Sept. 17, 1968 C. L. BAUER 3,401,453

ELECTRIC DRY SHAVER

Filed May 27, 1966 3 Sheets-Sheet 1

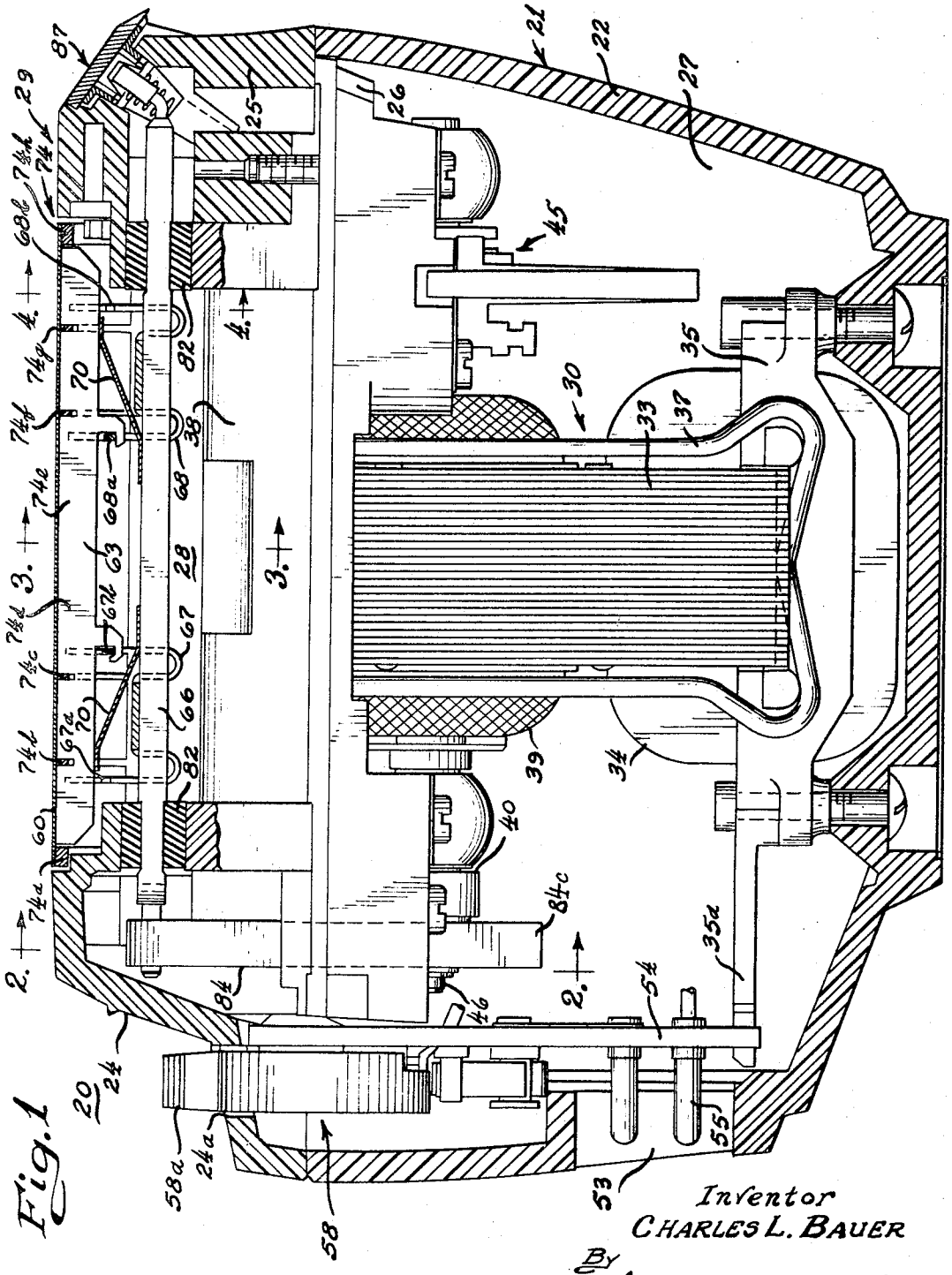


Fig. 1

Inventor
CHARLES L. BAUER
By George R. Clark
Atty

Sept. 17, 1968 C. L. BAUER 3,401,453

ELECTRIC DRY SHAVER

Filed May 27, 1966 3 Sheets-Sheet 2

Fig. 2

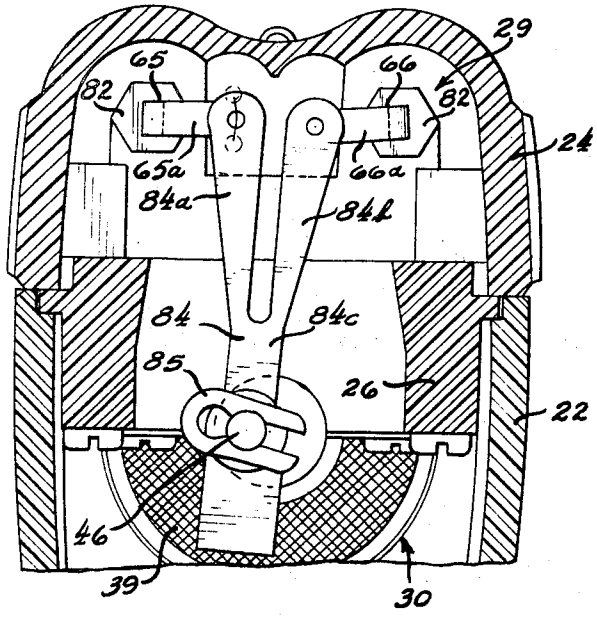
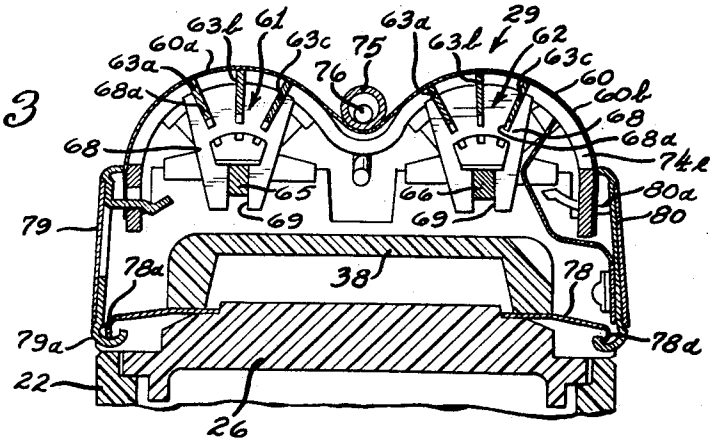


Fig. 3



Inventor
CHARLES L. BAUER
By George R. Clark
Atty

Sept. 17, 1968 C. L. BAUER 3,401,453

ELECTRIC DRY SHAVER

Filed May 27, 1966 3 Sheets-Sheet 3

Fig. 4

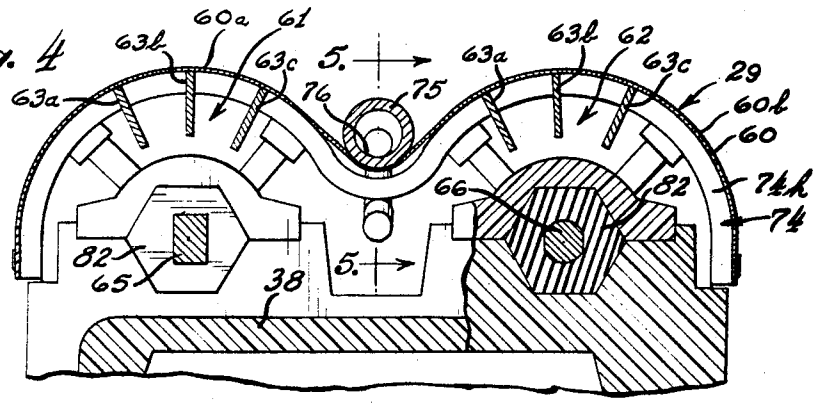
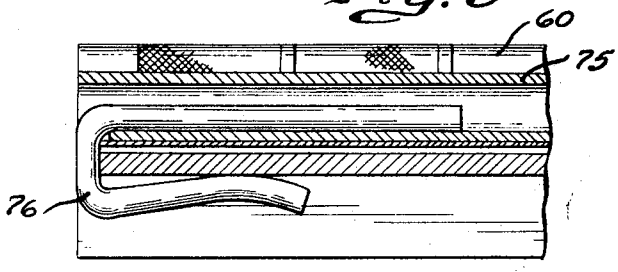


Fig. 5



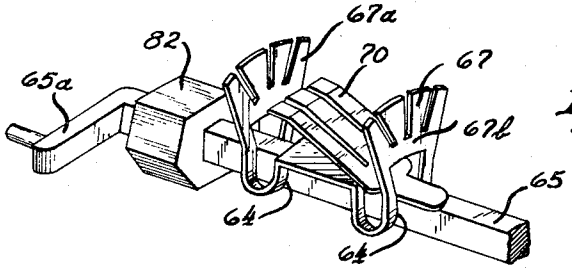


Fig. 6

Inventor
CHARLES L. BAUER
By
George R. Clark
Atty

United States Patent Office 3,401,453 Patented Sept. 17, 1968

3,401,453

ELECTRIC DRY SHAVER

Charles L. Bauer, Carol Stream, Ill., assignor to Sunbeam Corporation, Chicago, Ill., a corporation of Illinois

Filed May 27, 1966, Ser. No. 553,393
11 Claims. (Cl. 30—43.9)

ABSTRACT OF THE DISCLOSURE

Electric shaver or other appliance having a pair of parallel oscillating shafts of rectangular cross section. Each of these shafts drives a separate cutter or other driven member. A power unit is provided having motor means with a drive projection movable toward and away from the parallel shafts. A unitary bifurcated connecting rod interconnects the projection and the two parallel shafts. This connecting rod is sufficiently resilient to permit flexing so that no binding occurs. Spring means in the shape of a short handled multi-tined fork having the handle portion secured to the rectangular shafts bias the cutters into shearing engagement with the perforated comb. The comb is defined by two joined arcuate perforated sections.

This invention relates to apparatus for removing beards or face hair as well as hair on the arms, legs, and other portions of the human body, and is generally referred to as an electric dry shaver. More particularly, the present invention is in the nature of an improvement on the electric dry shaver disclosed and claimed in Jepson et al. Patent No. 3,196,539, granted July 27, 1965, and assigned to the same assignee as the present invention. Moreover, certain features disclosed in the present application are also disclosed in copending applications, both filed of even date herewith, Ser. No. 553,510, Stahly et al., and Ser. No. 553,575, Bauer, both assigned to the same assignee as the instant application.

Electric shavers of several different types are extensively employed by many persons as the sole means of shaving. The type of electric shaver disclosed in the above-mentioned Jepson et al. patent has proven to be unusually satisfactory for reducing shaving time while still furnishing a very satisfactory shave. Moreover, this shaver has been designed so that it may be held comfortably and conveniently in the hand of the operator. As disclosed in this Jepson et al. patent, the electric dry shaver is provided with a plurality of oscillating cutter blades mounted on an oscillating shaft and cooperating with a perforated comb and depending upon centrifugal force and spring means for moving the cutters into shearing engagement with the comb. The oscillating shaft carrying the cutter blades is connected through suitable cranks and a connecting rod to a rotary motor.

More recently a cutting head has been developed which employs a pair of such oscillating shafts, each of which carries a plurality of oscillating cutter blades cooperating with an arcuate portion of a perforated comb. It has been proposed to drive such a cutter head assembly from a rotary motor my means of a pair of connecting rods each driven from a respective one of a pair of eccentric projections each extending from a gear driven by a motor pinion, as more fully described in the above-identified Stahly et al. application. However, it will be appreciated that although the cost of any one driving arrangement may be small, nevertheless electric dry shavers of this general type are produced in a very large volume, and the consumer market for the sale of electric dry shavers is highly competitive. Accordingly, it is desirable to provide an electric dry shaver which will compete favorably in price on the consumer market. In this regard it is desirable to provide a drive means interconnecting a rotary motor and a pair of oscillating drive shafts which may be manufactured and assembled at a minimum cost.

Moreover, in the design of a cutter head employing a pair of joined arcuate comb surfaces, some difficulty may be experienced in maintaining a comparatively soft, flexible comb in the desired configuration. Further, in the consumer market it is important that the cutting blades be positively and economically secured to the respective cutter shaft so that the shaver may be economically produced and perform reliably for the ultimate user.

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

It is another object of the present invention to provide a new and improved electric shaver which overcomes the difficulties mentioined above.

It is another object of the present invention to provide an electric dry shaver having an improved cutting head.

A further object of the present invention is to provide an electric dry shaver of the type having a pair of oscillating cutter shafts provided with improved connecting means drivingly interconnecting the motor with the respective oscillating shafts.

A still further object of the present invention is to provide a new and improved cutting head assembly for a shaver.

It is another object of the present invention to provide an electric shaver which may be economically manufactured and assembled and which will provide foolproof operation.

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 an elevational sectional view through the cutter and casing portion only of an electric shaver embodying the present invention;

FIG. 2 is a fragmentary sectional view taken along line 2—2 of FIG. 1, assuming that FIG. 1 illustrates the entire shaver;

FIG. 3 is a fragmentary sectional view taken along line 3—3 of FIG. 1, again assuming that FIG. 1 shows the entire shaver;

FIG. 4 is a fragmentary somewhat enlarged sectional view taken along line 4—4 of FIG. 1, again assuming that FIG. 1 illustrates the entire shaver;

FIG. 5 is a sectional view taken along line 5—5 of FIG. 4, assuming that FIG. 4 shows the complete structure; and

FIG. 6 is a perspective view of the cutter shaft, blade supports, and blade biasing springs of the shaver according to the present invention.

The present invention is particularly adapted for use with an electric shaver of the type having a shaving head unit including a uniformly curved comb and an elongated cutter blade adapted to be moved along the inner surface of the comb in shearing engagement therewith. One feature of the invention is particularly adapted for use with an electric shaver having a double shaving head unit, that is, of the type having a comb defined by joined arcuate surfaces and including a pair of oscillating cutter shafts each carrying one or more cutting blades for moving the blades in shearing engagement with the comb.

In accordance with one feature of the present invention, the cutter shaft is rectangular. A rectangular shaft permits the use of an improved blade support which may be of generally U-shaped having groove means in its bight portion to receive the shaft, and provided with aligned slots in

its outwardly extanding legs for receiving the cutter blade. Additionally, there is provided an improved blade biasing spring which may be shaped like a short-handled multi-tined fork having the handle portion thereof secured to the flat surface of the shaft in any suitable manner as by welding, and having one of the tines each extending into the path of a different one of the cutter blades.

In accordance with another feature of the present invention, there is provided improved means for transferring power from a power unit to drive the pair of oscillating cutter shafts. It will be understood that such oscillating cutter shafts, provided with an offset projection defining a crank, create a change in spacing between the cranks as the shafts oscillate. The shafts are driven from the power unit by a unitary bifurcated connecting rod defining a body portion connected to the crank or drive member of the prime mover, and provided with a pair of spaced arms each connected to a respective one of the cranks and sufficiently resilient to permit flexing of the arms relative to each other as the cutter shafts oscillate. To provide the necessary resilience to the arms of the connecting rod, the arms may be provided with reduced cross-sectional areas adjacent the body portion of the connecting rod, and the connecting rod may be built of suitably resiilent material such as nylon.

The single connecting rod with the bifurcated arms considerably simplifies the connecting rod design providing an economical arrangement. Moreover, the rectangular shaft cross section simplifies the connection to the shaft of both the blade supports and the blade springs, thus reducing cost and simplifying assembly thereof.

Referring now to the drawings, the present invention is directed to an electric shaver or shaving unit **20** which includes a casing **21** defined by a generally cup-shaped casing member **22** and a pair of end caps **24** and **25**, all preferably molded from a suitable plastic. For supporting the motor and cutter described hereinafter, there is provided a support member **26** which effectively closes the open top of the cup-shaped casing member **22** to divide the casing **21** into a motor chamber below support **26**, generally designated as **27**, and a cutter chamber above the support **26** and between end caps **24** and **25**, generally designated as **28**. Disposed within the cutter chamber **28** is a cutting head assembly generally designated as **29**. Disposed within the motor chamber **27** is an electric motor **30** secured to the underside of the support member **26**.

Considering the motor **30** in more detail, it may be of a known type such as disclosed in copending Jepson et al. application Ser. No. 322,795, filed Nov. 12, 1963, and assigned to the same assignee as the instant application. As illustrated, motor **30** is of the rotating armature type having a generally U-shaped stator member **33**, the ends of the legs of the stator member **33** having a somewhat arcuate configuration defining opposed pole pieces in a known manner. A field winding **34** is carried on the bight portion of the stator member **33**. A hanger bracket **35**, as shown in the above-mentioned Jepson et al. application, and a pair of U-shaped bail clamps **37** and a bail hanger **38** hold the field structure in position relative to support **26**.

The motor **30** includes an armature **39** having an armature shaft **40** supported in suitable self-aligning spherical bearings in the manner described in the aforesaid Jepson et al. application. One end of the armature shaft carries a commutator assembly **45**, while the other end thereof is the crank end. Secured to the crank end of the armature shaft **40** is an eccentrically mounted crank pin **46**.

In order that a power connection can be made to the shaver **20** for driving the motor **30**, the casing member **22** is provided with a recess or opening **53** in its end adjacent its bottom defining a receptacle opening for receiving a power connection. A terminal board **54** within the casing **21** of the shaver **20** carries a pair of terminal members **55** extending into the recess **53** for engaging operating contacts of a power cord. The lower end of the terminal board is keyed to an arm or projection **35***a* of the hanger bracket **35** so as to provide support for the terminal board **54**.

To provide a manual control for starting and stopping the motor **30**, the terminal board **54** additionally supports a known electrical switch, shown generally at **58**. A manually operable switch knob **58***a* extends through an opening **24***a* in the end cap **24** to control the on-off condition of the switch **58**.

Referring now to the cutting head unit **29**, it includes a comb **60** defining a cutting surface. Comb **60** comprises a pair of joined arcuate perforated sections **60***a* and **60***b*, FIGS. 3 and 4, cooperating with a pair of substantially identical oscillating blade assemblies **61** and **62**. The oscillating blade assemblies **61** and **62** are adapted to be oscillated through suitable driving means by the motor **30** at a suitable speed which may be in excess of 8000 cycles per minute. Each of the blade assemblies **61** and **62** includes a plurality of cutters or cutter blades **63**, individually referred to as **63***a*, **63***b* and **63***c*.

For the purpose of supporting the cutter blades **63** for oscillation, there are provided a pair of oscillating cutter shafts **65** and **66**, each carrying a pair of U-shaped supports **67** and **68**, respectively, best shown in FIGS. 1 and 6. The cutter shafts **65** and **66** are of rectangular or square cross section. The bight portions of the blade supports **67** and **68** are provided with slots **64** and **69** respectively to receive and be secured to the respective shafts **65** and **66**, while the legs thereof extend upwardly to define slotted blade support portions **67***a*, **67***b*, **68***a*, **68***b* in a manner well understood in the art, blades **63** being receivable in aligned slots in the support portions **67***a*, **67***b*, **68***a* and **68***b*. The cutter blades **63** are effectively identical and may be similar to those fully described in either the above identified Jepson et al. patent or Jepson et al. application.

For the purpose of biasing the cutter blades **63** into shearing engagement with the comb **60**, there is provided for each blade support **67** and **68** a tined spring member **70**, best illustrated in FIG. 6. As illustrated each spring member **70** is shaped like a short-handled three-tined fork having the short handle portion thereof secured to the respective shaft **65** or **66** and with the three tines or spring fingers each extending into the path of a different one of the blades **63** and consequently biasing the blades upwardly against the comb **60**.

As best illustrated in FIG. 4, the comb **60** comprises a cutting surface formed of a very thin flexible material having a large number of hair receiving openings. Since the cutting surface of the comb **60** 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 **74**, comprising a plurality of parallel, double arcuate ribs **74***a*, **74***b*, **74***c*, **74***d*, **74***e*, **74***f*, **74***g* and **74***h* (FIG. 1) and spaced from one another in a direction running along the longitudinal axis of the cutting blades **63**. The end ribs **74***a* and **74***h* are effectively end frame members and are somewhat stronger than the remaining ribs. The cutting surface portion of the comb **60** is suitably fastened at its outside edges to the supporting frame **74** as by welding or other suitable means. If desired, it may be removably secured. Moreover, in order to have the cutting surface follow the double arcuate contour of supporting frame **74** with a central depressed portion (FIGS. 3 and 4) there is provided a tubular comb tightener **75** which is held in place by U-shaped spring retaining clips **76**, best shown in FIG. 5. This comb tightener is similar to that disclosed and claimed in the above-mentioned copending Stahly et al. application.

For retaining the comb **60** in shearing relationship with the rest of the cutting head assembly **29**, there is provided a comb lock spring **78** (FIG. 3) clamped in place

between the bail hanger **38** and the support **26** by the bail clamps **37**. As illustrated, the comb lock spring **78** terminates in downwardly extending pivot flanges **78***a*. A movable comb hinge plate **79** has one edge releasably secured to one lower edge of the comb supporting frame **74**. Moreover hinge plate **79** is hook-shaped as indicated at **79***a* on its other edge so as to make engagement with one of the downwardly depending flanges **78***a* of the comb lock spring **78**. A comb latch plate **80** on the opposite side of the comb **60** from the hinge plate **79** is pivotally related to the other pivot flange **78***a* on comb lock spring **78**. Latch plate **80** is further provided with a centrally disposed latch member **80***a* extending through a suitable latch opening in the comb supporting frame **74** thereby to latch the comb **60** in place as part of the cutting head assembly **29**. The comb hinge plate **79** and comb latch plate **80** preferably are similar to those more fully described in the prior mentioned Jepson et al. Patent No. 3,196,539.

To support the cutter shafts **65** and **66** for oscillation, each shaft is provided adjacent each end thereof with suitable resilient mounting blocks **82** preferably bonded to the associated shaft, which blocks may be of the type more fully described in a copending Jepson application, Ser. No. 410,115, filed Nov. 10, 1964, now Patent No. 3,244,916, and assigned to the same assignee as the present application. As in such copending application, the mounting blocks **82** are clamped securely into position between support member **26** and end caps **24** and **25**, suitable recesses for such mounting blocks being provided. As illustrated, the shafts **65** and **66** are each provided with integral crank portions **65***a* and **66***a*, respectively (FIGS. 2 and 6), defined by offset projections of the shafts.

For the purpose of converting rotary motion of the motor armature **39** to oscillating motion of the cutter shafts **65** and **66**, there is provided in accordance with the present invention an improved connecting rod **84** (FIGS. 1 and 2). The connecting rod **84** is generally fork-shaped with a bifurcated portion defining two crank arms **84***a*, **84***b*, each receiving a respective one of the crank portions **65***a*, **66***a* of the respective cutter shafts **65** and **66** and a body portion **84***c*. The body portion **84***c* receives the crank pin **46** and is held assembled with the crank pin **46** by means of a hairpin type lock spring **85**. Because of the variation in spacing between the driven ends of the oscillating shafts **65** and **66**, the arms **84***a*, **84***b* on the connecting rod **84** must flex to accommodate this variation as the shafts **65** and **66** are oscillating. Accordingly the connecting rod **84** is made of suitably resilient or springy material, such as molded nylon, and the arms **84***a* and **84***b* have a reduced cross-sectional area (FIG. 2) where they join with the body portion **84***c* to provide the desired flex of the arms **84***a*, **84***b*.

For cutting longer hair such as trimming a moustache, sideburns and the like, one of the end caps **25** carries a trimming cutter assembly **87** (FIG. 1) driven by a projection from one of the cutter shafts **66**. The trimmer cutter assembly **87** may be identical with that described in the above mentioned Stahly et al. application and forms no part of the present invention. Accordingly the trimmer cuter assembly is not described in the present application.

The twin cutter shafts driven by a single connecting rod simplifies the drive of the double shaft head and provides a simple design which is inexpensive to manufacture. The single oscillating connecting rod can replace two separate connecting rods, gears and pinion because of its ability to flex sufficiently to accommodate the variations in the shaft spacings of the cutter shafts as they oscillate. Moreover the rectangular cross section of the cutter shafts **65** and **66** permits the use of simple blade supports **67** of formed metal pieces which may be merely spot welded to the supporting shaft, and further permit the simple tined blade springs **70** to be readily spot welded or otherwise secured to the cutter shafts.

While there has been shown and described a particular embodiment 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 present 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 shaving head unit including a perforated skin engaging member and a pair of oscillating cutter shafts each carrying cutter blade means movable relative to said skin engaging member, each of said cutter shafts being provided with an offset portion defining a crank, a power unit including motor means having a drive projection movable toward and away from said cutter shafts, and a unitary bifurcated connecting rod defining a body portion connected to said projection and a pair of arms each connected to a respective one of said cranks and sufficiently resilient to permit flexing of said arms relative to each other as said cranks oscillate.

2. An electric shaver as set forth in claim **1** wherein said motor means is of the rotary type and said drive projection is eccentrically positioned relative to the axis of rotation thereof to define a crank pin.

3. An electric shaver as set forth in claim **1** wherein said arms are provided with reduced cross-sectional areas adjacent said body portion to provide greater resilience thereto.

4. An appliance comprising a driven unit including a pair of parallel driven shafts each provided with an offset portion defining a crank, a power unit having a drive projection movable toward and away from said cranks, and a unitary bifurcated connecting rod defining a body portion connected to said drive projection and a pair of arms each connected to a respective one of said cranks and sufficiently resilient to permit flexing of said arms relative to each other as said cranks oscillate.

5. A shaver of the type having a uniformly curved comb and an elongated cutter blade adapted to be moved along the inner side of said comb in shearing engagement therewith, the combination of a substantially rectangular shaft provided with spaced apart supports extending radially therefrom, each of said supports having a slot at the end thereof which is remote from said shaft, said slots receiving said cutter blade, and a pair of elongated springs each having one end thereof joined to said shaft and the other end thereof in biasing engagement with said cutter blade to bias said cutter blade into engagement with said comb.

6. A shaver as set forth in claim **5** having a plurality of said cutter blades and wherein said supports are provided with a plurality of slots, the corresponding slots on each support receiving one of said cutter blades, and wherein said springs are each shaped like a short-handled multitined fork having the handle portion thereof secured to said shaft and having said tines engaging and biasing a different one of said cutter blades.

7. A shaver of the type having a uniformly curved comb and an elongated cutter blade adapted to be moved along the inner side of said comb in shearing engagement therewith, the combination of a substantially rectangular shaft, a plurality of U-shaped supports having groove means in their bight portions receiving said shaft, the legs of said supports extending upwardly and provided with aligned slots to receive said cutter blade, and spring means engaging said cutter blade biasing said blade into shearing engagement with said comb.

8. A shaver as set forth in claim **7** having a plurality of said cutter blades, and wherein each of said legs is provided with a plurality of aligned slots to receive respective ones of said blades.

9. An electric shaver comprising a power unit, a shaving head unit operatively connected to said power unit

and including a cutter support member, a comb frame carried by said support member defined by a plurality of parallel frame ribs spaced from one another along the longitudinal axis of said shaving head unit and each formed by two joining arcuate sections providing a recessed portion therebetween, a perforated skin engaging comb member fastened at its edges to said comb frame, an elongated member defining a comb tightener positioned over said comb member along said recessed portion, tightening means biasing said member inwardly into said recessed portion to tighten said comb member over said comb frame to define a comb member having two joining arcuate sections, and a pair of movable cutter members each including blade means relatively movable against respective ones of the joining arcuate sections of said comb member.

10. An electric shaver as set forth in claim **9** wherein said tightening means is defined by a pair of U-shaped retaining clips, each engageable with a respective end of said elongated member and secured beneath an end one of said frame ribs.

11. An electric shaver of the type comprising a casing and motive means within said casing, a cutting head assembly associated with said casing including a pair of

spaced parallel cutter shafts, a plurality of blade supporting means secured to each shaft, and driving means for simultaneously oscillating said shafts about their respective longitudinal axes.

References Cited

UNITED STATES PATENTS

1,655,151	1/1928	Lund	74—48
2,178,151	10/1939	Wagar	267—1 X
2,246,270	6/1941	Staak	267—1 X
2,308,049	1/1943	Brull	30—43.8
2,688,184	9/1954	Jepson	30—43.9
2,858,607	11/1958	Kane	30—43.6
2,982,020	5/1961	Bulova et al.	30—43.9
3,206,850	9/1965	Jepson	30—43.9
3,262,335	7/1966	Heinlein et al.	74—581
3,290,774	12/1966	Schuessler	30—34.1

FOREIGN PATENTS

932,172	8/1955	Germany.
411,272	7/1945	Italy.

MYRON C. KRUSE, *Primary Examir*