Dec. 7, 1954 I. JEPSON ET AL 2,696,568

ELECTRIC HAIR CLIPPER

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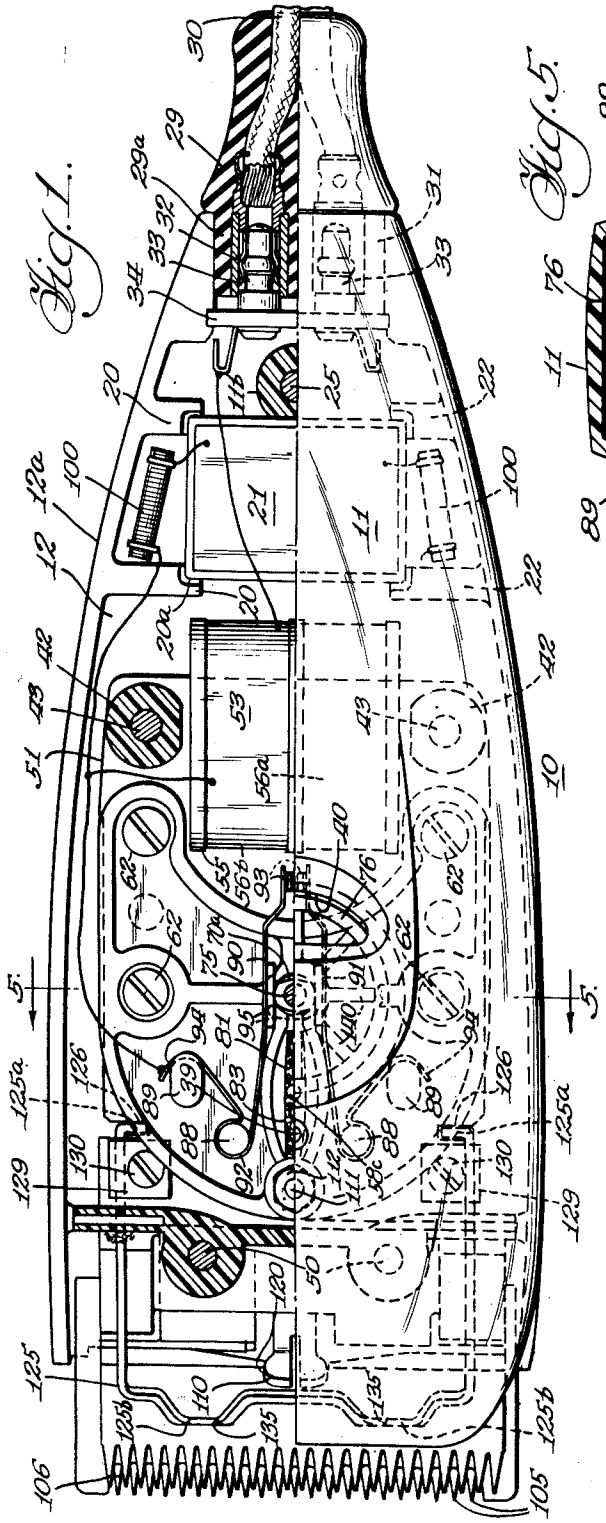


Fig. 1.

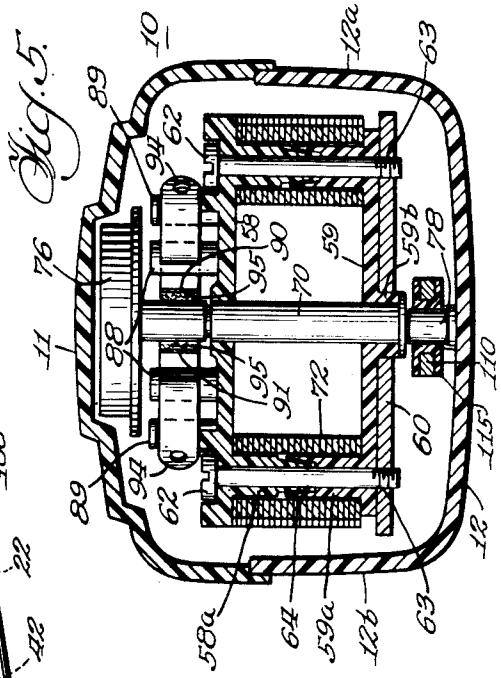


Fig. 5.

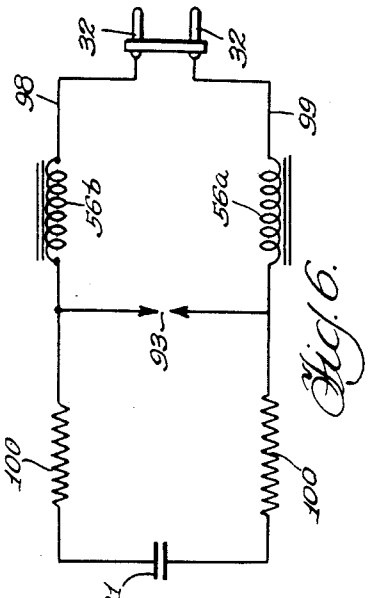


Fig. 6.

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Fig. 2.

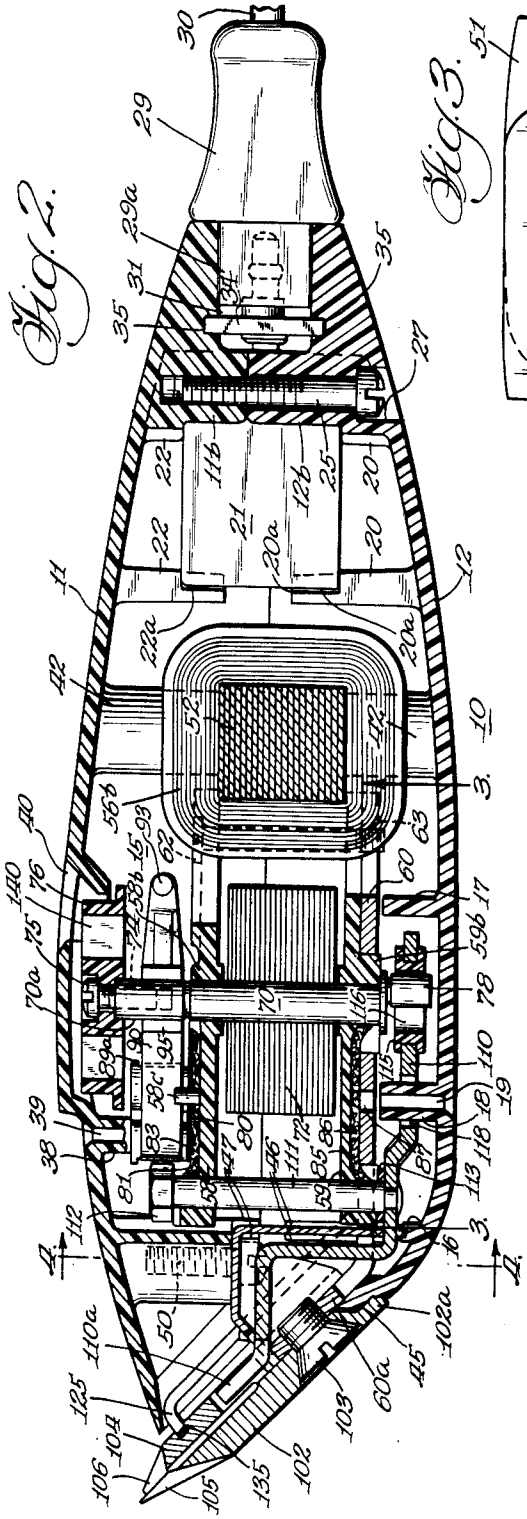


Fig. 3.

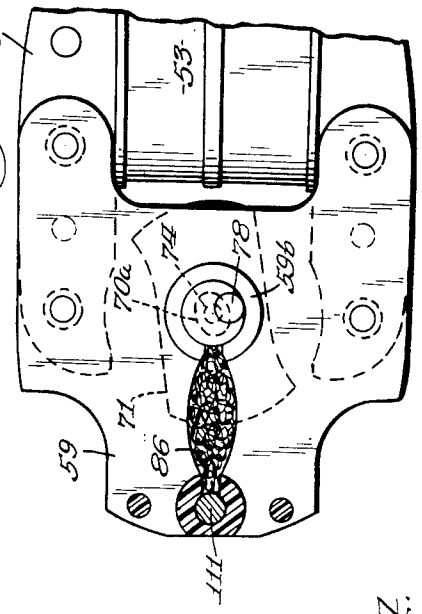
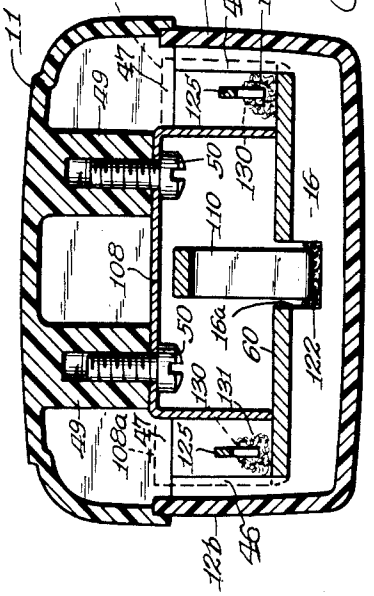


Fig. 4.



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ELECTRIC HAIR CLIPPER

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Application February 7, 1950, Serial No. 142,752

6 Claims. (Cl. 310—47)

The present invention relates to electric hair clippers and more specifically to electric hair clippers particularly well adapted for home use in clipping human hair.

A great many people do not have ready access to barber shops, because they live at considerable distances from such barber shops, or are effectively prohibited by the high charges from getting professional hair cuts in such shops. For this reason a great many people and particularly children have their hair cut at home by their parents, other members of their household, neighbors or the like employing the conventional scissors and perhaps hand clippers and more rarely, electric clippers. During the past decade, a large number of rural areas have been supplied with electricity so that a majority of the rural homes, rather than an occasional home, use electricity as a source of power and light. There is an extensive market, therefore, for an inexpensive electric hair clipper to be used by amateurs in connection with giving hair cuts particularly to children, not only to cut down the expense of keeping such children well groomed, but also to eliminate the difficulty of getting to barber shops when located at some distance from such shops.

There have been on the market many hair clippers designed for use particularly for professional hair cutters such as barbers which, although very satisfactory from the standpoint of hair clipping, are relatively expensive and hence commercially unattractive to the amateur hair cutter discussed above. It would be desirable to provide an inexpensive, yet very satisfactory, hair clipper which would have a long life with a minimum of care and yet which could be extensively used even by professional hair cutters.

Accordingly, it is a primary object of the present invention to provide a new and improved electric hair clipper particularly designed for home use.

It is another object of the present invention to provide an electric hair clipper having an improved and powerful electric motor of the impulse type capable of satisfactory operation on alternating or direct current.

Still another object of the present invention is to provide an electric hair clipper which is simple and compact and which lends itself to high speed manufacturing on a mass production basis so that it may be sold at a low cost to reach the enormous market with respect to sales of the clipper for home use.

It is a further object of the present invention to provide an electric hair clipper having improved means for assembling the clipper parts whereby if the occasion arises the clipper may be disassembled in a simple manner without especially designed tools or the like.

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 top plan view partially in section of an electric hair clipper embodying the present invention;

Fig. 2 is an elevational sectional view of the electric hair clipper shown in Fig. 1;

Fig. 3 is a sectional view taken on line 3—3 of Fig. 2 assuming that Fig. 2 discloses the complete unit;

Fig. 4 is a sectional view taken on line 4—4 of Fig. 2, also assuming that Fig. 2 discloses a complete unit;

Fig. 5 is a sectional view taken on line 5—5 of Fig. 1; and

Fig. 6 is a schematic circuit diagram of the electric circuit embodied in the electric hair clipper of Fig. 1.

The present invention contemplates an inexpensive electric hair clipper comprising a unitary sub-assembly of an impulse motor and shearing head arranged for mounting within a two-part molded casing which provides a handle for the clipper readily graspable by the operator when the clipper is used. The impulse motor includes novel means for supporting the periodically operable contacts for controlling the motor energization and the electrical circuit includes suitable means for preventing deleterious arcing at such contacts to insure long contact life as well as means for preventing radio interference, etc. The shearing or clipping portion includes a readily removable cutter member with novel means for holding the cutter in place and for biasing it into shearing engagement with a comb or the like. Improved means are provided for drivingly relating the cutter with the motor and the entire mechanism is arranged in a compact manner for simple and high speed assembly and for providing a small inexpensive hair clipper.

Referring now to the drawings, there is illustrated an electric hair clipper generally designated at **10** which comprises a generally elongated split or two-part housing or casing comprising upper housing section **11** and lower housing section **12**. These housing sections define a casing of a size so as to readily be grasped within the hand of an operator. Preferably also the casing is molded or cast from a suitable plastic material having electric insulating characteristics which material also will take suitable dyes so that a casing or housing of very pleasing appearance may be produced. A casing of this type may be comparatively light and inexpensive since various ribs, supporting elements and strengthening means may be molded as an integral part thereof and threaded bushings, inserts and the like may similarly be molded therein.

As is best shown in Figs. 2 and 4 of the drawings, the lower housing section **12** is provided with upwardly extending side flanges **12***a* and **12***b* to define a cup-shaped member for receiving therein a motor and shearing head sub-assembly generally designated at **15** and described in greater detail hereinafter. For increasing the strength and rigidity of the casing, a plurality of transversely extending ribs **16** and **17** may be provided integrally molded with the casing. Also adjacent the forward central portion of the lower housing section **12** is an inwardly extending tubular member **18** also integrally formed therewith and having a passageway **19** leading from the exterior to the interior of the casing, the purpose of which will become apparent from the ensuing description. Adjacent the rear portion of the lower casing section **12** are a plurality of pairs of spaced inwardly projecting members **20** having corner recesses **20***a* defined therein at the ends most remote from the housing section proper so as to support therebetween a suitable condenser or capacitor **21**. The upper housing section **11** similarly includes such projections designated at **22**, each provided with a corner recess **22***a* to engage the corners of the upper portion of the condenser **21** so that when the housing is assembled, as best shown in Fig. 2, the condenser **21** is rigidly supported in the casing to prevent any movement relative thereto. Adjacent the rear of the housing sections **11** and **12** are defined a pair of pillar members **11***b* and **12***b* respectively, which have their ends abutting to position the housing sections when held together by fastening means such as the screw **25** extending into openings defined within the pillars **11***b* and **12***b* and threadedly engaging suitable threads defined in the pillar **11***b*. Preferably the opening for receiving the screw **25** in the lower casing section **12** is counterbored as indicated at **27** so that the screw head is within the confines of the casing surface.

To the rear of the abutting pillars **11***b* and **12***b* is an enlarged recess for receiving the end of a suitable electric plug connector **29** connected to an electric conductor **30** of a conventional cord set which may suitably be connected to a source of electric energy, not shown. Preferably the plug connector **29** includes an insulated extension **29***a* adapted to be received within the recess

31 defined at the rear end of the casing. With this arrangement the plug connector 29 may be designed to have a streamlined appearance with the casing proper as is clearly shown in Figs. 1 and 2 of the drawings. Preferably also the plug connector 29 is provided with female plug type contacts 33 to receive the male type plug contacts or prongs 32 associated with the casing comprising the housing sections 11 and 12. The prongs 32 should be split prongs or the like to provide a slightly expansible construction, thereby insuring good electric contact with the female type plug contacts 33.

For the purpose of supporting the prongs 32 defining the male type plug contacts, there is provided an insulating plate 34 which is adapted to be disposed in cooperating grooves 35 defined in each of the housing sections so that when the casing is assembled, the insulating terminal plate 34 is firmly and rigidly held in position, whereas when the casing is disassembled, the terminal plate 34 may readily be removed.

The upper casing section 11 is provided with an inwardly disposed inner tubular extension 38 having a passageway 39 therein, similar to the tubular extension 18 and disposed in the casing section at a point more or less opposite the tubular extension 18. The casing section 11 further includes a somewhat semi-circular opening 40 to which access to a starting thumb wheel may be had as will become apparent from the following description. Both the upper and lower casing sections 11 and 12 are provided with opposed enlargements 42 adjacent the central portion of the casing for accommodating suitable screws 43 to maintain the casing sections 11 and 12 in assembled relationship. The forward end of the casing as best shown in Figs. 2 and 4 is open to permit the shearing head, hereinafter described. to extend therefrom. The lower casing section is provided with an offset lip 45 extending across the casing section and disposed at an angle so as to properly support a shearing head. Both the upper and lower casing sections are also provided with inwardly extending ribs 46 and 47 defining a groove for receiving a portion of the clipper motor and shearing head assembly therein as will be described hereinafter. Suitable inwardly depending enlargements 49 adjacent the forward end of the upper casing section are provided to receive suitable fastening means 50 whereby the casing section 11 may be fastened to the motor sub-assembly.

For the purpose of providing a simple, compact and highly efficient motor sub-assembly 15, there is disposed within the casing defined by the upper and lower housing sections 11 and 12, a suitable impulse type motor which comprises a field structure 51 made up preferably of a stack of U-shaped laminations 52 thereby to form a U-shaped field structure. Encircling the base or bight of the field structure 51 is a field coil unit 53 comprising an insulating spool 55 having two sections for receiving therein two field windings 56*a* and 56*b* best shown in the schematic diagram of Fig. 6 of the drawings. It will be understood that the insulating spool 55 may be formed from any suitable material such, for example, as a heat resistant cellulose acetate, and furthermore is preferably formed of two spool parts capable of being interrelated when placed around the base or bight of the U-shaped field structure 51.

Secured to the field structure 51 are upper and lower insulating bearing plates 58 and 59 respectively which extend for a substantial distance beyond the open end of the U-shaped field structure. Also attached to the U-shaped field structure is a base plate 60 formed of metal and having at the forward end an angularly disposed bifurcated portion 60*a* for supporting part of the shearing head to be described hereinafter.

Preferably, the bearing plates 58 and 59 and the base plate 60 are rigidly related to the field structure 51, in the manner shown in Figs. 1 and 2 of the drawings, by suitable screws or fastening means 62 which extend through aligned openings in these members and threadedly engage the base plate 60 as indicated at 63. For the purpose of insulating the fastening means 62 from the laminations 52, the insulating bearing plates 58 and 59 are provided with integral tubular extensions 58*a* and 59*a* best shown in Fig. 5 of the drawings for completely insulating the fastening means. These tubular extensions 58*a* and 59*a* preferably include interfitting portions designated at 64 in Fig. 5 of the drawings.

To hold the sub-assembly 15 in assembled relation with the upper housing section 11, the field structure 53 is furthermore provided with suitable openings to accommodate the screws or fastening means 43. Preferably the insulating bearing plates 58 and 59 are formed of a molded plastic such as nylon which has been found to be very satisfactory. These bearing plates are each provided adjacent the end of the field structure with an opening surrounded by flange portions integrally formed therewith defining bearings designated as 58*b* and 59*b* for the bearing plates 58 and 59 respectively. Journalled within the bearings 58*b* and 59*b* is a crank shaft 70 to which is suitably fastened as by a set screw or the like, an armature 71 formed of a stack of laminations 72 riveted or otherwise secured together. The armature laminations 72 have a configuration such as is best shown in Fig. 3 of the drawings to provide a two-pole armature capable of rotating between the ends of the U-shaped field structure 51. The longitudinal axis of the crank shaft 70 is dipsosed perpendicular to the longitudinal axis of the casing and also perpendicular to the base of the U-shaped field structure 51. The upper end of the crank shaft 70 extending above the bearing plate 58 and designated by the reference numeral 70*a* has an elliptical cross section for controlling the contacts of the impulse motor to be described hereinafter. This upper end of the crank shaft 70 furthermore is provided with a threaded opening 74 extending along the longitudinal axis thereof for receiving a screw 75 whereby a starting thumb wheel 76 may be attached thereto. The lower end of the crank shaft 70 extending beneath the base plate 60 terminates in a crank comprising an eccentric pin 78.

For the purpose of lubricating the upper armature bearing 58*b*, the upper bearing plate is provided with a shallow somewhat elliptical shaped recess 80 for receiving therein a lubrication wick 81 preferably held in position by a projection 58*c* integrally formed with the upper bearing plate 58 and a suitable metal wick retainer 83. The wick preferably extends to the crank shaft 70 to cause lubrication to be supplied to the bearing 58*b*. The lower bearing plate 59 similarly is provided with a recess 85 for having disposed therein a suitable wick 86. The base plate 60 retains the wick 86 in position. As will be apparent from Fig. 2 of the drawings, the base plate 60 is provided with a suitable opening 87 disposed coaxially with respect to the passage way 19 in the tubular extension 18 whereby one may readily supply the oil retaining wick 86 with lubrication from the exterior of the casing. It will be noted that the upper tubular extension 38 extends substantially to the upper wick 80 whereby it may readily be supplied with lubrication through the passageway 39.

In accordance with the present invention the upper bearing plate 58 is provided with integral upwardly extending pairs of projections 88 and 89. The pair of projections 89 are each provided at their upper ends with an over-hanging lip 89*a*. These projections serve to maintain in position a pair of resilient contact arms 90 and 91, one disposed on either side of the elliptical extension 70*a* of the crank shaft 70. In accordance with the present invention each of the contact arms 90 and 91 are provided with a central portion 92 of circular configuration so as to substantially encircle its associated projection 88. One end of each resilient contact arm, preferably formed of Phosphor bronze or beryllium copper, is provided with an arc resisting contact 93, while the other end is provided with a hook-shaped portion 94 adapted to engage the associated projection 89. This construction makes for a very simple and fool-proof assembly of the resilient contact arms 90 and 91 since it is merely necessary to place the circular portions 92 of these contact arms so as substantially to encircle the associated projections 88 with the hook-shaped portions 94 engaging the associated projections 89 and disposed beneath the overhanging lips 89*a* thereof. These lips 89*a* prevent upward movement of the resilient contact arms and consequently, although readily assembled, they are firmly held in place. Each of the contact arms is also provided with a block of insulating material 95 disposed adjacent the elliptical extension 70*a* of the crank shaft 70. These contact blocks 95 are engageable with the elliptical extension 70*a* upon rotation of the crank shaft 70 so as to alternateiy make and break the circuit at the contacts 93. When the ends of the maximum diameter of the elliptical portion 70*a* engage the insulating contact blocks 95, which latter are preferably formed of nylon or the like, the circuit at the contacts 93 is broken.

On the other hand, when the elliptical portion **70***a* of the crank shaft **70** is disposed so that the ends of its minimum diameter are suitably engaged by the contact blocks **95**, a circuit is completed at the contacts **93**. It should be understood that rotation of the crank shaft **70** will cause alternate making and breaking of the circuit contacts **93**.

The electrical circuit of the impulse motor of the present invention can now be considered with reference to Fig. 6 of the drawings where the circuit elements are schematically illustrated. The contact prongs **32** are connected by suitable conductors **98** and **99** with one terminal of the field windings **56***a* and **56***b* respectively. The other ends of these field windings are connected to one each of the contacts **93**. It should be understood that the impulse motor per se is old and the operation thereof is well understood by those skilled in the art. The contacts **93** engage each other to complete the field circuit when the armature poles approach the field or stator poles of the field structure **51**, and the contacts **93** are opened when the armature poles are about to recede from the stator poles. In other words, the armature is so shaped and positioned with respect to the field structure that the torque produced by the action of the field magnet upon the armature would be alternately clockwise and counterclockwise if the armature were mechanically rotated while the field magnet was constantly excited without any interruptions in its excitation. It is for this reason that the contacts **93** are provided which are so interrelated by means of the elliptical portion **70***a* of the crank shaft **70** that the energization circuit for the field structure is opened at those times when the torque tends to be negative with respect to the desired direction of rotation. An impulse motor operates at a speed of the order of 8,000 revolutions per minute and by virtue of the periodically operated contacts **93** operates equally well when connected to a source of direct or alternating current.

For the purpose of preventing excessive arcing at the contacts **93** and thereby to increase the contact life the capacitor **21** is connected across the contacts preferably through two serially arranged identical resistors **100**. The resistors **100** tend to limit the magnitude of the discharge current of the capacitor **21** so as to reduce arcing when the charged capacitor **21** is suddenly short circuited by closure of the contacts **93**. For a particular application of the present invention very satisfactory operation was obtained by employing a capacitor having a capacitance of .025 microfarads and with the resistors **100** each having a resistance of 24 ohms. It should be understood, however, that very satisfactory operation can be obtained with considerably different values of resistance and capacitance.

In order to perform a hair cutting or clipping operation, the hair clipper **10** of the present invention comprises cutting elements in the form of a comb **102** rigidly attached to the angularly disposed bifurcations **60***a* of the base plate **60** by suitable screws **103**, and a reciprocating cutter **104**. The cutter and comb are preferably formed of suitable blade steel and are each provided at the cutting edge thereof with suitable cutting teeth designated as **105** on the comb and **106** on the cutter. By virtue of the angular disposition of the bifurcations **60***a* relative to the base plate **60**, the comb **102** is disposed at a suitable angle with respect to the clipper casing which has been found most satisfactory. Since the surface of the comb remote from the cutter **104** is in engagement with the skin, the surface is preferably relatively smooth and the screws **103** are recessed so that the heads will cause no interference in the movement of the clipper over the skin. If desired, the comb may have flutings on the skin engaging surface thereof so as to provide limited contact with the skin and thereby reduce the friction of the clipper in moving it along the skin. The inter-engaging surfaces of the comb and cutter are accurately finished to insure ready reciprocal movement of the cutter while in shearing engagement with the comb.

Suitably supported from the base plate **60** on the opposite side of the bifurcations **60***a* to which the cutter **102** is fastened, is a cover bracket **108** which may be welded or otherwise secured to the bifurcations **60***a*. This cover bracket is provided with suitable openings to receive the screws **50** for attaching the forward portion of the clipper motor assembly to the upper casing section **11**. The cover bracket **108** furthermore includes lateral extensions **108***a* adapted to be received in the grooves defined between the ribs **46** and **47** of the housing sections **11** and **12** as is best shown in Figs. 2 and 4 of the drawings. It should be noted that the comb **102** includes a lip portion **102***a* which engages with the off-set lip **45** of the lower housing section **12** whereby the clipper casing and comb blend together in a streamlined manner to afford a pleasing appearance and furthermore close the casing against the access of dirt or hair at this point.

In order to transmit rotatable motion of the crank shaft **70** to reciprocal movement of the cutter **104**, there is provided a drive lever **110** pivotally mounted to a suitable pivot pin **111** extending between the ends of the bearing plates **58** and **59** remote from the field structure **51**. As illustrated, the pivot pin **111** has one end riveted to the drive lever **110** whereupon the pivot pin **111** extends through aligned openings defined in the bearing plates **58** and **59**. A suitable nut **112** attached to the upper threaded end of the pivot pin **111** maintains the pivot pin **111** and its associated drive lever in assembled relationship with the motor sub-assembly. If desired, a drive lever thrust washer **113** may be interposed between the base plate **60** and the drive lever **110**.

For drivingly connecting the crank shaft **70** and the drive lever **110**, the latter is provided at one end with an elongated opening for receiving therein a nylon bearing block **115** having an elongated opening **116** into which the eccentric pin **78** of the crank shaft **70** extends. The drive lever **110** also includes an elongated opening **118** through which the tubular extension **18** of the lower housing section **12** may extend without interfering with free movement of the drive lever. The other end of the drive lever **110** is of somewhat L-shaped configuration and includes a split end **110***a* with somewhat arcuate edges for drivingly engaging a cooperating slot **120** defined in the cutter **104**. The L-shaped portion of the drive lever **110** is disposed within the cover bracket **108** but the bifurcated end **110***a* extends outside this bracket to engage the slot **120** centrally disposed along the lower edge of the cutter **104**. It will be understood that the split end **110***a* of the drive lever **110** provides a cushioned cutter drive. Since the drive lever **110** as viewed in Fig. 4 of the drawings is beneath the top of the transverse rib **16** of the lower housing section **12**, a suitable recess **16***a* is provided in this transverse rib **16** in order to accommodate oscillatory movement of the drive lever. Preferably a layer of felt or other cushioning material **122** of a somewhat U-shaped configuration is disposed in the recess **16***a* around the drive lever **110**.

To provide the desired force for maintaining the cutter **104** in shearing engagement with the comb **102**, there is provided in accordance with the present invention a cutter spring **125** preferably formed of suitable spring steel and having a generally U-shaped configuration with the arms of the U each including an inwardly directed lateral extension **125***a*, clearly shown in Fig. 1 of the drawings. In accordance with the present invention, the base plate **60** is provided at its upper surface with a pair of L-shaped grooves **126** for receiving therein the ends including the extension **125***a* of the U-shaped cutter spring **125**. These ends are clamped against the base plate by suitable cutter spring clamps **129** and fastening means **130**. The arms of the U-shaped cutter spring **125** pass through slots **130** defined in the extensions **108***a* of the cover bracket **108** as clearly shown in Fig. 4 of the drawings. A resilient material such as felt or the like indicated at **131** is preferably disposed around the arms of the U-shaped cutter spring **125** where they pass through the openings **130** in the extensions **108***a* of the cover bracket **108**.

The bight or base portion of the U-shaped spring **125** is provided with a pair of deformations **125***b* extending toward the cutter **104** so as to be disposed in spaced grooves **135** defined in the cutter. It will be apparent that oscillating movement of the cutter will cause oscillating movement of the base portion of the cutter spring **125** which will, however, provide the desired force for biasing the cutter constantly into shearing engagement with the comb **102**. It will be apparent that for cleaning or other purposes the cutter **104** may readily be removed from the remainder of the apparatus merely by lifting the deformations **125***b* of the U-shaped spring **125** out of the grooves **135**.

In accordance with the present invention, the thumb wheel **76**, which is accessible from outside the casing for applying a starting force to the impulse motor, is provided with a plurality of helically curved spokes **140** so as to

operate as fan blades to cause cooling air to circulate through the casing by moving through the opening **40** and out past the shearing or clipping portion of the device. Preferably the thumb wheel **76** is provided with suitable indicia for locating the same relative to the elliptical portion **70***a* of the crank shaft **70** for proper timing of the operation of the contacts **93**.

From the above description it will be apparent that there has been provided a simple and compact clipper mechanism in which an impulse motor of improved construction is employed and in which a motor and shearing sub-assembly is provided completely operative so that it may be inserted within a casing defined by the housing sections **11** and **12**. The sub-assembly is inserted into the upper casing section **11** and the screws **50** are inserted to hold the bracket cover, forming a part of the assembly, to the casing section. The lower casing section **12** is then applied and the fastening means comprising the screw **25** and the screws **43** complete the assembly with all the parts including the terminal plate **44** and the condenser **41** firmly maintained within the casing. The resistors **100** are disposed in a suitable space at either end of the condenser **21**.

In view of the detailed description included above, the operation of the clipper embodying the present invention will readiiy be understood by those skilled in the art. Moreover, from the above description it will be apparent that a very simple, compact clipper is provided which is especially well adapted for home use and which can be sold at a relatively low cost. The clipper furthermore is adapted to give long years of fool-proof service.

While there has been shown and described a particular embodiment of the present invention, it will be understood that various changes and modifications may obviously be made by those skilled in the art without departing from the invention in its broader aspects, and it is desired 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. In a device of the character described, an electric motor unit adapted to be installed in a casing capable of being readily held in the hand of an operator, said motor unit comprising a field structure and a rotatable armature, an insulating plate fastened to said field structure and including a pair of projections of insulating material formed integrally with said plate, at least one of said projections being of generally cylindrical configuration, a resilient contact arm having a preformed portion for substantially encircling and by virtue of the inherent resilience gripping said one of said projections, an integral lateral extension on the other of said projections, and an extension on said resilient contact arm biased into engagement with the other of said projections below said extension, whereby said extension locks said resilient contact arm to said plate while still permitting ready assembly or disassembly thereof with respect to said plate.

2. In an electric motor of the impulse type adapted to be installed in a casing capable of being readily held in the hand of an operator comprising a field structure, a rotatable armature, and a pair of contacts for periodically making and breaking the energization circuit of said field structure in response to rotation of said armature, the combination of a pair of resilient contact members for supporting said contacts each comprising an elongated resilient contact arm supporting one of said contacts at one end and including a reversely bent portion at the other, an insulating projection on said field structure substantially encircled by said reversely bent portion and a locking extension on said reversely bent portion for engaging a portion of said field structure to hold said contact arm in position with respect to said projection.

3. In a device of the character described, an electric motor unit adapted to be installed in a casing capable of being readily held in the hand of an operator, said motor unit comprising a field structure and a rotatable armature, an insulating plate fastened to said field structure and including a pair of projections of insulating material formed integrally with said plate, a resilient contact arm having a preformed portion for substantially encircling and by virtue of the inherent resilience gripping one of said projections, an integral lateral extension on the other of said projections, and an extension on said resilient contact arm biased into engagement with the other of said projections below said extension, whereby said extension locks said resilient contact arm to said plate while still permitting ready assembly or disassembly thereof with respect to said plate.

4. In a device of the character described, an electric motor unit adapted to be installed in a casing capable of being readily held in the hand of an operator, said motor unit comprising a field structure and a rotatable armature, a molded nylon plate fastened to said field structure and including a pair of integral projections, a resilient contact arm having a preformed portion for substantially encircling and by virtue of the inherent resilience gripping said one of said projections, an integral lateral extension at the top of the other of said projections, and an extension on said resilient contact arm inherently biased into engagement with the other of said projections below said extension, whereby said extension locks said resilient contact arm to said plate while still permitting ready assembly or disassembly thereof with respect to said plate.

5. In a device of the character described, an electric motor adapted to be installed in a casing capable of being readily held in the hand of an operator, said motor comprising a field structure and a rotatable armature, means defining a plurality of openings in said field structure, a pair of insulating plates disposed on either side of said field structure and including integral sleeve members insertable into said openings from either side of said field structure and cooperating to provide a continuous insulated passageway in each of said openings, and fastening means disposed in each of said passageways for holding said plates and field structure in assembled relationship while being insulated from said field structure.

6. In a device of the character described, an electric motor adapted to be installed in a casing capable of being readily held in the hand of an operator, said motor comprising a laminated field core and a rotatable armature, means defining a plurality of openings in said field core for receiving fastening means to hold said field core in assembled relationship, a pair of insulating plates disposed on either side of said field core and including integral sleeve members insertable into said openings from either side thereof, said sleeve members including interfitting portions at the ends thereof to provide a continuously insulated passageway in each of said openings when said insulating plates are assembled with said core, and fastening means disposed in each of said passageways for holding said plates and field core in assembled relationship.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
1,128,914	Stone	Feb. 16, 1915
1,764,614	Dremel	June 17, 1930
1,837,231	Murray	Dec. 22, 1931
1,839,924	Lutes	Jan. 5, 1932
1,870,085	Apple	Aug. 2, 1932
2,077,034	Boerger	Apr. 13, 1937
2,146,551	Putnam	Feb. 7, 1939
2,165,858	Jepson	July 11, 1939
2,176,337	Hanley	Oct. 17, 1939
2,415,715	Upham	Feb. 11, 1947
2,502,048	Kahn	Mar. 28, 1950