Dec. 13, 1966 I. JEPSON ETAL 3,290,776

ELECTRIC DRY SHAVER WITH COMMON SHAFT FOR CUTTER AND MOTOR

Original Filed Dec. 21, 1962 3 Sheets-Sheet 1

Fig. 1

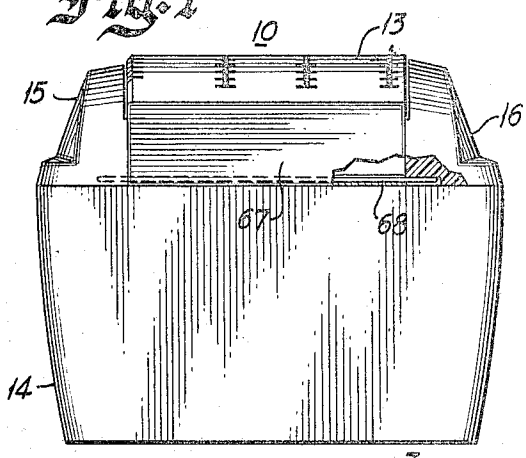
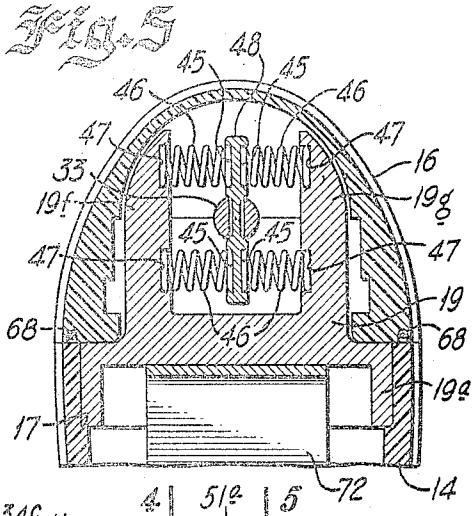


Fig. 3



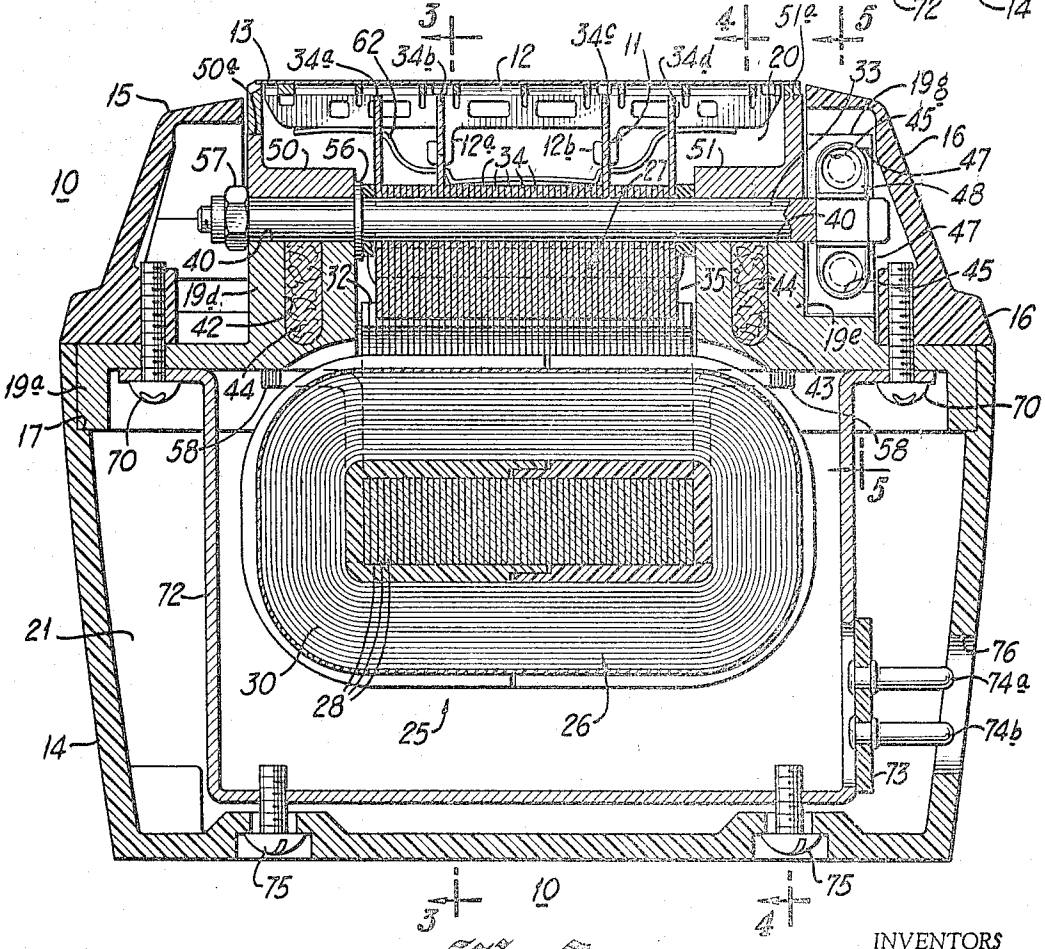


Fig. 2

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Fig. 3

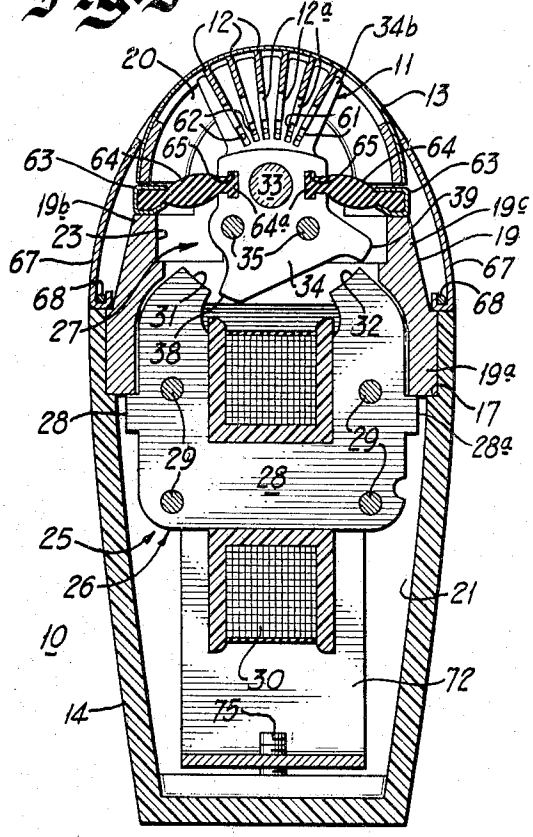
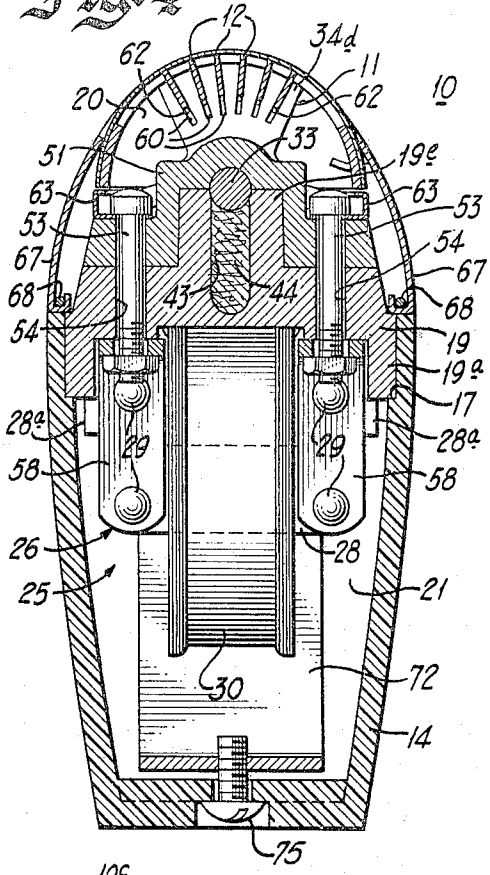


Fig. 4



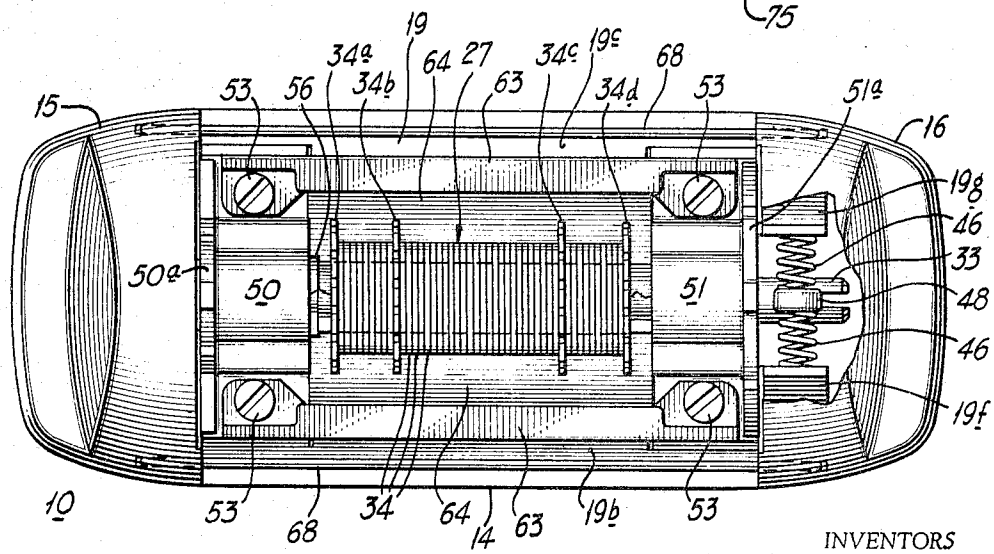


Fig. 5

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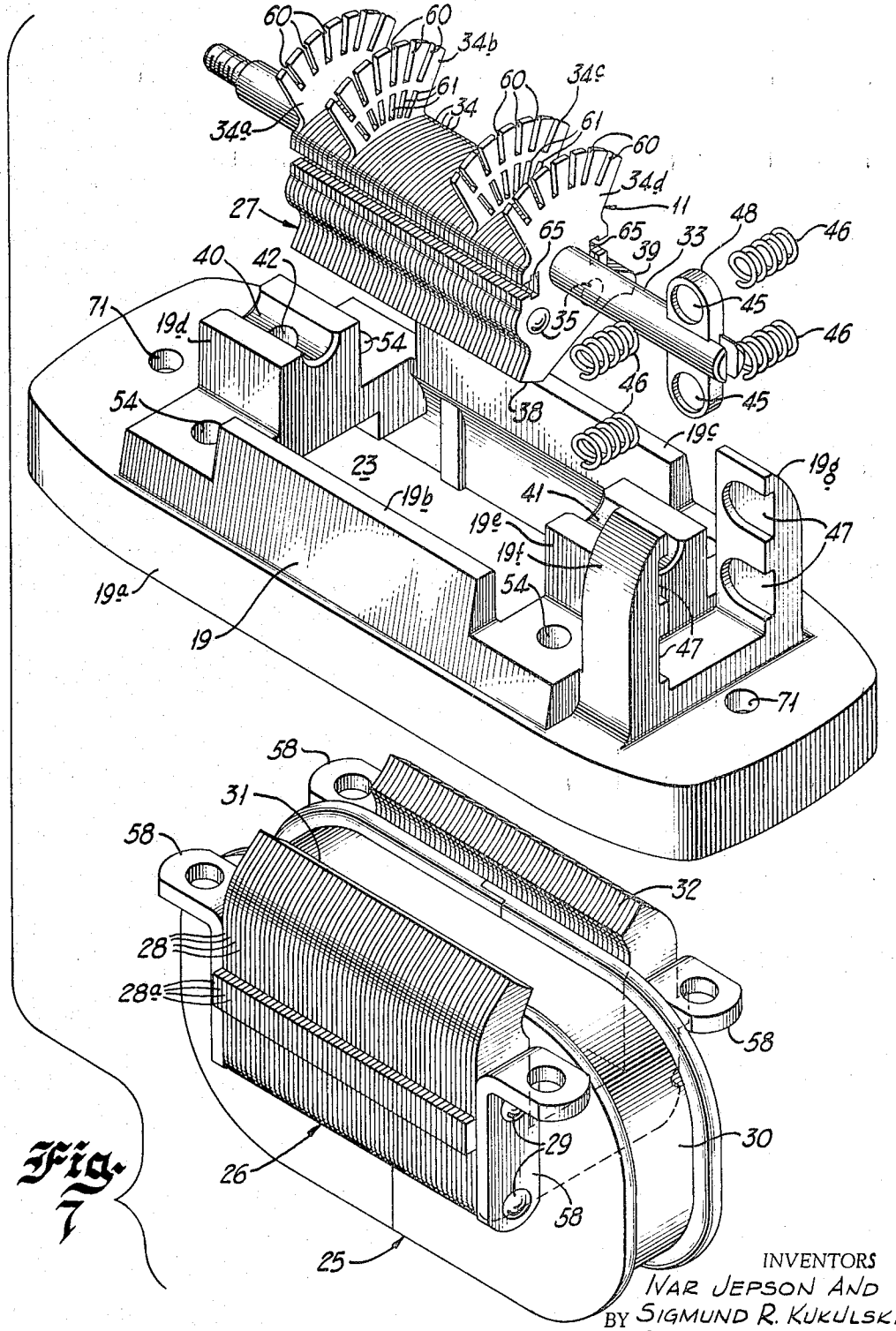

Fig. 7

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ELECTRIC DRY SHAVER WITH COMMON SHAFT FOR CUTTER AND MOTOR

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Original application Dec. 21, 1962, Ser. No. 246,488, now Patent No. 3,213,301, dated Oct. 19, 1965. Divided and this application Apr. 6, 1965, Ser. No. 445,973

5 Claims. (Cl. 30—43.9)

This application is a division of copending Jepson et al. application Serial No. 246,488, filed December 21, 1962, now Patent No. 3,213,301, granted October 19, 1965, and assigned to the same assignee as the instant application. The present invention relates to apparatus for removing beards or face hair as well as for removing hair from arms, legs and other portions of the human body. Such apparatus is generally referred to as an electric dry shaver.

For many years electric dry shavers, very similar to that disclosed in Jepson Patent No. 2,797,479, granted July 2, 1957, and assigned to the same assignee as the instant application, had been extensively sold on the market. The electric dry shaver of the above-mentioned Jepson patent is one in which the hair to be removed, such as the beard, enters the cutting area through a network of small holes in a curved perforated comb. An oscillating cutter comprising a parallel blade travels back and forth across the comb at high speed and is thrown by centrifugal force against the inside surface of the comb, thus providing a very satisfactory cutting action with the comb. The cutter blade floats in a cutter head and shaft assembly that is oscillated by a powerful electric motor, with the cutter blade oscillating at a frequency in excess of seven thousand cycles per minute. An electric motor of the rotary type is mounted within the casing, and the cutter mechanism includes an oscillating shaft. A suitable means for converting rotary motion of the motor shaft to oscillating motion of the cutter shaft is provided and drivingly interconnects the motor and the cutter mechanism. Separate bearings for the motor shaft and for the oscillating cutter shaft are provided. It would be desirable to provide an arrangement in which one set of these bearings could be eliminated, and, in fact, an arrangement in which the oscillating cutter shaft also becomes the shaft about which the armature of the motor moves. With such an arrangement the manufacturing cost is greatly reduced and the assembly operation is substantially simplified.

It will be appreciated that in a shaver in which the cutting blade or blades are oscillated, the blades must come to a complete stop at each end of the stroke and then movement in the opposite direction must take place. This means that at each end of the stroke it is necessary for the prime mover to supply the necessary energy to overcome this inertia of the moving parts which are momentarily at a standstill. It would be desirable to provide an arrangement wherein it is unnecessary for the prime mover to supply this energy twice during each cycle to overcome the inertia of the blade assembly at the ends of the oscillating stroke to move this assembly in the opposite direction. Accordingly, it is desirable to provide an energy storage arrangement whereby energy stored during a portion of the operating stroke is released to overcome the inertia due to momentary stoppage of the moving cutter parts. It would also be desirable to provide some sort of resilient stopping means whereby the blade assembly is cushioned to a stop at each end of its stroke.

In an oscillating shaver such as is disclosed in the above-mentioned Jepson patent there is effectively provided a motor chamber and a cutter chamber which are separated by a wall-like member. Since the driving connections between the motor and cutter mechanism are disposed outside the cutter chamber, no problem exists with respect to having hair received in the cutter chamber passing into the motor chamber. Since it is desirable, as set forth above, to have the armature shaft and oscillating cutter shaft coincident or, in other words, having a common armature and cutter shaft, it is quite obvious that there must be a connection between the motor and cutter chambers. It would, therefore, be desirable to provide an improved means for preventing hair from entering the motor chamber. It would furthermore be desirable to eliminate the maximum number of parts while still retaining the same cutting functions whereby a very inexpensive and yet very efficient construction is obtained.

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 a dry shaver of the type employing an oscillating cutting mechanism driven by an electric motor in which only a single shaft for both the motor and the cutting mechanism is employed.

It is another object of the present invention to provide an electric shaver of the type employing an oscillating cutter wherein cutter blades are supported on extensions of the armature laminations.

Still another object of the present invention resides in the provision of an electric dry shaver having an oscillating motor wherein the oscillating armature directly supports one or more cutting blades.

It is a further object of the present invention to provide an electric dry shaver of the oscillating type wherein the requirement to overcome the inertia of the cutter blade assembly at each end of its stroke when the direction of motion is changed is eliminated and, instead, stored energy is utilized to act as a cushioned stop and, moreover, this stored energy overcomes the inertia with respect to movement in the opposite direction.

It is a further object of the present invention to provide an improved electric dry shaver which is very simple and compact, which can be manufactured and assembled at a greatly reduced cost and which will give years of trouble-free service.

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 side elevational view of an electric dry shaver embodying the present invention with a portion thereof cut away more clearly to illustrate the invention;

FIG. 2 is an enlarged longitudinal sectional view of the shaver shown in FIG. 1;

FIG. 3 is a sectional view taken on line 3—3 of FIG. 2 assuming that FIG. 2 shows the complete structure;

FIG. 4 is a sectional view taken on line 4—4 of FIG. 2, again assuming that FIG. 2 shows the complete structure;

FIG. 5 is a fragmentary sectional view taken on line 5—5 of FIG. 2, also assuming that FIG. 2 shows the complete structure;

FIG. 6 is an enlarged top plan view of the shaver of FIG. 1 with the comb, comb locks and cutting blades removed, and with certain portions of the shaver cut away more clearly to illustrate the present invention; and

FIG. 7 is an exploded perspective view of parts of the electric dry shaver of the present invention omitting the casing and those parts omitted in FIG. 6.

The present invention is concerned with an arrangement in which an oscillating shaft is supported for oscillation on

a suitable support member. Moreover, this oscillating shaft supports a motor armature comprising a number of laminations, a few of which project upwardly to support cutter blades. A field structure is adapted to be mounted on the support member so that the entire motor and cutting mechanism is a simple compact mechanism mounted on a support in a subassembly which can readily be associated as a unit with a shaver housing. Moreover, energy storage means are provided which are associated with the oscillating shaft so that energy is stored and released by this energy storage means as the motor is operated whereby a motor of relatively low power output is sufficient and greatly increased efficiency of operation results. In a specific embodiment this energy storage means comprises springs which tend to move the oscillating shaft to a central or homing position.

Referring now to the drawings, the electric dry shaver embodying the present invention is generally designated by the reference numeral **10**. The external appearance of the shaver, the construction of the perforated comb and cutting blades, and the means for biasing the cutting blades into engagement with the comb form no part of the present invention and may be similar to or identical with that disclosed in a copending Jepson and Schuessler application, Serial No. 109,551, filed May 12, 1961, now Patent No. 3,196,539, granted July 27, 1965, and assigned to the same assignee as the present application. The present invention is essentially concerned with the motor and cutter supporting and oscillating mechanism. Essentially, the shaver **10** comprises the cutting mechanism generally designated at **11**, including a plurality of cutting blades **12**, six of them being shown in the drawings, although, obviously, a greater or lesser number of blades may be employed. The blades **12** coact with a comb or stationary cutting member **13**, which latter may be identical with those disclosed in the above mentioned Jepson patent or Jepson and Schuessler copending application. The comb and cutting mechanism are associated with a suitable casing comprising three parts on portions **14**, **15** and **16** (designated hereinafter as casing members or sections), the comb **13** preferably comprising a substantial portion of the surface of the casing. The portion **14** of the casing is preferably a cup-shaped member open at the top and provided with a circumferential ledge or shoulder **17** around the inside surface near the open end thereof, this ledge or shoulder being a predetermined distance down from the open end. The casing members **15** and **16** are commonly referred to as end caps. The casing for the electric shaver comprising portions or sections **14**, **15** and **16** is preferably of boxlike configuration so that it may readily be held in the hand of the user. It is preferably molded from a suitable plastic material.

In accordance with the arrangement disclosed in Jepson et al. application Serial No. 322,795, filed November 12, 1963, the shaver **10** includes a support or chassis member **19** (also designated as a frame or frame member) to which the motor described hereinafter and the cutting mechanism or assembly **11** are mounted in the manner described hereinafter. The support or chassis member **19** may be a molded insulating support or, as in a device built in accordance with the present invention, may comprise a die casting of light metal such as zinc. This support or chassis member **19** includes a peripheral portion **19***a* having such a configuration as to be snugly received in the open end of cup-shaped casing member **14** so as to rest on the ledge or shoulder **17**, as clearly shown in FIGS. 2, 3, 4 and 5 of the drawings. When the support or chassis member **19** is disposed in the casing portion **14** as described above, it divides the shaver housing into two chambers—an upper cutting chamber **20** and a lower chamber which houses at least a portion of the motor to be described hereinafter, and hence may be referred to as a motor chamber **21**. As illustrated, the support or chassis member **19** is provided with a pair of spaced, parallel, longitudinal extending, raised side members **19***b* and **19***c* projecting upwardly from the portion **19***a* thereof, and also a pair of spaced upwardly projecting end members **19***d* and **19***e*, these members **19***b*, **19***c*, **19***d* and **19***e* effectively defining the boundaries of an opening **23** between the chambers **20** and **21**.

As was pointed out above, the present invention contemplates that the oscillating cutter shaft and motor shaft heretofore required are combined into a single shaft element. In other words, the cutter mechanism **11** and the prime mover or electric motor for oscillating the cutter mechanism are combined to eliminate certain elements. Before completing the description of the details of the frame or chassis member **19**, consideration will be given to the electric motor incorporated in the shaver **10** which motor is generally designated by the reference numeral **25**. The motor **25** is a simple compact motor with no brushes or contacts which could cause radio or television interference. As illustrated, it is a powerful resonant motor comprising a field structure **26** and an armature structure **27**. The field structure, as best shown in FIGS. 2, 3, 4 and 7 of the drawings, comprises a plurality of U-shaped laminations **28** which are held together in an assembled stack by suitable rivets **29**. A suitable field winding **30** encloses the bight portions of the assembled U-shaped laminations **28**. The ends of the arms of the U-shaped laminations have a somewhat arcuate configuration to define spaced pole faces **31** and **32** extending along the entire length of the assembled field structure **26**, as best shown in FIG. 7 of the drawings. The pole faces **31** and **32** are preferably concentric with a combined armature and cutter shaft **33** supporting a plurality of armature laminations **34** held in assembled relationship by suitable rivets **35**. The armature **27** comprising the assembled armature laminations **34** is disposed within the air gap defined between the pole faces **31** and **32**. The portion of the armature structure **27** adjacent the pole faces **31** and **32** and effectively within the field air gap functions as the motor armature and provides a low reluctance flux path between the pole faces **31** and **32**. Consequently, the lower portion of the armature **27** is provided with cooperating pole faces **38** and **39** which are substantially coextensive with the pole faces **31** and **32**, respectively. The combined armature and cutter shaft **33** supports the armature **27** for oscillating movement between the pole faces **31** and **32**, energization of the winding **30** tending to move the armature pole faces into alignment with the field pole faces.

In accordance with the present invention, the armature **27** is adapted to be disposed in the opening **23** in the support or chassis member **19**, and the upper surfaces of the projections **19***d* and **19***e* are provided with semi-cylindrical cavities **40** and **41**, respectively, to function as lower bearing portions for the oscillating shaft **33**. For lubrication purposes, the projections **19***d* and **19***e* are preferably provided with recesses **42** and **43**, respectively (FIG. 2), for receiving suitable wicking **44**, preferably saturated with a suitable lubricant. Any suitable means may be employed for securing the assembled laminations **27** to the oscillating shaft **33**. This may comprise a press fit, a keyed arrangement or the like.

For the purpose of providing a normal or rest position of the armature **27**, and also to provide energy storage means for storing energy from the electric motor and then releasing this energy during the oscillating stroke of the cutting means, one end of the shaft **33** is bifurcated so as to receive therein a rocker bar **48** having a pair of spaced recesses **45** on each side thereof. These recesses are each adapted to receive one end of an energy storage means in the form of a coiled compression spring **46**, as best shown in FIGS. 5 and 7 of the drawings. Preferably these energy storage means are accurately calibrated to have a natural frequency of vibration of the order of the frequency of the alternating current supplied to winding **30**. The other ends of these springs **46** are supported in

opposed recesses 47 defined in adjacent faces of projections 19*f* and 19*g* extending upwardly and integrally formed with the frame or chassis member 19. The recesses 47 are open on the side thereof remote from the opening 23 so that the armature shaft 33 with the armature assembled thereon as well as the rocker bar 48 assembled therewith may be placed into position with the springs having adjacent ends thereof disposed in the recesses 45. The other ends of these springs may then readily be inserted in recesses 47 through the open sides of these recesses.

The normal or at rest position of the armature 27 is best shown in FIG. 3 of the drawings wherein the pole faces 38 and 39 thereof are completely out of registry with the pole faces 31 and 32 of the field structure. Upon energization of the winding 30 it will be apparent that the armature 27 will be attracted until the pole faces of the armature are in substantial registry with the pole faces of the field structure. It will be apparent that the motor 25 will operate at double the frequency of the alternating current supply, so that with a sixty cycle current supply to winding 30, the armature 27 and associated cutting mechanism will oscillate at 7200 cycles per minute.

In order to maintain the armature and associated shaft 33 within the lower bearing portions 40 and 41 and to hold the same in assembled relationship with the frame or chassis member 19, there are provided end bearing portions 50 and 51 which are suitably clamped to the chassis member 19 as by fastening means 53 which extend through aligned openings in the end bearing portions 50 and 51 and in the chassis 19, the latter openings being designated by the reference numeral 54.

For properly maintaining the combined motor and armature shaft 33 in a predetermined longitudinal position with respect to the bearing portions 40 and 41, the shaft 33 is preferably provided with a washer receiving recess for receiving a suitable washer 56 (FIGS. 2 and 6) which engages one end of the bearing defined by end bearing portion 50 and the upwardly projecting abutment 19*d*, as clearly shown in FIG. 2 of the drawings. Preferably, the end of the shaft 33 adjacent end bearing portion 50 is threaded to receive a suitable nut 57, thus determining the longitudinal position of the shaft 33.

To support the field structure 26 from the frame or chassis member 19, suitable L-shaped brackets 58 are secured to the ends of the field laminations 28 by the rivets 29, and the same fastening means 53 which hold the end bearing portions 50 and 51 in assembled relationship also hold the field structure in the assembled relationship shown in FIGS. 3 and 4 of the drawings. Preferably the field laminations 28 are provided with projections 28*a* (FIGS. 3 and 7) whereby these projections abut against the lower edge of chassis member 19, thus positioning the field structure relative to this frame or chassis member.

For the purpose of supporting the cutter blades 12, particular laminations of the armature structure 27 are designed somewhat differently from the remaining laminations so as to provide blade supporting portions. These laminations are specifically designated as 34*a*, 34*b*, 34*c* and 34*d*, and each comprises an upwardly directed segmental projection having a plurality of spaced notches 60, open at the top, disposed therein. These notches are disposed on radii of the axis of the shaft 33 and the same number of notches 60 and the identical spacing thereof are provided in each of the upwardly projecting portions of the laminations 34*a*, 34*b*, 34*c* and 34*d*. The number of these notches depends upon the number of cutting blades 12 employed, since these notches are designed to receive the cutting blades therein. In the above-mentioned Jepson patent, only a single notch for supporting a single blade was employed in each support, while in the copending Jepson and Schuessler application mentioned above three notches in each support were provided for supporting three blades. In the illustrated embodiment of the present invention six notches for supporting six blades in spaced relationship are illustrated. The projecting supports of the laminations 34*b* and 34*c* in addition to the notches 60 are provided with an equal number of slots or openings 61 to cooperate with locking means 12*a* and 12*b* provided on each cutting blade 12 in a manner fully described in the above-mentioned copending Jepson and Schuessler application. Additionally, the slots 61 receive and retain therein the central or bight portions of somewhat U-shaped wirelike spring members 62 which have lateral projections from the ends of the legs of the U extending into the slots 60 of end laminations 34*a* and 34*d*. These springs 62 bias the cutting blades 12 toward the comb 13 and may be identical with those disclosed in the above-mentioned copending Jepson and Schuessler application. The particular construction of the springs 62, the blades 12 and the comb 13 forms no part of the present invention, and hence no further discussion thereof is included herewith except to mention that in order to support the comb 13 in the conventional manner the end bearing portions 50 and 51 are each provided with comb supporting projections 50*a* and 51*a*, respectively, which function in the identical manner of similar elements in the above-mentioned Jepson patent or copending Jepson and Schuessler application.

From the above description it will be apparent that during the cutting action of the cutting mechanism 11 hair will enter the cutting chamber 20, and this hair could enter the motor chamber 21 through the opening 23 unless additional means are provided to prevent this. To this end there are provided a pair of somewhat U-shaped hair seal brackets 63 (FIGS. 3, 4 and 6) which are held in position by the fastening means 53. These hair seal brackets are elongated U-shaped members for clampingly engaging one long edge of an elongated hair seal such as 64, one being provided on either side of armature 27 and clamped by a corresponding one of said brackets 63. Moreover, the armature 27, and specifically the laminations thereof, are provided on each side with a T-shaped slot 65 for receiving therein the T-shaped end 64*a* of the associated hair seal 64, as best shown in FIGS. 3 and 7 of the drawings. The hair seals 64 are preferably formed of a neoprene foam rubber.

As in the above-mentioned Jepson patent or the copending Jepson and Schuessler application, the comb 13 is securely held in position on the supporting portions 50*a* and 51*a* of end bearing portions 50 and 51, respectively, by comb locks 67 in a manner well understood by those skilled in the art. The comb locks are pivoted by suitable hinge pins 68, which hinge pins may be held in position in any suitable manner. As best shown in FIG. 6 of the drawings, the hinge pins 68 are disposed in suitable recesses in end caps 15 and 16, respectively. It will be apparent that the comb locks 67 also provide access to the cutter chamber 20, and provide a ready means through which collected cuttings may be removed from this chamber.

From the above description it will be apparent that the cutting mechanism 11 and the electric motor 25 are secured to the chassis or frame member 19 to provide a subassembly. As illustrated in the drawings, the end caps 15 and 16 may be secured to this subassembly by suitable fastening means 70 (FIG. 2) which extend through suitable openings 71 (FIG. 7) in the chassis member 19 and engage tapped openings in the respective end caps 15 and 16.

For the purpose of securing this subassembly to the casing section 14, there is preferably provided a U-shaped chassis bracket 72, best shown in FIG. 2 of the drawings, which is secured to the subassembly by the same fastening means 70. This chassis bracket 72 may suitably support a terminal board assembly 73 supporting suitable terminals 74*a* and 74*b*, which are electrically connected to the motor winding 30 in a well understood manner. The subassembly including the bracket 72 is then inserted into casing section 14 so that the chassis member 19 rests on the ledge 17 and the subassembly may be secured

into position by suitable fastening means 75 extending through openings in casing section 14, as best shown in FIGS. 2 and 4 of the drawings, and threadedly engaging tapped openings in the chassis bracket 72. The casing section 14 will be provided with a suitable recess or opening 76 adjacent the terminals 74*a* and 74*b*, whereby a suitable power cord can readily be connected to these terminals through the opening 76.

In view of the detailed description included above, the operation of the electric shaver described above will readily be understood by those skilled in the art. Upon energization of the winding 30, with an alternating current, the alternating flux emanating between the pole faces 31 and 32 will cause the armature 34 to oscillate, and alternately the springs 46 will have energy stored therein and will give up this energy to the cutting mechanism 11. It will be apparent, moreover, that the armature itself directly supports the cutting blades, and with this arrangement a single oscillating shaft acts both as the oscillating cutter shaft and as the armature shaft. Preferably, the natural frequency of vibration of the energy storage devices 46 is chosen to be closely akin to that of the frequency of oscillation of the motor 25. By virtue of employing six cutting blades, cutting action occurs over a large area of the comb 13 even with a small oscillating stroke. It should be understood that the energy storage devices 46, instead of comprising springs, might comprise some other suitable means such as rubber or the like, as disclosed in copending Jepson application Serial No. 237,239, filed November 13, 1962, now Patent 3,206,850, granted September 21, 1965, and assigned to the same assignee as the instant application. Moreover, instead of providing separate energy storage devices associated with a rigid shaft 33, the shaft itself might comprise both the shaft and the energy storage device, and the torsion or deflection of the shaft might be directly employed. So that the deflection of the shaft does not affect movement of the cutters away from the comb, such a shaft should preferably be rigid as far as deflection toward or away from the comb 13 is concerned, but should be flexible in a lateral direction.

While there have been illustrated and described several embodiments of the present invention, it will be apparent to those skilled in the art that various changes and modifications may be made without departing from the invention in its broader aspects, and it is, therefore, contemplated in the appended claims to cover all such changes and modifications as fall within the true spirit and scope of the invention.

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

1. An electric shaver comprising a casing, a cutting head associated with said casing including an oscillating shaft, an electric motor comprising an oscillating armature, said armature being supported on said shaft whereby said shaft is common to both said cutting head and said electric motor, and resilient means connected to each side of said armature for providing a hair seal between said cutting head and said motor.

2. The electric shaver of claim 1 wherein said armature is provided on each side thereof with a T-shaped slot, and said resilient means include cooperating T-shaped portions receivable in the associated slots.

3. A dry shaver comprising an electric motor mounted within a casing to drive a plurality of elongated oscillating cutters, an elongated arcuate perforated comb mounted on said casing in shearing engagement with said cutters, an oscillating cutter shaft extending parallel to said comb and coincident with the axis of said comb, said cutters being supported by said shaft, a laminated armature supported on said shaft and having a pair of spaced elongated salient poles extending parallel to said shaft, a U-shaped field having elongated spaced pole faces equidistant from the axis of said shaft and extending parallel to said shaft, resilient means biasing said armature to a rest position with said poles displaced from said pole faces, and field coil means for creating magnetic flux at said pole faces to move said armature poles toward said pole faces.

4. A dry shaver comprising a thin flat casing having a comb extending lengthwise along one edge thereof, a cutter supporting shaft journaled in said casing for oscillation about an axis parallel to and spaced from said comb, a plurality of cutters mounted on said shaft for shearing engagement with said comb, an elongated armature carried by said cutter supporting shaft and having a pair of spaced salient poles extending parallel to said shaft, a motor field formed of a stack of U-shaped laminations positioned in planes perpendicular to said shaft to provide a pair of elongated spaced pole faces extending parallel to said shaft, resilient means biasing said armature to a rest position, and means to energize said field to move said salient poles toward said pole faces.

5. A dry shaver comprising a thin flat casing having a comb extending lengthwise along one edge thereof, a cutter supporting shaft journaled in said casing for oscillation about an axis parallel to and spaced from said comb, a plurality of cutters mounted on said shaft for shearing engagement with said comb, an elongated armature carried by said cutter supporting shaft and having a pair of spaced salient poles extending parallel to said shaft, a motor field formed of a stack of U-shaped laminations positioned in planes perpendicular to said shaft to provide a pair of elongated spaced pole faces extending parallel to said shaft, resilient means biasing said armature to a rest position, and means to energize said field to move said salient poles toward said pole faces, said cutters being mounted in slots provided in extended portions of the laminations forming said armature.

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