will become apparent as the following description proceeds, and the features of novelty which characterize the invention will be pointed out with particularity in the claims annexed to and forming a part of this specification.

For a better understanding of the present invention reference may be had to the accompanying drawings in which:

Fig. 1 is a perspective view showing the electric dry shaver of the present invention disposed in

the hand of a user to illustrate not only its size but also the free, easy and comfortable manner in which the shaver may be held in the hand of the user for shaving without strain or discomfort in any way;

Fig. 2 is an elevational view with portions thereof cut away to show certain details of an electric dry shaver embodying the present invention;

Fig. 3 is a top view of Fig. 2 showing a plan view of the cutting surface of the shaver of the present invention, the cutter guard of Fig. 2 being removed therefrom;

Fig. 4 is a sectional view taken on line 4—4 of Fig. 3;

Fig. 5 is an end view of the shaving device of the present invention with portions of the casing cut away or removed in order to show the details of the mechanism for converting rotary motion of the motor to oscillating motion of the cutter blade;

Fig. 6 is an inside view of a casing end cap;

Fig. 7 is a sectional view taken on line 7—7 of Fig. 4;

Fig. 8 is a top view of the shaver with the comb removed therefrom and the comb-holding members disposed in a position permitting removal of hair particles from the cutting chamber; and

Fig. 9 is a perspective view of the cutter blade.

Referring now to the drawings the invention as illustrated is embodied in an electric dry shaver generally designated at 11 of the type used in shaving beards and for removing hair from other parts of the body. Essentially the shaver comprises an oscillating cutting blade or cutter 12, suitably disposed in a casing or housing 13 and coating with a comb or cutting surface 14 preferably comprising a substantial portion of the surface of said casing or housing. Housed within the casing 13 is a suitable electric motor generally designated at 15 which is adapted to be connected by suitable driving means generally designated at 16, comprising an important feature of the present invention and described in detail hereinafter, for causing oscillation of the cutter blade 12 at a speed of the order of 8,000 cycles per minute.

I have discovered that conventional electric dry shavers available on the market prior to the present invention generally comprised an elongated casing around which the operator's fingers were usually clasped in a fairly tight grip to manipulate the shaver. With the view of eliminating the requirement of tightly gripping such a shaver and the resultant awkwardness, it has been endeavored to produce an electric shaver having such a configuration that the device may readily be cupped in the hand of the user in a natural manner with the fingers loosely engaging the same. I have found that by making the casing 13 of rectangular box-like configuration with the two walls of major area substantially square as is clearly shown in the drawings and of a size such as is shown in Fig. 1 in relation to the size of the hand of an operator, it may readily be grasped by such operator in a very comfortable manner. Fig. 1 illustrates one method of holding my improved dry shaver which is preferred by a substantial number of users of the same. However, it should be understood that the casing lends itself to other methods of manipulating the same and all users thereof will not hold it in the same way. However, the manner of holding the shaver even though it may vary slightly among different users, is still such in each case as to be comfortably cupped in the hand with the fingers loosely en-

gaging the same as contrasted with the tight grip required of most users when holding the elongated casing of the dry shavers used heretofore where the fingers of necessity encircle the longitudinal axis of the casing.

For ease of assembly of the electric dry shaver 11, of the present invention, the casing 13 essentially comprises three parts, two of which are identical, respectively designated as 17 and 18.

The portion 17 of the casing 13 is a rectangular cup shaped member preferably molded from a suitable material, many moldable plastic materials being readily available on the market for this purpose, which provide a smooth and desirable appearing surface of any desired color. Preferably, as illustrated, the central portion of the casing 13 where likely to be engaged by the operator's fingers is provided with very slightly raised rib portions 17a to make it easier to manipulate and also for the additional purpose of providing a more pleasing appearance. The casing portions 18 are referred to hereinafter as end caps and are preferably molded from the same material as the casing portion 17. As illustrated the casing 13 is roughly of the order of 3 $\frac{3}{8}$ inches long with reference to Fig. 2; 2 $\frac{3}{4}$ inches high and about one inch thick. Effectively the casing 13 is divided into a motor chamber and a cutter chamber. The motor chamber is substantially all disposed within the housing section 17, although as is apparent from Fig. 4 of the drawings, a portion of the motor 15 extends up into the chamber defined by the end caps 18. The space between the end caps 18 and the motor 15 comprises the cutter chamber which will be described in greater detail hereinafter.

As best shown in Figs. 4 and 6 each of the end caps is provided with a depending flange 18a which is adapted to interfit with the inner edge of the cup shaped portion 17 of the casing 13 as is clearly shown in Fig. 4 of the drawings. The end caps 18 are further provided with integrally molded ribs such as 18b and an upper central rib 18c, which rib 18c has a horizontally extending integral protuberance 18d adapted to engage a cooperating opening in the head of the dry shaver 11 to be described hereinafter for aiding in supporting the end caps 18 in position without the requirement of any fastening means in the nature of screws or the like except for the fastening means which hold the shaving mechanism in the casing 13.

The parts 17 and 18 of the casing 13 are firmly held in position relative to each other and to the shaving device by virtue of the portions 18a and 18d merely by a pair of screws 19 which extend through suitable openings 20 and 21 defined in the bottom of the casing portion 17 and threadedly engage cooperating tapped openings 22 defined in the motor 15. The opening 20 is preferably elongated in the direction of the axis of the motor 15 to allow for slight variations in spacing between the tapped openings 22. The casing portion 17 is also provided at one end adjacent the bottom thereof with an opening 23 for receiving a suitable cord connector whereupon the electric dry shaver may be connected with a suitable source of electric energy such as the conventional house wiring circuit. In addition the casing portion 17 is preferably provided with suitable raised protuberances 24, 25 and 26 which support the shaving mechanism including the motor 15 in the casing 13, the portion 26 serving to prevent one of the brush connectors described hereinafter from being disconnected.

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From the above description it will be apparent that the motor 15 and associated cutting head supported thereon, as described in detail hereinafter, may be inserted into the casing portion 17 whereupon the end plates 18 may be put into position with the portions 18a interfitting with the top edge of the portion 17 and the portions 18d extending into cooperating openings defined in the cutter head. The fastening screws 19 are then put in place as indicated in Fig. 4 whereupon the shaver is assembled with the casing in an extremely simple manner.

In accordance with the present invention the casing 13 of rectangular configuration with the walls of maximum area being substantially square is particularly well adapted to receive an electric motor 15 preferably of the universal type such as is disclosed and claimed in my prior co-pending application, Serial No. 783,419, filed October 31, 1947, and also assigned to the same assignee as the present application. This motor 15 is a small compact motor of substantially rectangular configuration adapted to be disposed almost entirely within the motor chamber defined in the housing portion 17. In accordance with the present invention the longitudinal axis of the motor 15 extends in spaced parallel relationship with the cutter blade 12, as distinguished from prior art devices where the cutter blade is generally perpendicular to the longitudinal axis of the associated motor. In the illustrated embodiment the casing walls of maximum area, although substantially square, are slightly longer than wide, and the axis of the motor 15 extends in the direction of the maximum dimension of the casing 13.

The motor 15, which is fully described in my co-pending application Serial No. 783,419 briefly comprises a field structure of generally rectangular shaped cross section formed of a plurality of laminations 27 encircling an armature 28. The armature 28 is supported by a shaft 29 suitably journaled in self-aligning bearings 30 and 31 which are supported respectively by end bearing blocks 32 and 33. For reasons which will become apparent the bearing block 32 is designated as the crank end bearing block while the bearing block 33 is designated as the commutator end bearing block. The shaft engaging portions of the self-aligning bearings 30 and 31 are preferably formed of powdered bronze or the like so as to comprise what is generally referred to as an oilless bearing. The laminations 27 forming the field structure are clamped together by field studs 34 which have threaded extensions at each end thereof visible in Fig. 5 of the drawings for supporting the bearing blocks 32 and 33. Suitable nuts 35 applied to the field studs 34 hold the end bearing blocks 32 and 33 in assembled relation with the field structure defined by the laminations 27. Supported on the field structure defined by the laminations 27 in diametrically opposed relationship are a pair of field coils 40 and 41 respectively, which are clearly shown in Fig. 4 of the drawings. These field coils energize the field structure during the operation of the motor and are electrically connected in series with each other in a manner to produce the desired field polarity.

It will be understood that a universal motor is operable on either alternating or direct current power and the motor 15 is such a motor illustrated as of the series commutating type. Consequently associated with the armature 28 and rotatable therewith is a commutator 42. Supported in the commutator end bearing block 33 are a pair of brush holders 45 and 46 in the form of sleeves so

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disposed that one end of each sleeve is adjacent the commutator 42 and the other end extends outside the commutator end bearing block 33. These sleeves 45 and 46 are disposed in diametrically opposed relationship with respect to the commutator 42 in a manner to obtain proper commutation. The outer end of each sleeve 45 and 46 is formed with a bead 47 so as to be clampingly engaged by resilient fingers forming part of removable conducting caps 48 which interfit with the beads 47 in a manner clearly shown in Fig. 4 of the drawings. A portion of each cap 48 in the form of an extension 48a provides a ready means to which the leads 40a and 41a from the field coils 40 and 41 respectively may be connected. Reciprocally movable in each sleeve 45 and 46 is a brush 49 arranged to electrically engage the commutator 42 and the pressure of which on the commutator 42 is determined by a spring 52 disposed between a shoulder 53 on the associated brush 52 and the cooperating conducting cap 48. This construction is advantageous in that the electrical connections and the brushes are readily accessible from the exterior of the motor for maintenance and service purposes and at the same time permits the use of relatively long springs 52 between the brushes 49 and the caps 48 which is desirable to minimize the variation in brush pressures as the brushes 49 wear down in use.

For the purpose of making electrical connection with the field windings 40 and 41 and consequently also with the commutator 42 through the brushes 49 there is provided an electrical terminal assembly generally indicated at 60 of the type having a plurality of coaxial contacts, which terminal assembly is suitably supported from the crank end bearing block 32. As illustrated the terminal assembly 60 comprises an elongated relatively small diameter pin 61 having an enlarged flange adjacent one end with a coaxial knurled portion 63 extending from the flange on the opposite side from the elongated pin 61. A portion of the pin 61 defines one contact of the coaxial contact terminal assembly 60. A terminal 64 is disposed adjacent the flange on the pin 61 and electrically connected thereto. To insulate the pin 61 from the other contact of the coaxial contact terminal assembly 60 and also to support the same there is provided a flanged sleeve 65 of insulating material such as nylon or the like, which is concentrically arranged with respect to the elongated pin 61. A sleeve contact 66 having a contact portion 66a and a terminal flange or terminal portion 66b is disposed over the insulating sleeve in a manner so as to be electrically insulated from the elongated pin 61 which extends a substantial distance beyond the insulating sleeve 65. The flange of the sleeve 65 electrically insulates the terminal 64 from the terminal portion 66b. With this arrangement it will be apparent that there is provided a terminal assembly comprising a pair of concentric contacts defined by the tip of the elongated contact member 61 and the sleeve contact 66, which are electrically connected to the terminal portions 64 and 66b respectively. These terminal portions are suitably connected by conductors 68 and 69 with the field coils 40 and 41 respectively. The knurled portion 63 of the terminal 60 is suitably fastened to the crank end bearing block 32 such for example as by being molded therein at 70 when the block is molded. The terminal 60 is supported in a manner so that when the electric dry shaver mechanism is disposed within the portion 17 of the hous-

ing 13 that the elongated pin portion 61 and the sleeve contact 66 are disposed in co-axial relationship with the opening 23 defined in the casing portion 17.

In order that the electric motor 14 may be electrically connected with a suitable source of current, either alternating current or direct current, there is provided a power cord, best shown in Fig. 1, having a plug connector 71 of the type in which coaxial contacts cooperable with the contacts just described are employed. As illustrated the conductor 72 of the power cord is connected to a ring contact 73 supported within the plug connector 71 which ring contact is adapted to electrically engage the sleeve contact 66 when the plug connector 71 is inserted in the opening 23 in the casing portion 17 in the manner indicated in Fig. 4 of the drawings. Similarly the conductor 75 of the power cord is electrically connected within the plug connector 71 with a tip contact 76 adapted electrically to engage the end of the elongated pin 61 when the plug connector 71 is in the position indicated in Fig. 4 of the drawings. With this arrangement a very small plug connector is provided having a diameter slightly larger than that of the conventional power cord so as not to interfere with the easy manner of holding the dry shaver in the operator's hand, the power cord for example, extending between two of the operator's fingers one of which might for example be the operator's thumb. By employing the above described plug and cooperating coaxial contact terminal assembly 60 the operator's fingers may more readily be spaced in substantially any manner desired without interference. It will be understood that the illustrated positioning of the plug connector 17 and the terminal assembly 60 relative to the casing 13 is by way of example only, since it will be understood that the plug connector might be disposed at the opposite end of the housing or even at the bottom if desired.

In order to support the motor 15 within the housing 13 the end bearing blocks 32 and 33 are provided with flat surfaces 32a and 33a respectively at the bottom thereof as viewed in Fig. 4 engaging the raised protuberances 24 and 25 defined within the bottom of the casing portion 17. When the device is assembled as shown in Fig. 4, the protuberance 26 is disposed beneath the lower brush cap 48 and consequently precludes its becoming unfastened.

In accordance with the present invention the actual shaft 29 of the motor 15 stops short of the self-aligning bearing 30 and is provided with a coaxial recess 29a in the end thereof for receiving the crank shaft 82 which supports a combined counterweight and a crank 83 and a crank pin 84. Any suitable means for effectively causing the crank shaft 82 to comprise an extension of the motor shaft 29 may be employed. Preferably, for ease of assembly, the end of the crank shaft 82 remote from the crank arm 83 is threaded for engaging with cooperating threads defined within the axial recess 29a.

As has been pointed out above the entire surface of the casing 13 between the end caps 18 defines the shaving or cutting area of the shaver 11, and this cutting surface is more than twice the cutting area provided by electric shavers commercially available at the present time. For the purpose of effectively dividing the casing 17 into a motor chamber and a cutter chamber, there is provided a comb lock spring 86 in the form of a thin plate of spring steel disposed in a hori-

zontal position above the motor 15. Essentially the comb lock spring, best shown in Fig. 5 of the drawings is of rectangular configuration and has a central opening 87 therein through which a portion of the coil 40 of the motor 15 extends. The edges of the comb lock spring 86 parallel with the motor shaft 27 are provided with hook-shaped portions 86a to receive the comb locks described hereinafter. For the purpose of insuring suitable electrical insulation between the comb lock spring and the brush cap 48 a suitable brush insulator 88 is clampingly disposed between the commutator end bearing block 33 and the comb lock spring 86. The comb lock spring is preferably clamped between the top of the motor 15 and a cutter assembly generally designated at 90 and described hereinafter.

The cutter head assembly 90 includes the cutter 12, which cutter, to cooperate with the very large cutting area, must be much longer than cutting blades employed heretofore. As illustrated, and in addition to the blade 12, the cutter head assembly comprises a die cast head portion 91 which includes a horizontally disposed portion 91a extending over the comb lock spring 86 and fastened to the motor 15 in a manner to clamp the comb lock spring 86 and the brush insulator 88 into position as by means of screws 93. Preferably the crank end bearing block 32 is provided with tapped openings to receive screws 93 extending through the portion 91a of the head member 91. To simplify the assembly operation the commutator end bearing block 33 is provided with horizontally disposed nut receiving grooves whereupon suitable nuts may be inserted therein for threadedly engaging with the screws 93 at the commutator end of the head 91. This arrangement permits foolproof assembly even though the motor 15 may vary slightly in length, the head 91 preferably being provided with slotted openings for the screws 93 at the commutator end.

As illustrated the head portion 91a comprises a raised portion 91b closely fitting around the field coil 40 so as to provide sufficient room for this field coil, and slightly increase the volume of the motor chamber. One end of the head member 91 has an arcuate-shaped upwardly extending portion 96 which defines not only the support for the comb 14 but also includes an opening therethrough which opening is disposed parallel to the motor shaft 29 for supporting a head bearing bushing 97. An indentation 96a provided in the arcuate portion 96 is adapted to receive the extension 18d of the end cap 18 to support the same in assembled relationship as described above. Preferably the head member 91 is a die casting formed of zinc or the like and includes a pair of extensions 91c at each end thereof of rectangular configuration interfitting with suitable recesses defined in the end caps 18 to securely position the same and prevent relative movement therebetween.

For imparting oscillatory motion to the cutter 12 there is provided a cutter shaft 99 which in accordance with the present invention is supported in the cutter assembly in spaced parallel relationship with the motor shaft 29 and substantially coextensive therewith. The commutator end of the cutter shaft 99 is inserted into the head bearing bushing 97 and pivotally supported thereby. To support the other end of the cutter shaft 99 for pivotal movement there is provided a bearing seat 101 which defines the lower half of a suitable bearing therefor. The

upper half of the bearing is defined in a head bearing cap 103. Both the head bearing cap 103 and the head bearing seat 101 are clamped to the head 91 by fastening means 104 in the form of suitable stud bolts or the like. The head bearing cap 103 and the head bearing seat 101 are preferably formed of powdered bronze or the like so as to form an oilless bearing for the crank end of the cutter shaft 99. For the same reason the head bearing bushing 97 is preferably formed of powdered bronze. The head bearing cap 103 also is provided with an arcuate-shaped portion 105 similar to the portion 96 of the head 91 for supporting the comb 12 and also to aid in supporting the end cap 18 whose extension 18d of the rib 18c is adapted to be inserted in a suitable recess 105a defined in the head bearing cap portion 105.

In order to maintain the commutator end of the cutter shaft 99 in the bushing 97, this end thereof is threaded so that when disposed in the head bearing bushing 97 a suitable spacer 107 and nuts 108 may be associated therewith as clearly indicated in Fig. 4 of the drawings.

The other end of the cutter shaft 99 extends through the bearing defined by the head bearing seat 101 and the head bearing cap 103 and is rigidly connected with a crank arm assembly comprising a counterweight 111, a crank arm 112 and a crank pin 113, which crank pin 113 is disposed in coextensive, spaced parallel relationship with the crank pin 84 so that the crank pins may be interconnected by a connecting rod 115 as illustrated in Figs. 4 and 5 of the drawings. The length of the crank arm 112 is such that rotation of the motor shaft 29 causes oscillation of the cutter shaft 99 in a manner which will become apparent from an examination of Fig. 5 of the drawings, the lower end of the connecting rod 115 describing a circle while the upper end of the connecting rod 115 describes a relatively short arc of the circle which would be defined by the end of the crank arm 112 upon rotation of the cutter shaft 99 through 360°.

The connecting rod 115 is preferably formed of insulating material so that any electric currents induced within the motor shaft 29 are prevented from reaching the cutter shaft 99 and consequently the cutting portion of the dry shaver 11. Preferably the connecting rod 115 is molded from a suitable material such as nylon so as to be hollow from end to end thereof as indicated at 116 in Fig. 7 of the drawings. This space within the hollow connecting rod is preferably packed with grease, thereby to eliminate the requirement of oiling the connecting rod bearings for many years and assuring efficient and trouble-free operation with a minimum of friction.

In order to support the cutter 12 upon the cutter shaft 99 for oscillating movement therewith, the cutter shaft 99 is provided with four upwardly extending supports 120a, 120b, 120c and 120d arranged in spaced parallel relationship along the cutter shaft and having the lower ends thereof rigidly fastened to the cutter shaft so as to provide a unitary cutter supporting structure. The upper ends of the spaced cutter supports 120 are of forked construction, each being provided with a slot 121 best shown in Fig. 5 of the drawings.

For the purpose of resiliently supporting the cutter 12 within the slots 121 in the spaced supports 120 there is provided a resilient spring member 123 in the form of a wire of spring mate-

rial deformed to a somewhat U-shaped configuration having the bight portion parallel with the cutter shaft 99 and extending through suitable openings defined in the two center cutter supports 120b and 120c. The leg portions of the deformed spring wire 123 extend up toward the free ends of the end cutter supports 120a and 120d and are disposed in the slots 121 in these supports. With this arrangement the ends 123a are parallel with the cutting blade 12 and resiliently support the same in a manner to aid centrifugal force in biasing the cutter against the comb 14. It will be apparent that the wire-like spring member 123 is simple to manufacture, easy to assemble and yet is substantially fool-proof in operation.

It will be apparent that the slots 121 properly position the cutting blade 12 in a direction perpendicular to the axis of the cutter shaft 99. For the purpose of properly orientating the cutter 12 in the direction of the axis of the cutter shaft 99 before the comb 14 is in position, the cutter 12 is provided with depending projections 12a spaced so as to be disposed between the two central supports 120b and 120c. These projections 12a are guided by the adjacent faces of the supports 120b and 120c.

To insure proper balance of the movable portions of the cutter head assembly the support 120d which is illustrated as the support adjacent the commutator end of the motor is provided with a downwardly extending portion 130 to which is suitably attached a counterweight 131. The horizontal portion of the bearing head 91 beneath the counterweight 131 is preferably provided with a recess 91d for receiving the same and permitting movement thereof in response to oscillations of the cutter shaft 99. It will be understood that the centrifugal force produced as a result of high speed oscillation of the cutter 12 will cause it to be forced against the inside surface of the comb 14 in shearing engagement therewith in accordance with the principle set forth in United States Letters Patent 2,081,694 granted May 25, 1937. This centrifugal force is of course combined with the force of the spring 123.

Except for the fact that the comb 14 of the present invention presents more than twice the cutting area of the comb disclosed and claimed in United States Letters Patent 2,234,891, it is similar thereto in most respects. As illustrated the comb 14 comprises a cutting surface 124 formed of very thin flexible material perforated by one or more punching operations with a large number of hair receiving openings 125 particularly well adapted for receiving short beard hairs, and a plurality of elongated slots 126 having serrations or teeth along the edges thereof for receiving long loose hairs. The area provided with the openings 125 and slots 126, best shown in Fig. 3 of the drawings comprises the cutting area which area defines a substantial portion of the casing surface and smoothly conforms thereto. Flanking the cutting area are a plurality of openings 127 effectively disposed adjacent the lower end of the cutting chamber which are hair discharge openings. These openings are relatively large.

Since the cutting surface 124 of the comb 14 is formed of relatively thin material it tends to conform itself to the shape of the surface with which it is in contact and therefore must be supported by a suitable supporting structure or frame generally designated at 129 comprising a plurality of parallel arcuate ribs 129a, spaced from one

another in a direction along the longitudinal axis of the cutter blade 11 and each terminating in parallel horizontally extending frame portions 129b. The ribs 129a are uniformly spaced except adjacent the slots 126 where closer spacing for satisfactory support is necessary. The cutting surface portion 124 of the comb 14 is suitably riveted as indicated at 130 to the comb frame portions 129b so as to provide a relatively rigid removable unit which may be cleaned and is sufficiently sturdy so as not to be damaged when handled in a normal manner in use.

In order that the cutter 12 may make shearing contact with the inner surface of the arcuate shaped comb 14 without interfering with the ribs 129a, the cutter blade 12 is provided with a plurality of notches 12b for receiving the arcuate or curved ribs 129a as is clearly shown in Figs. 4 and 9 of the drawings. These notches 12b and cooperating ribs 129a aid in supporting the cutter blade in its oscillating movement and it will be apparent that the guide extensions 12a are really only required during the assembly operation of the cutter until the comb 14 and comb frame 129 are associated with the dry shaver 11.

As has been mentioned above the comb 14 is supported on the arcuate portions 96 and 105 of the head assembly 90. The four corners of the arcuate comb 14 are furthermore notched out as indicated at 132 to cooperate with extensions 133 of the head assembly thereby properly positioning the comb on the head assembly 90.

To secure the comb 14 in position on the shaver 11, there are provided a pair of comb locks 135, one disposed on either side of the head assembly 90. The lower edge of each of the comb locks 135 is provided with a longitudinally extending hook-shaped portion 135a for engaging with the corresponding hook-shaped portion 86a of the comb lock spring 86 in a manner to provide a sort of hinged support whereby the comb locks 135 may be pivoted between the closed position shown in Fig. 5 to the open and hair removing position shown in Fig. 8 of the drawings. The upper edge of each of the comb locks 135 is provided with a plurality of latch extensions 136 adapted to be received within cooperating openings 137 defined in the comb structure to maintain the comb in assembled position on the cutter assembly in a readily releasable manner for cleaning purposes as was mentioned above.

For the purpose of protecting the cutting surface when the electric dry shaver is not in use a comb guard 140 shown in Fig. 2 of the drawings may be employed which is adapted to clip on to the dry shaver in a readily releasable manner.

In view of the detailed description included above, the operation of the electric dry shaver described above will be apparent to those skilled in the art. It will furthermore be apparent that a dry shaver has been described comprising readily assembled parts each of very sturdy construction which will give long and foolproof operation. Provision is made for oiling the moving parts, but actually years of service of the device may be had without the requirement of any lubrication thereof. By arranging the motor shaft and cutter shaft in spaced parallel and substantially co-extensive relationship a very compact assembly is provided which may be disposed in a small rectangular casing of a shape capable of being comfortably held in the hand of an operator in a manner to avoid strain or fatigue in use. By more than doubling the cutting area which actually conforms with the casing surface in a

pleasing manner and comprises a substantial area thereof, shaving time has been found by actual test by a considerable number of users to be decreased anywhere from thirty to fifty per cent. Furthermore by virtue of the parallel arrangement of the motor and cutter shafts and the crank interconnections thereof there is provided an arrangement for converting rotary motion of the rotor to oscillating motion of the cutter 12 with greatly reduced friction so that speeds of the order of 8,000 revolutions per minute of the motor 15 can readily be maintained with many years of trouble-free service.

While only a single embodiment of the present invention has been shown, it will be understood that various changes and modifications will occur to those skilled in the art, and it is contemplated in the appended claims to cover all such changes and modifications as fall within the true spirit and scope of the present invention.

What is claimed as new and desired to be secured by Letters Patent of the United States is:

1. A shaver comprising a casing in the shape of a rectangular solid having an arcuate comb defining the major portion of one side of said casing which side extends in the direction of the maximum dimension of said casing, a motor having a rotatable shaft mounted in said casing with said shaft disposed parallel with the longitudinal axis of said comb, a head rigidly secured to said motor to define a pair of spaced bearings adjacent each end of said motor, a cutter shaft coextensive with said motor shaft mounted for oscillatory movement in said bearings in spaced parallel relationship with said motor shaft, said parallel shafts being spaced a minimum distance apart determined by the dimensions of said motor to produce a compact structure, an elongated cutter blade supported for movement by said cutter shaft across the inner surface of said comb in shearing engagement therewith, a first crank arm rotatable with said motor shaft, a second crank arm movable with said cutter shaft, and a connecting rod interconnecting said crank arms for converting rotary motion of said motor shaft to oscillating movement of said cutter blade.

2. A shaver comprising a casing in the shape of a rectangular solid having an arcuate comb defining the major portion of one side of said casing which side extends in the direction of the maximum dimension of said casing, a motor having a rotatable shaft mounted in said casing with said shaft disposed parallel with the longitudinal axis of said comb, a cutter shaft mounted for oscillatory movement in said casing in spaced parallel relationship with said motor shaft, an elongated cutter blade supported for movement by said cutter across the inner surface of said comb in shearing engagement therewith, a first crank arm rotatable with said motor shaft, a second crank arm movable with said cutter shaft, and a hollow insulating connecting rod formed of nylon interconnecting said crank arms for converting rotary motion of said motor shaft to oscillating movement of said cutter blade, the space within said hollow connecting rod being adapted to be filled with grease to supply lubrication for the bearings at the ends of said connecting rod.

3. An electric dry shaver comprising a rectangular casing, an elongated cutting blade mounted in said casing for movement relative to said casing, a motor in said casing having a shaft disposed in spaced parallel relationship

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with the longitudinal axis of said cutting blade and substantially coextensive therewith, a head rigidly secured to said motor including bearing supports at each end of said motor, a cutter shaft mounted for pivotal movement in said bearing supports disposed in spaced parallel relationship with said motor shaft, said cutting blade being supported by said cutter shaft, said cutter shaft and said motor shaft being spaced from each other a minimum distance determined substantially solely by the dimensions of said motor, and means drivingly interrelating said motor shaft and said blade.

4. A shaver comprising a casing of rectangular configuration having a thickness of about one inch and a width and height of dimensions relatively similar to each other and at least twice said thickness so as readily to be cupped within the hand of the operator in a loosely held and comfortable manner, cutting means including a movable cutting blade and a cooperating skin engaging cutting surface extending along most of one edge of the maximum dimension of said casing to provide a cutting surface of between one and one and one half square inches, said cutting blade extending substantially parallel with the long dimension of said one edge, an electric motor mounted in said casing having a shaft extending in the direction of the maximum dimension of said casing parallel with said cutting blade and coextensive therewith, and means interconnecting said motor and said cutting blade for converting rotary motion of said motor to oscillating movement of said cutting blade.

5. In an electric shaver, a subassembly comprising a motor and a cutting head including a movable blade supporting means and means drivingly interconnecting said motor and said blade supporting means, a casing comprising a pair of end caps and a cup-shaped member, said subassembly being positioned within said cup-shaped member with substantially only said cutting head protruding therefrom, said end caps having portions interfitting with both said cup-shaped member and said cutting head, and means for holding said subassembly in said cup-shaped member whereby said end caps are held in fixed position relative to said cutting head and cup-shaped member.

6. In an electric shaver, a subassembly comprising a motor and a cutting head including a movable blade supporting means and means drivingly interconnecting said motor and said blade supporting means, a casing comprising a pair of end caps and a cup-shaped member each formed of a suitable insulating material, said subassembly being positioned within said cup-shaped member with substantially only said cutting head protruding therefrom, said end caps having portions interfitting with both said cup-shaped member and said cutting head, and means engaging the closed end of said cup-shaped member for holding said subassembly in said cup-shaped member whereby said end caps are held in fixed position relative to said cutting head and cup-shaped member.

7. In an electric shaver, a subassembly comprising a motor and a cutting head including a movable blade supporting means and means drivingly interconnecting said motor and said blade supporting means, a casing comprising a pair of end caps and a cup-shaped member, said subassembly being positioned within said cup-shaped member with substantially only said cutting head protruding therefrom, said end caps hav-

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ing portions interfitting with both said cup-shaped member and said cutting head, means for holding said subassembly in said cup-shaped member whereby said end caps are held in fixed position relative to said cutting head and cup-shaped member, a cutter blade supported for oscillating movement by said cutting head between said end caps and an arcuate member supported on said cutting head in shearing engagement with said cutter blade, said arcuate member with said cup-shaped member and end caps effectively defining a complete casing of generally rectangular configuration.

8. An electric dry shaver comprising a rectangular casing, a cutter shaft mounted in said casing for movement relative to said casing, an elongated cutting blade, means for supporting said cutting blade on said cutter shaft and in spaced parallel relationship therewith, a motor in said casing having a shaft disposed in spaced parallel relationship with the longitudinal axis of said cutting blade and substantially coextensive therewith, said cutter shaft being pivotally supported in support means rigidly connected to either end of said motor, said motor shaft and cutter shaft being spaced apart a distance determined solely by the maximum dimensions of the structure of said motor, a pair of crank arms one associated with said motor shaft and the other with said cutter shaft, and a connecting rod interconnecting said crank arms.

9. An electric dry shaver comprising a rectangular casing, a cutter shaft mounted in said casing for movement relative to said casing, an elongated cutting blade, means for supporting said cutting blade on said cutter shaft and in spaced parallel relationship therewith, a motor in said casing having a shaft disposed in spaced parallel relationship with the longitudinal axis of said cutting blade and substantially coextensive therewith, a head rigidly supported on said motor and including bearing means at either end thereof corresponding to either end of said motor, said cutter shaft being mounted in said bearings whereby said cutter shaft is effectively mounted as an integral unit with said motor, a pair of crank arms one associated with said motor shaft and the other with said cutter shaft, means comprising suitable counterweights associated with said cutter shaft and motor shaft, and a connecting rod interconnecting said crank arms.

10. An electric dry shaving device in the form of a rectangular solid with a thickness of between seven-eighths of an inch and one and one-quarter inches, and the other dimensions each at least twice said thickness, a rotating electric motor comprising a major portion of said rectangular solid, a shaft for said motor extending for substantially the full length of one of said other dimensions, a cutting mechanism including a movable cutter shaft disposed parallel to and coextensive with said motor shaft, means rigidly supported by said motor for supporting said cutter shaft at either end thereof, said motor shaft and said cutter shaft being spaced from each other a minimum distance limited by the dimensions of said motor, a casing for said device housing said motor and said cutting mechanism, and means extending within and along one end of said casing and along one end of said motor for drivingly connecting said cutter and said motor.

11. A shaver comprising a casing in the shape of a rectangular solid having an arcuate comb defining the major portion of one side of said

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casing, which side extends in the direction of the maximum dimension of said casing, a motor having a rotatable shaft mounted in said casing with said shaft disposed parallel with the longitudinal axis of said comb, a cutter shaft mounted for oscillatory movement in said casing in spaced parallel relationship with said motor shaft, an elongated cutter blade supported for movement by said cutter across the inner surface of said comb in shearing engagement therewith, a first crank arm rotatable with said motor shaft, a second crank arm movable with said cutter shaft, and a nylon connecting rod interconnecting said crank arm for converting rotary motion of said motor shaft to oscillating movement of said cutter blade.

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References Cited in the file of this patent
UNITED STATES PATENTS

	Number	Name	Date
	1,551,654	Garman -----	Sept. 1, 1925
5	2,100,135	Florman -----	Nov. 23, 1937
	2,205,590	Bowman -----	June 25, 1940
	2,220,911	Khalil -----	Nov. 12, 1940
	2,234,891	Bruecker -----	Mar. 11, 1941
10	2,247,661	Moskovics et al. -----	July 1, 1941
	2,282,725	Jepson -----	May 12, 1942
	2,284,038	Bruecker -----	May 26, 1942
	2,323,745	Wilderboor -----	July 6, 1943
	2,331,500	Rand, Jr. -----	Oct. 12, 1943
15	2,345,263	Jepson -----	Mar. 28, 1944
	2,530,302	Jepson -----	Nov. 14, 1950