April 28, 1942. J. GUR ARYE 2,281,434

SHAVING DEVICE

Filed Sept. 23, 1936 5 Sheets-Sheet 1

Fig. 1.

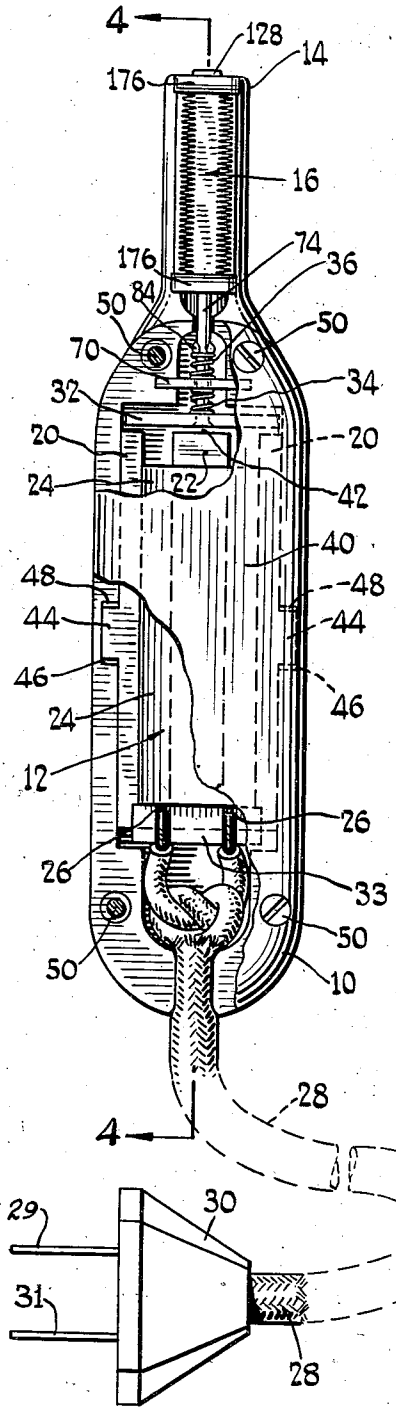


Fig. 3.

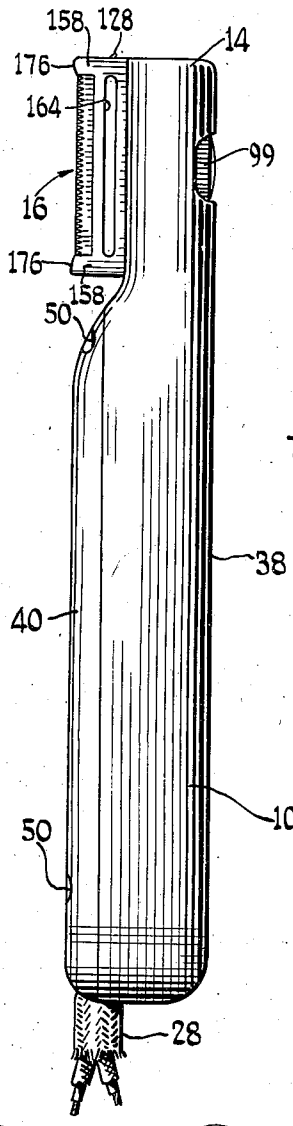


Fig. 4.

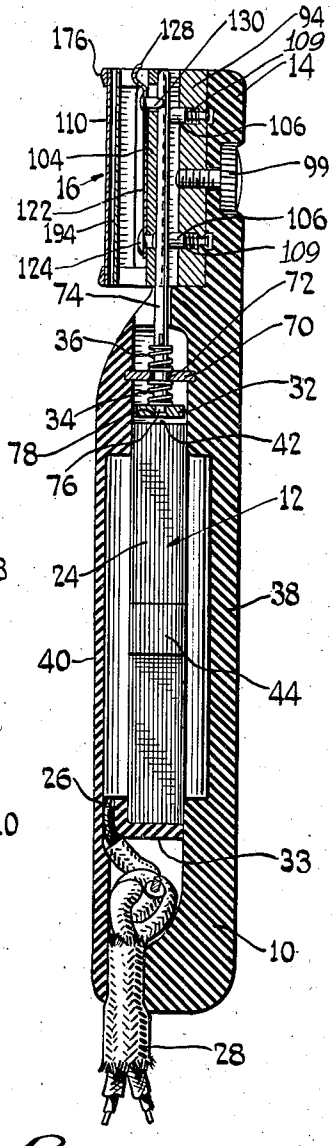
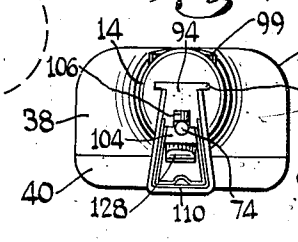


Fig. 2.



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April 28, 1942. J. GUR ARYE 2,281,434

SHAVING DEVICE

Filed Sept. 23, 1936 5 Sheets-Sheet 2

Fig. 5.

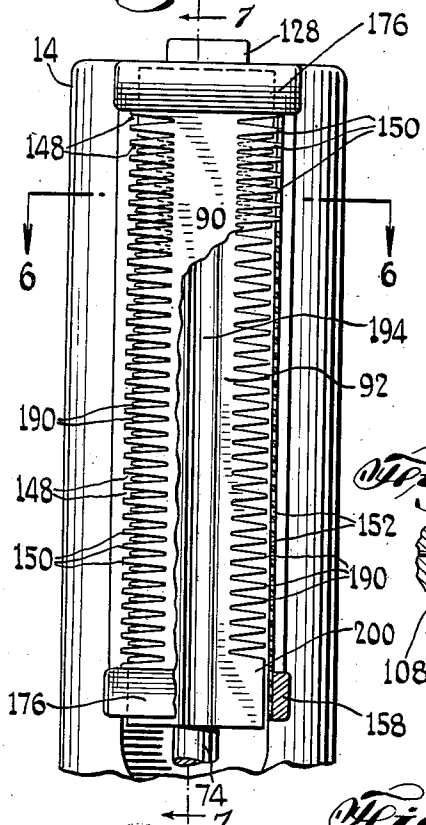

Fig. 8.

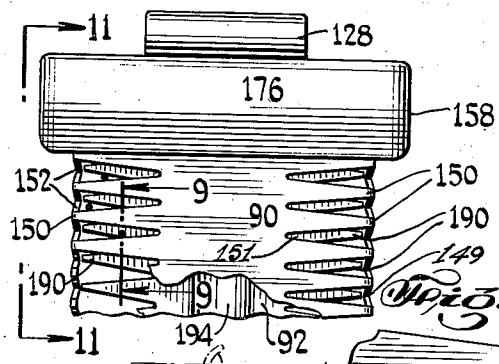

Fig. 12.

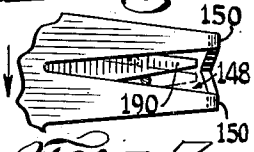

Fig. 9.

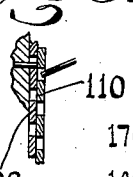

Fig. 7.

Fig. 10.

Fig. 6.

Fig. 11.

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April 28, 1942. J. GUR ARYE 2,281,434

SHAVING DEVICE

Filed Sept. 23, 1936 5 Sheets-Sheet 3

Fig. 13.

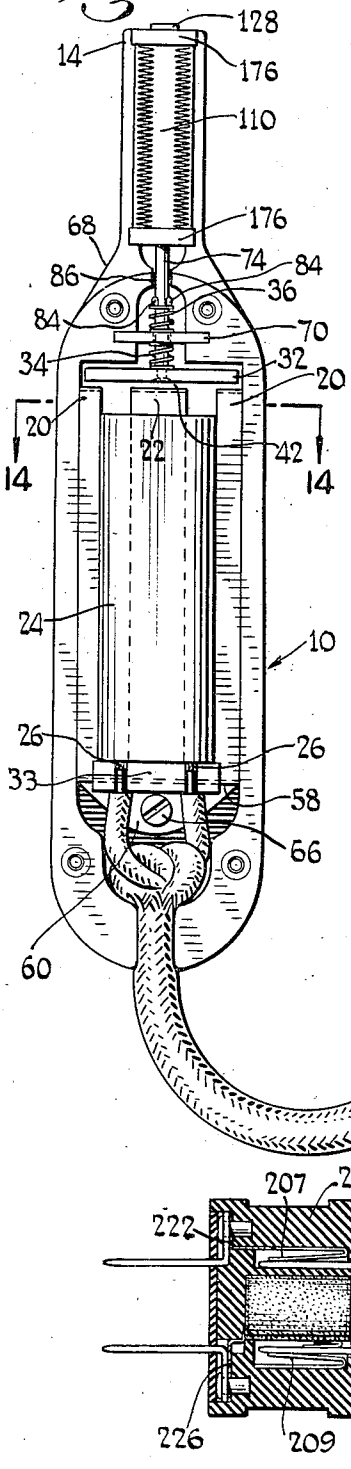


Fig. 16.

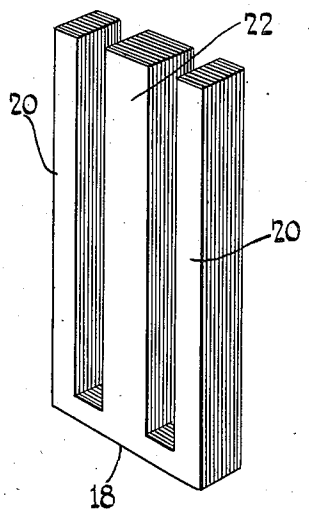


Fig. 17.

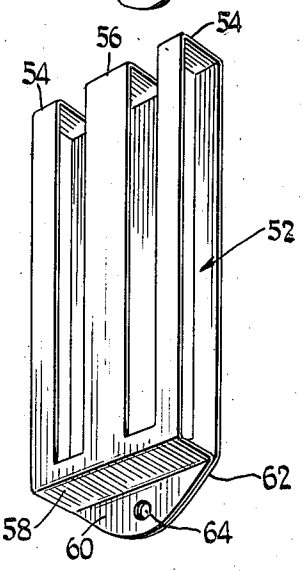


Fig. 14.

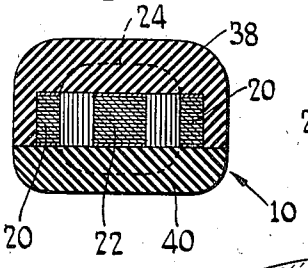
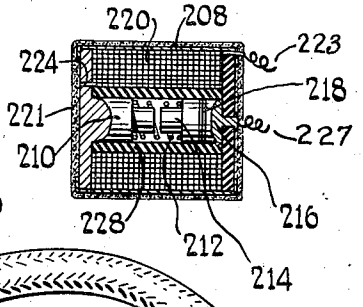
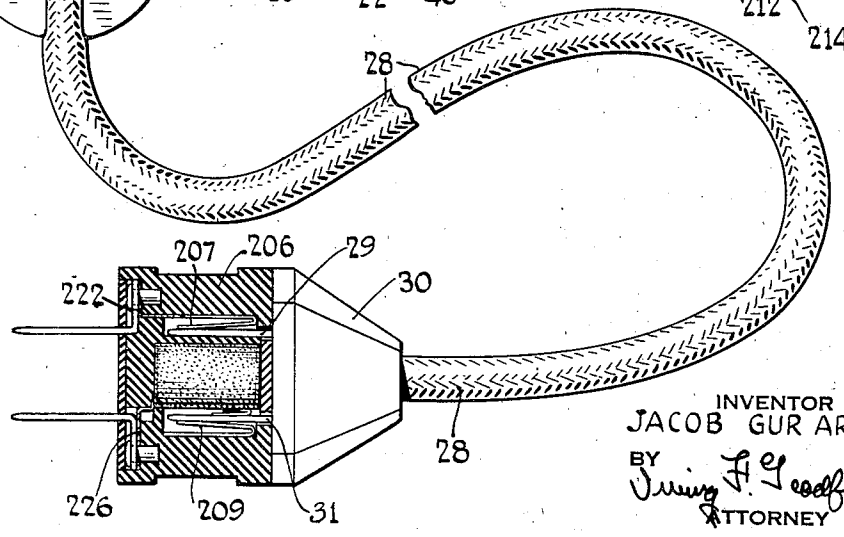


Fig. 15.





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April 28, 1942. J. GUR ARYE 2,281,434

SHAVING DEVICE

Filed Sept. 23, 1936 5 Sheets-Sheet 4

Fig. 18.

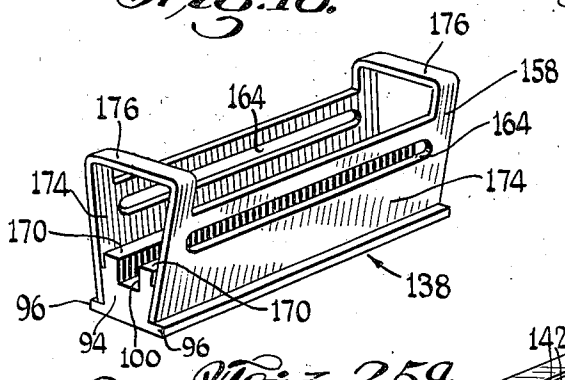


Fig. 24.

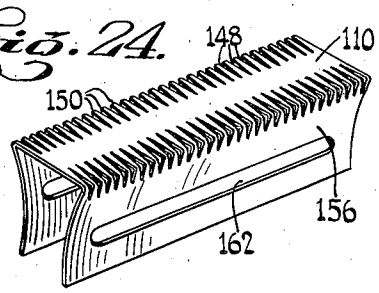


Fig. 19.

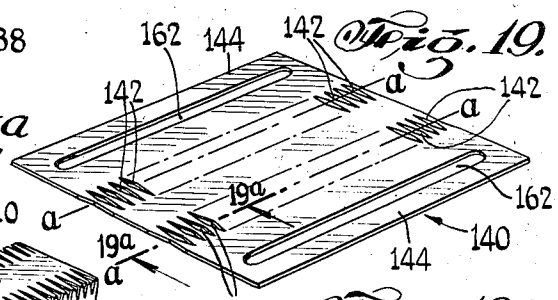


Fig. 25a.

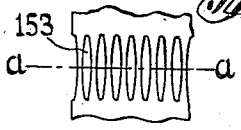


Fig. 20.

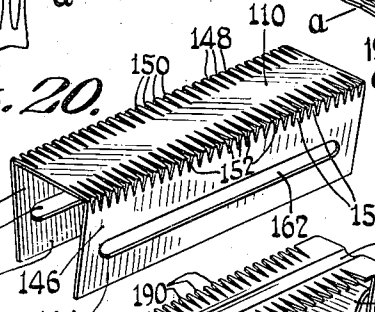
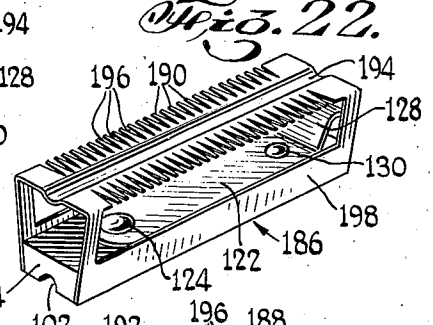


Fig. 19a

Fig. 22.



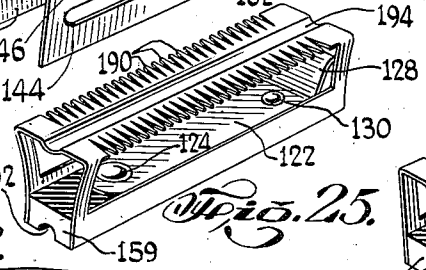


Fig. 25.

Fig. 23.

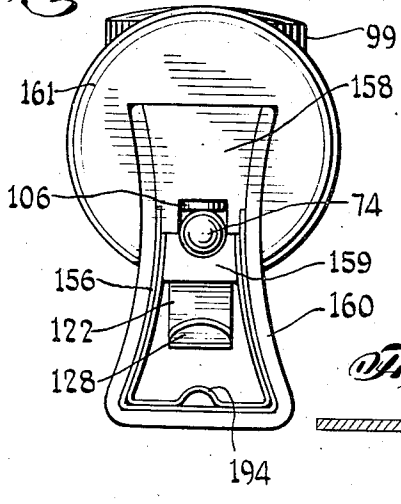


Fig. 21.

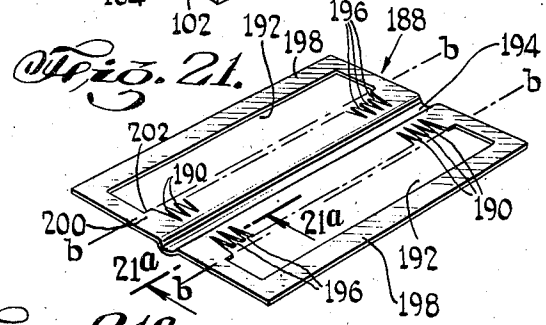
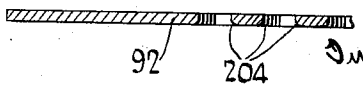


Fig. 21a



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April 28, 1942. J. GUR ARYE 2,281,434

SHAVING DEVICE

Filed Sept. 23, 1936 5 Sheets-Sheet 5

Fig. 26.

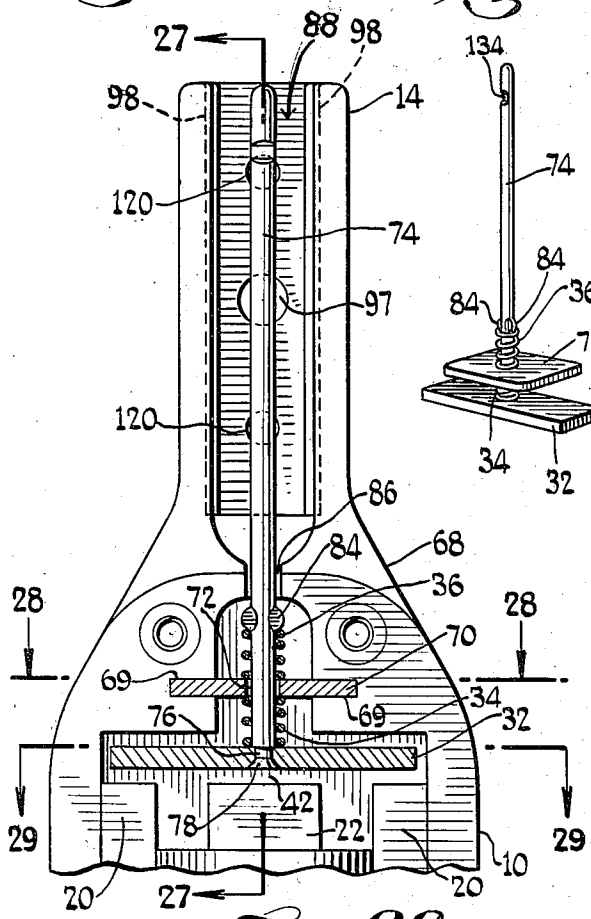


Fig. 30.

Fig. 31.

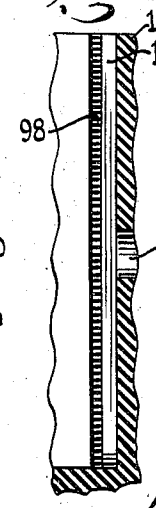


Fig. 27.

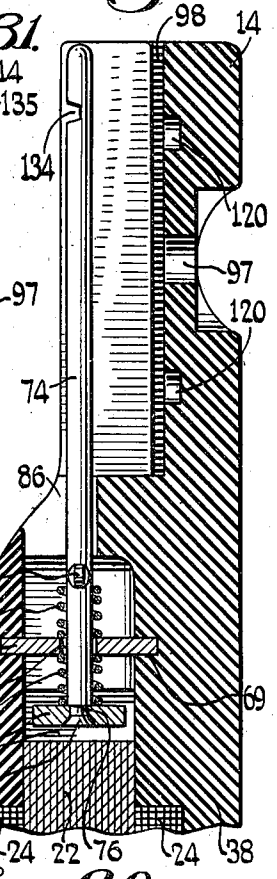


Fig. 28.

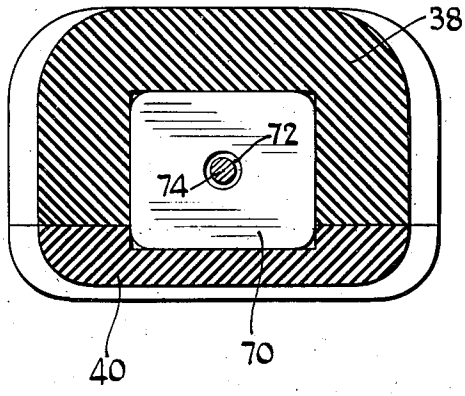
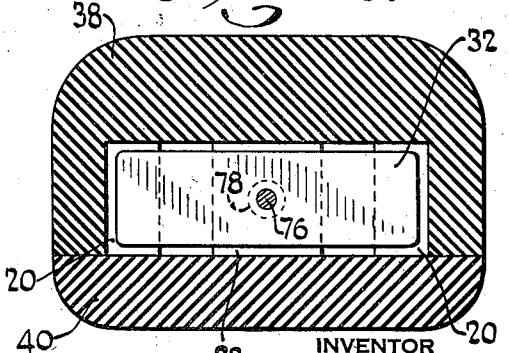


Fig. 29.



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Patented Apr. 28, 1942 2,281,434

UNITED STATES PATENT OFFICE

2,281,434

SHAVING DEVICE

Jacob Gur Arye, New York, N. Y., assignor to Samuel Gorad, New York, N. Y.

Application September 23, 1936, Serial No. 102,064

15 Claims. (Cl. 30—43)

This invention relates to mechanically operated hair clippers and shaving devices and more particularly to such hair clippers and shaving devices which are operated by means of electrically powered mechanism.

Shaving devices of this kind heretofore found in the art have been comparatively costly to manufacture by reason of the required relatively fine precision metal cutting machine and tool operations inherent with their construction and the comparatively complex and expensive power means used to operate them.

My invention contemplates the provision of such mechanically operated hair clippers and shaving devices which, because of their novel construction and the novel method of manufacture employed, eliminating among other things the costly metal cutting machine and tool operations heretofore necessarily employed, and substituting therefor simple metal forming operations such as punching or stamping, metal drawing and bending, are relatively inexpensive to manufacture.

My invention further contemplates the elimination of such comparatively expensive operating means heretofore used, as electric motors, and the substitution therefor of an efficient and inexpensive electromagnetic vibrator. Although it has been heretofore proposed to operate prior hair clipper and shaving devices by means of electromagnetic vibrators, these vibrators have been unsuccessful because, by reason of their construction, they are relatively heavy and are, therefore, costly, cumbersome and unwieldly to handle, noisy in operation and greatly overpowered.

My invention contemplates a vibrator construction which eliminates these inherent disadvantages of similar prior structures and provides an exceptionally efficient vibrator having maximum power for minimum weight, and one which is comparatively noiseless to operate and of such dimensions that lend it particularly desirable for use in combination with hair clippers and shaving devices.

My invention still further contemplates the provision of novel means for connecting the operating power means to a movable cutter member, which connecting means reduces attendant operating friction to a minimum, enables a comparatively short operating stroke to be used, and permits the elimination of the heretofore customary noisy armature slap against the electromagnet, thereby permitting a relatively low powered vibrator to be used, which is light in weight and extremely quiet in operation by eliminating all unnecessary noise.

My invention still further contemplates the provision of such a hair clipper and shaving device, which is so constructed that the cooperating cutting teeth on the movable and stationary cutting members will at some point throughout the effective hair cutting operative stroke of the device always be in shearing contact, and which will at all times cut hair so long as the cutting members are operated relatively to each other a distance equal to the width of a hair.

My invention still further contemplates the construction of such a shaving device in which the weight of the operative cutting members is at no time placed on the power connecting means, thereby reducing operating friction and providing a device, the parts of which may be readily and separately dismantled and assembled without straining, bending, or misaligning the various moving parts thereof.

My invention still further contemplates the provision of comparatively noiseless circuit interrupter or converter which may be combined with my electrically powered hair clipper and shaving device or other electrically powered device which makes direct current available for their operation.

Further objects and advantages of my invention will be clear from the description which follows and from the drawings in which

Figure 1 is a top plan view of my hair clipper and shaving device with the cover of the handle partially broken away.

Figure 2 is an inverted front elevation thereof.

Figure 3 is a side elevation thereof.

Figure 4 is a longitudinal sectional view taken on line 4—4 of Figure 1.

Figure 5 is a top plan view of the cutter assembly, the stationary cutter member being partially broken away to show the movable cutter member arranged in operative relation therebeneath.

Figure 6 is a transverse sectional view of the cutter assembly taken on the line 6—6 of Figure 5.

Figure 7 is a longitudinal sectional view of the cutter assembly taken on the line 7—7 of Figure 6.

Figure 8 is a fragmentary plan view of the cutter assembly, with the stationary cutter member partially broken away.

Figure 9 is a fragmentary longitudinal cross sectional view of the stationary and movable cutter members in operative relation taken on

the line 9—9 of Figure 8, illustrating the cutting action thereof on a hair.

Figure 10 is a fragmentary cross sectional view of the cutter members, in operating relation similar to that of Figure 9, illustrating further cutting action of the members on a hair.

Figure 11 is a fragmentary side elevation of the cutter assembly, illustrating the cutting action thereof on a hair.

Figure 12 is an enlarged fragmentary elevation of a hair admitting slot in the cutter assembly.

Figure 13 is a top plan view of a modification of my shaving device.

Figure 14 is a transverse sectional view of the operating power means taken on the line 14—14 of Figure 13.

Figure 15 is a cross sectional view of a direct current converter which is used in combination with my novel device when operated by direct current.

Figure 16 is a perspective view of a modification of the laminated magnetic iron body portion of the electromagnetic vibrator operating means.

Figure 17 is a perspective view of the securing envelope used with the modification illustrated in Figure 16.

Figure 18 is a perspective view of the stationary cutter member frame.

Figure 19 is a plan view of a metal stamping from which the stationary member is formed.

Figure 19*a* is a longitudinal sectional view taken on the line 19*a*—19*a* of Figure 19.

Figure 20 is a perspective view of a stationary cutter member stamping bent to shape.

Figure 21 is a perspective plan view of the metal stamping from which the movable cutter member is formed.

Figure 21*a* is a longitudinal sectional view, taken on the line 21*a*—21*a* of Figure 21.

Figure 22 is a perspective view of the movable cutter member.

Figure 23 is an inverted front elevation of a modification of the cutter assembly.

Figure 24 is a perspective view of the stationary cutter member stamping bent to shape illustrated in Figure 23.

Figure 25 is a perspective view of the movable cutter used with the modification of my device illustrated in Figure 23.

Figure 25*a* is a fragmentary plan view of the metal stamping from which a further modification of a stationary cutter member is formed, illustrating the configuration of the slots thereof.

Figure 26 is an enlarged top plan view of the connecting rod assembly arranged in the handle.

Figure 27 is a longitudinal sectional view taken on the line 27—27 of Fig. 26.

Figure 28 is a transverse sectional view taken on the line 28—28 of Fig. 26.

Figure 29 is a transverse sectional view taken on the line 29—29 of Fig. 26.

Figure 30 is a perspective view of the connecting rod armature unit.

Figure 31 is a fragmentary transverse sectional view of the head of the handle illustrating a modification of the cutter assembly slot.

Referring now to the drawings in which similar elements are designated by the same reference character, and particularly to Figures 1 to 4 inclusive, I provide a comparatively narrow and elongated handle 10 in one end of which is housed the operating power means, preferably an electromagnetic vibrator 12, and in the head 14 of which is seated the cutter assembly or unit 16.

It will be understood that, while my novel hair clipper may be operated by any mechanical means other than that illustrated, I prefer to use an electromagnetic vibrator, since such power means are inherently inexpensive and have a minimum number of moving parts which are of comparatively low replacement cost; do not require the provision of bearings for any rotating members and are, therefore, highly desirable for use with mechanically operated shaving devices, provided they can be mechanically adapted for operation therewith.

The vibrators heretofore used to operate shaving devices were provided with a relatively long operating stroke due to the construction and relative arrangement of the cutter assemblies.

In addition, the means for connecting the cutting units of such prior devices have comprised a number of moving parts setting up considerable operating friction. The resulting vibrators were, therefore, of relatively large power capacities, unwieldy and cumbersome, and had such large dimensions as to make them unsuitable for the purpose, difficult to hold and control during the shaving operation by reason of the comparatively heavy vibrations set up, and extremely noisy in operation.

My novel shaving device, on the other hand, due to the construction of the operative parts, such as the electromagnetic vibrator, which I have mechanically adapted to satisfactorily operate such devices, the shape of the teeth of the cooperating cutting members and the floating armature and connecting rod assembly and the relative arrangement of these elements, operates with minimum friction and a comparatively short operating stroke, thereby reducing the required power capacity of the operating means.

The vibrator 12 comprises the yoke 18, extending upwardly from which at each side thereof are the legs or pole pieces 20. Intermediate the pole pieces and extending upwardly from the yoke is arranged the core 22 around which is wound, in the usual manner, an electric current conductor wire coil 24 to thereby provide the conventional electromagnetic solenoid. The iron body is constructed, in a manner well known in the art, from laminations of soft magnetic iron. The solenoid coil is secured at its terminals 26 to the conventional wire cord 28 which extends to the usual cord terminal outlet plug 30, from which extend the terminal members 29 and 31 which are inserted in a conventional current outlet to complete the circuit. Any suitable insulating means, such as the terminal cap 33, may be disposed over the terminals to prevent accidental short circuits.

Magnetization of the core and pole pieces by the closing of the electric circuit attracts the magnetic load or armature 32 against the influence of the springs 34 and 36. Since the armature must be alternately attracted toward and repelled from the magnet, such vibrators operate only on alternating electric current unless some form of adapter or converter is provided to make direct current available. At any event, to operate the device the electromagnet is alternately magnetized and demagnetized by some form of alternating or fluctuating circuit of electrical energy.

Upon demagnetization of the magnet, the armature is urged back to its normal position under the influence of the springs, and such successive alternate movement of the armature

thereby provides a simple, inexpensive hair cutter unit operating means.

I have found that such an E-shaped vibrator provides the most efficient type of electromagnet for use with such shaving devices because it provides maximum power for the minimum size of unit.

In addition, this type of vibrator permits an elongated narrow and tapered housing for the operating means and, therefore, a shaving device handle which may be readily and conveniently grasped by the hand of the user.

Such E-shaped magnet is essentially a double magnet and produces the combined effect of two magnets arranged side by side, each of which influences equally both sides of the armature. This insures uniform movement of the armature toward the magnet and inhibits misalignment or canting to one side of the armature about its centre. It will be apparent that by such construction the centre and sides of the armature will always be in the same plane parallel to the face of the pole pieces and core as it is attracted toward the magnet. Other advantages of such construction will become further apparent.

The electromagnet is arranged in a suitable recess provided in the base 38 of the handle which, together with the cover plate 40, provides a combined operating means housing and shaving handle.

I have found that because of the construction of my shaving device it will operate with a maximum stroke equal to approximately .020". In order to provide satisfactory and inexpensive means for positioning the magnet in its housing and adjusting the air gap 42 to the required distance for such an operating stroke, I preferably provide on each pole piece a laterally extending ear 44. In assembly, the magnet is seated in the housing with the laterally extending ears arranged in suitable recesses 46 provided on each side of the base of the handle and which recesses are somewhat larger than the corresponding ears.

The electric circuit is then closed and the mutual attraction between the armature and the magnet urges and moves the magnet toward the armature, so that the laterally extending pole piece ears are urged and held against the shoulders 48 formed by the recesses.

It will be understood that probably the greatest source of the noise experienced in prior vibrators is occasioned by the rapid successive slapping of the armature against the pole pieces and core. It has been heretofore difficult to inexpensively adjust the armature to prevent such slapping of the armature, because of the necessity of fine precision metal cutting machine operations required to construct the corresponding parts within selected tolerances and the attendant costly selective assembly of the parts.

With the construction just described, in order to eliminate such slapping, it becomes only necessary in assembling the parts and closing the electrical circuit, as described, to insert extremely thin wafer-like shims between the shoulder of the recess and the corresponding pole piece ears until the armature just fails to meet the adjacent parts of the magnet as it operates in the assembled device.

It will be apparent that only unskilled labor will be required to assemble and adjust the parts in the housing and it is not required to construct the elements of the structure within selected manufacturing tolerances or to provide selective assembly thereof.

The electromagnet is secured in the handle by means of the cover plate which also is recessed to receive the electric coil and other operative parts and which plate is firmly held on the base of the handle by means of the countersunk cap screws 50 to thereby secure the operating means in the housing, without necessity of other positioning and securing means.

Referring now to Figures 13, 16 and 17, I have therein illustrated a modification of my novel magnet assembling and air cap adjusting means. This construction eliminates the recesses in the base of the handle and cooperating pole piece ears and substitutes therefor the magnet iron body enclosing envelope 52, the side pockets 54 of which enclose the magnet pole pieces and the centre pocket 56 of which encloses the magnet core. The envelope is further provided with a yoke enclosing base portion 58 from which extend the top and bottom lips 60 and 62 which are provided with aligned somewhat longitudinally elongated cap screw receiving apertures 64.

In assembly, the magnet iron body is placed in the envelope, the electric solenoid coil disposed on the enclosed core, and this formed structure arranged in the recessed base of the handle. The magnet receiving cap screw 66 is disposed in the elongated apertures in the envelope lips and loosely secured in a threaded opening arranged in the base of the handle. This permits the envelope enclosed magnet iron body to be moved longitudinally in the casing to thereby adjust the air gap to the desired dimension to prevent armature slap, as previously described. After such adjustment, the cap screw is tightly brought home against the lips to thereby firmly secure the magnet at the desired relative position in the base.

In addition to providing a novel magnet positioning and air gap adjusting means, the envelope also provides an enclosing casing which prevents fraying of the pole piece and core edges by the separation of the laminations forming them. Such envelope further presents a uniform even flat surface on the ends of the pole pieces and core adjacent the armature, thereby tending to provide a uniform air gap between the magnet and all parts of the armature surface.

It will, of course, be understood that both the modifications of the magnet positioning and air gap adjusting means may be combined in a single structure if desired.

In order to reduce the power required to operate the device to a minimum, and to avoid misalignment due to wear, it becomes necessary to eliminate operative friction or possibility thereof and therefore to prevent misalignment of the operative parts or their accidental distortion. My novel means for operatively connecting the power unit to the cutting unit therefore contemplates the provision of a floating armature and connecting rod assembly which is not rigidly held adjacent to and in relation to the magnet.

Referring now particularly to Figures 26 to 30 inclusive, I have therein illustrated a preferred embodiment of my novel connecting rod and armature unit. In order to provide means for housing the connecting rod and armature assembly, the base of the handle is inwardly tapered adjacent the head 14 to provide a neck 68, which is suitably recessed to receive the parts. The neck is slotted to provide the channels 69

which receive the connecting unit assembly retaining plate 70 to thereby operatively seat it in the handle. The retaining plate is provided with an aperture 72 somewhat larger in diameter than the connecting rod 74, which extends therethrough and is freely movable therein.

In order to secure the armature to the connecting rod, the end of the connecting rod may be reduced in diameter at its outermost end 76, which extends through a suitable countersunk opening arranged centrally of the armature and which is then peened to form the countersunk cap 78, thereby riveting the rod to the armature.

To normally maintain the connecting rod at its outermost operative position, the coiled springs 34 and 36, of approximately equal tension, are arranged on the connecting rod on each side of the retaining plate, the movable end of the inner spring 34 bearing against the inner face of the armature and the movable end of the outer spring 36 bearing against any suitable means arranged on the connecting rod adjacent the outer end thereof, such as the extending lugs 84, the fixed ends of both springs bearing on opposed faces of the retaining plate.

It will be seen that movement of the armature to the innermost stroke position, under the attraction of the electromagnet will distend the inner spring and simultaneously compress the outer spring. As the influence of the electromagnet is arrested, the connecting rod is urged to return toward its normal position by the contraction of inner spring and the expansion of outer spring, thereby providing a uniform force on the connecting rod equally on each side of the retaining wall, the tension of the springs being sufficiently powerful to carry the rod to the outermost stroke position.

It will be apparent that the armature and connecting rod may be operatively positioned in or removed from the handle as an integral unit (see Figure 30), merely by inserting the retaining plate 70 in the channels 69 arranged in the neck of the handle.

In operation, for all practical purposes, failure of the operative parts due to wear is likely to occur only in the connecting rod assembly springs or the connecting rod, since the electromagnet comprises no movable parts and, as will be shown, the cutter members are self sharpening. In the event of failure of these parts, it becomes a simple matter then to replace them by removing the entire unit (as illustrated in Figure 30) and inserting a new replacement unit.

It will be further apparent that the connecting rod itself is not rigidly secured to the frame but floats in the retaining plate and is free to adjust itself in the frame relatively to the magnet.

The connecting rod extends through a suitable passage 86 arranged in the neck of the handle and is disposed above the cutter unit seat 88 recessed in the comparatively narrow head 14 extending from the handle base integrally therewith.

The cutter unit comprises a stationary cutter member 90 and a movable cutter member 92, which will be more fully described below (see Figures 4, 5, 6 and 7) and which are seated in the head of the handle in such a manner that their weight is never directed upon the connecting rod itself but is completely carried by the handle itself.

Referring now to Figures 4 to 7 inclusive, the base 94 of the stationary cutter has arranged on each side thereof the laterally extending guides 96 which in assembly are arranged in the grooves or guide-ways 98 on each side of cutter unit seat. (See Figure 26.) To assemble the device, the stationary cutter is slid into its seat in the head of the handle, the cutter member being securely held in the head by means of the set screw 99 which engages a suitable tapped hole 97 in the base of the stationary member. It will be seen that the weight of the cutter unit is thereby carried by the handle and that possibility of the cutter accidentally falling out of the seat is to a great extent prevented.

The base of stationary cutter is provided with a longitudinal slot 100 which cooperates with the longitudinal semicircular slot 102 arranged on the underside of the base 104 of the movable cutter to form a longitudinal groove to receive the connecting rod, upon assembling the two parts together.

In operation, the connecting rod is urged in the semicircular groove against the base of movable cutter by the spring pressed plungers 106, arranged at equal distances from the centre of the cutter member in suitable cylindrical sockets 109 in the base of the stationary cutter member, and which plungers thereby hold the face 108 of the movable cutter in operative relation against the face 110 of the stationary cutter.

The spring pressed plungers are undercut at their outer ends to form the pins 111, which have arranged on them the caps 112.

The plunger heads are urged against the connecting rod by the expanding coil springs 114, which bear against the shoulders 116 formed by reducing the diameter of the cylindrical groove at its outer end and the underside 118 of the head of the plunger.

To assemble the plungers in the stationary cutter, the coil springs are arranged on the pins and the plungers inserted into the cylindrical grooves with the springs resting on the shoulders formed therein and with the pins extending beyond the bottom face of the base of the cutter. The ends of the pins are then peened to form the retaining caps 112 which prevent the plungers from being urged out of the cylindrical grooves under the influence of the springs.

It will be apparent that upon assembling the parts, the connecting rod will displace the pins inwardly and suitable recesses 120 are therefore arranged in the head to receive them.

The connecting rod is preferably made from any suitable material, such as steel or copper wire, so that it may be formed and shaped by the conventional drawing operation, the plungers being of a somewhat softer material so that the rubbing wear attendant upon operation will take place entirely on the caps which otherwise would, by their abrading action, form grooves in the connecting rod.

In operation, the spring pressed plungers maintain the connecting rod against the movable cutter member in alignment therewith, the armature and connecting rod being always maintained in floating alignment with the magnet and thereby adapted to spontaneously adjust itself to compensate for any relative displacement of the parts occasioned by wear or other cause, thereby reducing operating friction to a minimum.

I have provided a simple means for locking the movable and stationary cutters together, which permits the movable cutter to be removed and

reinserted without necessity of first removing the entire cutter unit or assembly.

In the embodiment illustrated in Figure 7, one end of the flat spring 122 is secured to the base of the movable cutter by means of the rivet 124, the underhead 126 of which is countersunk in the under face of the cutter base, so that a smooth even face will be presented to the connecting rod.

Extending from the free end of that flat spring is arranged outside of the cutter unit the finger piece 128, adjacent which is provided the locking pin 130 which extends from the base through the aperture 132 to engage a suitable recess 134 arranged in the connecting rod to thereby operatively connect the movable cutter to the operating mechanism.

The movable cutter may be removed from the cutter unit by lifting the finger upwardly against the tension of the flat spring which normally maintains the pin in locking engagement with the connecting rod. Upon reinserting the movable cutter, the locking pin is spontaneously urged into the recess when they are brought into alignment.

I have found that by slightly bevelling the end of the locking pin and providing the recess with an inward taper, for all practical purposes, rubbing wear of these parts, which would be occasioned by the expected frequent removal and reinsertion of the cutter in use and which otherwise would, within a comparatively short time, render the parts inoperative, is thereby eliminated.

Such bevel and taper need only be very slight to increase the life of the parts, for example with a connecting rod $1\frac{29}{32}$'' in length, $\frac{3}{32}$'' in diameter and operated with a .020'' stroke, a recess having an outer dimension of $\frac{1}{16}$'' tapering with approximately a 2 degree taper to an inner dimension of $\frac{3}{64}$'' has been found very satisfactory.

It will be apparent that by the construction described the weight of the cutter unit and the parts comprising it is carried directly by the handle and no strain is placed by them upon the connecting rod, thereby avoiding possibility of bending the rod out of alignment.

It will be apparent that with the construction just described, the movable cutter must be first removed in order to remove the stationary cutter so that the springs may displace the spring pressed plunger pins from the respective recesses in the cutter seat of the head.

In Figure 31, I have illustrated a modification of the cutter unit receiving head, in which is substituted for the recesses 130 the longitudinal slot 135, which receives the spring pressed plunger pins. It will be apparent that such construction will enable the entire cutter assembly as a unit or the stationary cutter alone to be removed without first removing the movable cutter.

Referring now to the cutter unit or assembly, it is disposed with the cutting face thereof parallel to the longitudinal axis of the handle so that reciprocation of the movable cutter is in the direction of vibration of the armature and axially thereof. Such construction permits the connecting rod to be directly connected to the armature centrally thereof, thereby eliminating the customary plurality of connecting elements heretofore required in prior devices to convert the vibratory motion of the operating means to the conventional divergent endwise motion of the cutter, and resulting in a simple, inexpensive unitary structure in which operating friction is reduced to a minimum.

It will be seen that the entire cutter unit or assembly is so constructed that the elements thereof may be manufactured by conventional inexpensive metal-forming press operations, such as stamping and punching and drawing.

Considering first the stationary cutter member, it comprises the slotted element 136 (Figure 20), which is fixed in the supporting frame 138 (Figure 18).

In order to eliminate any magnetic attraction between the operative members of my device, the slotted element is preferably made from any suitable non-magnetic metal such as beryllium copper or non-magnetic stainless steel, and is thin enough to be perforated from a metal sheet or blank by the conventional die punch press operation to form the metal stamping 140 (Figure 19), having the series of preferably substantially diamond shaped holes 142 punched therein. I have found that for the stationary slotted member illustrated, a thickness of metal stock in the neighborhood of .010'' is preferable. Such thickness results in a cutter face thin enough to enable a close shave to be had and at the same time is not too thick to prevent the formation of the desired shaped perforations sufficiently close together to provide proper spacing of the cutter teeth resulting therefrom by a die punch operation, practically and without excessive wear on the forming dies and punches.

The slotted element 136 is formed from the metal stamping 140 by bending in a press with suitable shaping dies the side elements 144 thereof along the line of bend *a*—*a* into the form illustrated in Figure 20, the side elements thereby presenting the stationary cutter side walls 146.

Upon bending the stamping into the desired shape, the substantially diamond perforations 142 form the hair admitting slots 148 on each edge of the cutter member, the edges of the slots forming knifelike hair cutting teeth 150, which are substantially triangular shaped.

For best cutting results, the hair admitting slots should be as narrow as mechanical limitations permit. In order, however, to insure the admission of hair into the slots for presentation to the cutting edge, I prefer to make the hair admitting slots wider at their open ends 149 and tapered inwardly to their narrowest dimension at their closed ends 151. (Figure 8.)

I have found that excellent results are obtained with hair admitting slots approximately .015'' wide at their open ends and tapering uniformly to approximately .005'' wide at their inner ends. The slots preferably do not taper into sharp pointed corners at their inner ends, as such construction would cause excessive wear on the dies used to punch the stamping. In order to reduce wear of the forming dies, the slots on all elements of the device are rounded at their inner ends, the type of rounded corner controlling the actual dimensions of the slot at such point.

I have found that it is not necessary to provide slots that extend entirely across the face, because a hair directed into any slot will, by reason of the rapid reciprocation of the cutter, be cut completely after it has passed only a few thousandths of an inch into the slot. Hair admitting slots $\frac{3}{64}$'' in depth have given very satisfactory results.

In forming the cutter member side walls, they are bent inwardly from the edges of the cutter and have arranged thereon a plurality of slots 152 forming the comblike teeth 154 between them.

formed by the perforations in the blank. Each slot on the cutter member walls enters a corresponding hair admitting slot on the face of the cutter member, the teeth adjacent the wall slots serving as a comb to direct the hair into position to be cut by the operative cutter parts.

The side wall slots, since their function is only to assist in directing the hair into the hair admitting slots adjacent the cutting teeth, need not be as narrow nor as long as the hair admitting slots. I have found that such side wall slots, tapering to a width at their closed ends **184** of .010" and having a depth of $\frac{3}{64}$", give very satisfactory results.

In forming the metal stamping, the diamond shaped holes are provided with dimensions which, upon bending the stamping, will form slots of such dimensions as selected.

In Figure 25*a*, I have illustrated fragmentarily a modification of the perforated metal stamping from which the stationary slotted element is formed, in which the perforations **153** are substantially elliptical by reason of their curvilinear walls.

This form of perforation, since it permits the greatest amount of metal for any specific dimensions selected, provides a tooth of maximum strength and permits the use of rounded dies and punches resulting in reduced wear thereof and is therefore a particularly desirable construction.

The radius of curvature of the walls of the slots will vary with the size of opening of the resultant hair admitting slot. I have found that for a slot .010" to .015" wide (which is the minor axis of the elliptical perforation), a radius of $\frac{11}{32}$" provides a satisfactory perforation $\frac{1}{8}$" long, which upon bending the stamping into the desired shape along the line of bend *a*—*a* results in a hair admitting slot $\frac{1}{16}$" deep.

It will be understood that the inner ends of the resulting slot are likewise rounded to eliminate sharp pointed slot inner corners.

It will be seen that I have provided an exceedingly simple structure having an integral comblike wall formed from the very same member that provides the cutter teeth.

The angle of divergence of the side walls from the cutter edge may be varied as desired, the sharper the angle the greater the comblike action of the side wall teeth.

I have found that an exceptionally convenient manner of providing the desired sharp angle of side wall divergence is to provide the curvilinear side walls **156** (Figure 24) formed from the metal stamping by a suitable forming die. Such construction provides a relatively sharp angle, while at the same time presenting a strong rigid structure having the desired relatively wide base necessary for strength and appearance.

Such modification, in addition, eliminates the cutter unit guides **96** and the cutter unit slot cooperating grooves or guide-ways **98** of the modification heretofore described.

In that modification in which the cutting unit is provided with curvilinear side walls, base **158** of the stationary cutter, the base **159** of the movable cutter and the stationary cutter frame **160** are correspondingly curved (Figure 23). Similarly the head **161** of the handle is correspondingly curved to provide a channel which slidingly receives and retains the modified cutting unit or assembly **160**.

I have found that the modification just described, by reason of the comparative sharp angle of divergence, is particularly advantageous for use in cutting relatively long hair such as is found on the arms, legs and body.

In order to reduce the weight of the device, the elongated apertures **162**, which, upon bending the stamping as described, serve to form the cutting unit interior cleaning slots **164**, may be simultaneously punched out upon forming the metal stamping.

In forming the metal stamping, the forming punch is brought down on the face of the metal sheet or blank in the direction of bend of the side elements so that the upper edges **166** of the walls adjacent the slots (see Figure 19*a*) are rounded off by the metal shaping action of the die, thereby presenting a smooth rounded surface for contact with the skin of the user.

The stationary member frame comprises the base **94**, which is preferably made from any suitable soft metal such as brass or copper in order that it may be extruded into the shape illustrated as by drawing a bar of metal stock through suitable shaping dies in a conventional press, and the slotted member enclosing shell **158** (Figure 18).

The base has formed thereon the extended longitudinal barlike elements **170** which together form the longitudinal slot **100**, in which the connecting rod is arranged, and are spaced inwardly from the sides of the base to provide shoulders **172** (Figure 6) against which the slotted element is disposed.

The slotted element enclosing shell, which may be made from any suitable metal, such as brass, copper or stainless steel (non-magnetic) and preferably only of such thickness sufficient to present a rigid inflexible structure but yet permitting the shell to be formed by punching with a suitable die and then shaped by bending with a shaping die comprises the side walls **174** and the transverse straps **176**.

The side walls of the shell, which are secured to the base in any suitable manner as by soldering, welding, or riveting, and which are likewise provided with the elongated cleaning apertures **164**, form together with the barlike elements the longitudinal channels in which the slotted cutter element is inserted in constructing the stationary member.

The formed slotted element is arranged in the frame and secured thereto as by soldering, welding, or riveting the lower edges of the element side walls to the base and the face of the element to the transverse straps to thereby provide a rigid inflexible structure and insure against flexure of the movable cutter face **108**.

In the manufacture of the device, the stationary cutter slotted element metal stamping is hardened prior to perforating it to thereby provide a good cutting edge on the teeth after the grinding operation without further necessity for heat treatment. After the stamping is formed and prior to shaping it is ground to remove the burrs and to sharpen the cutting teeth by the conventional surface finishing grinding machine. It will be apparent that such grinding and sharpening operation is relatively simple and inexpensive when compared to the internal grinding and sharpening operations required with the construction of prior devices and is possible only because of the novel method of manufacture which presents a flat even surface for the grinding operation.

Referring now to the movable cutter, it is preferably made from a hard steel such as stainless surgical steel, which usually is a magnetic

steel. It will be understood that where one of the rubbing parts is formed from a magnetic metal, I prefer to form the other rubbing part from a nonmagnetic metal.

The movable cutter member 92 comprises the base 104 to which is secured the movable cutter slotted element 186, as by soldering, welding, or riveting (Figure 22).

The movable cutter base like the stationary cutter base is preferably extruded into the shape illustrated.

The movable cutter slotted element is thin enough to be perforated from a metal blank and to be formed into the stamping 188 (Figure 21) by the conventional die punch press operation. By simultaneously forming the substantially triangular teeth 190, the outer edges of which are preferably rounded, and the rectangular slot 192 adjacent thereto, a blank, metal stock of greater thickness may be used, which I have found for satisfactory results may be approximately .020".

The provision of such a slot adjacent the teeth, reduces the weight of the movable member to the desired minimum, and, in addition, enables the punch and die to provide the necessary support to permit a practicable stamping operation, in forming the teeth, which otherwise would cause excessive wear upon the die and punch when operated upon metal of appreciable thickness. It is for this reason that metal blank from which the stationary cutter slotted element is formed must be comparatively thin, since the metal around the diamond shaped portions is not supported extraneously against flexing, while the metal from which the movable cutter slotted element may be practically twice as thick.

In order to provide a rigid structure and to give added support to the metal in punching and the teeth in the stamping, the inwardly dished out longitudinal strengthening groove 194 is simultaneously formed in the metal blank by the conventional metal drawing die punch operation. Such a longitudinal groove, in addition, imparts rigidity and inflexibility to the movable cutter structure itself.

The slots 196, which separate the cutting teeth 190 of the movable member, are preferably .020" wide at their open ends and taper inwardly to a rounded corner of approximately .005" and are approximately $\frac{1}{16}$" in depth to correspond with the hair admitting slots on the stationary cutter. It will be understood that the same considerations relating to the selected form, shape and dimensions thereof apply to the slots and teeth of the movable cutter as were set forth above relating to the slots and teeth of the stationary cutter.

The side elements 198 of the metal stamping 188 are bent in a press by a suitable shaping die along the line of bend *b*—*b* into the form illustrated in Figure 22, these side elements thereby forming the side walls of the movable cutter.

Ears 200 are formed in the stamping at the ends of each row of teeth, extending somewhat beyond the outer rounded edges of the teeth. The line of bend *b*—*b* is coincident with outer edges 202 of the pair of ears adjacent each set of teeth and upon bending the movable cutter stamping into the desired shape as described, the ears become guide bars extending beyond the teeth and engaging the inner surfaces of the frame straps, which guide bars serve to prevent lateral movement and misalignment of the movable cutter in the stationary cutter frame.

Such construction prevents the points of the movable cutter teeth from extending into and engaging the stationary cutter slots, should the movable cutter for any reason be displaced laterally.

In forming the movable cutter stamping, the forming punch is brought down on the face of the metal sheet blank in a direction opposite to the bend of the side elements, so that the rounded and therefore unsharpened edges 204 of the walls adjacent the slots (see Figure 21*a*) are not disposed against the ground surface of the stationary cutter.

In the manufacture of the device, since the metal stock from which the movable cutter stamping is punched, is comparatively thick, a relatively soft unhardened metal, which has not been heat treated, is preferably used. The metal blank is punched and shaped, as described, and then hardened in the conventional manner. After shaping and heat treating for hardening, the resulting flat upper surface 108 may be relatively inexpensively and simply ground and the edges of the teeth thereby sharpened by a conventional surface finishing and grinding machine.

The movable cutter illustrated in Figure 25 has formed thereon by the usual die forming operation the curved side walls similar to and for association with the curved side walls of the modification of my cutter assembly or unit shown in Figure 23.

Referring now to Figures 5 and 8, the operative parts of the cutter are assembled together so that each hair admitting slot has arranged adjacent thereto and normally intermediately thereof a single tooth of the movable cutter and each cutting edge adjacent such slot is in operative engagement with a corresponding edge of a movable cutter tooth. It will be apparent that the respective cooperating edges of each part are always engaged in angular relation to each other irrespective of the longitudinal displacement of the movable cutter with respect to the stationary cutter.

By arranging the cutting edges of the movable teeth divergently to a corresponding cutting edge of each slot on the stationary member, a hair presented therebetween will be cut or clipped by a shear which is similar to a pivoted scissors action by reason of the fact that the cutting edges must throughout the stroke of the cutter member, as it is translated relatively to the stationary member, cross at an angle to each other.

It will be apparent that cutting will take place as an edge of a tooth of the movable cutter is moved toward a corresponding edge adjacent the hair admitting slot on the stationary cutter (see Figure 12). At the outer stroke position of the movable cutter (away from the electromagnet) the teeth of the respective members will be in cutting engagement adjacent the closed end of the slot. As the movable cutter is translated with respect to the stationary cutter, the point of cutting contact will advance along the corresponding edge of slot until at the inner stroke position of the movable cutter (toward the electromagnet), the respective cutting edges will be in cutting engagement adjacent the open end of the hair admitting slot.

It will be apparent that any translated movement of the movable cutter will provide corresponding movement of the cutting edge of a tooth along the corresponding cutting edge of a hair admitting slot, the greater the stroke of the

movable cutter the greater will be the effective cutting distance along the edge of the slot.

This will become apparent from an inspection of Figure 12, which illustrates in heavy lines a position of the tooth 190 and in dotted lines a successive position of the tooth upon translation of the cutter in the direction of the arrow. It will be seen that such movement advances the point of cutting engagement of the cooperating edges toward the open end of the slot, the cooperating edges being at all times at an angle to each other.

It will be at once apparent that any slight reciprocation of the movable cutter, though only of a few thousandths of an inch, will effect shearing or cutting coaction at some point along the edges of coacting teeth so that my device will at all times cut hair so long as the movable cutter is translated with respect to the stationary cutter at least a distance equal to the width of a hair.

It will be understood that my device, when powered by the electromagnet described or by an alternating current motor, will not operate on a direct current circuit. Prior devices, whether vibrator or motor driven, have been arranged to operate on both direct or alternating current by the provision of means which, when inserted in a direct current circuit, successively interrupt the electrical circuit, thereby causing an interrupted or fluctuating direct current which simulates the effect of an alternating current circuit on the electromagnets associated with the power means. Such interrupter means have in these prior devices been directly combined with the power means, whether vibrator or motor, and have therefore been arranged in the handle of the device wherein they are customarily housed.

Such prior interrupters or converters, by reason of their construction, have been exceedingly noisy, the effect of which on the user is aggravated and intensified since the noise is located in the handle of the device which is held against the face adjacent the ears.

I provide a direct current interrupter or adapter, which is itself relatively quiet in operation, and in which the effective noise of operation is further reduced by dissociating it from the operating means and the handle customarily enclosing it and which interrupter may be integrally or detachably associated with the conventional electric cord terminal plug 30 (Figure 13) and therefore disposed remote from the operating means and enclosing handle.

Such combination and relative association of elements provides a comparatively noiseless hair clipper or shaving device which becomes thereby pleasant to operate and use.

Referring particularly to Figures 13 and 15, my direct current interrupter or converter 206 may be detachably associated with cord terminal plug 30, the terminal members 29 and 31 being received in contact with the resilient contact members 207 and 209, and is provided with the insulating shell 208 which houses the circuit interrupter operative elements.

Arranged in the shell is the fixed magnetic iron core 210 which is undercut at its inner end to provide a shoulder against which one end of the expanding spring 212 bears. The movable circuit breaker electrode 214 is normally held against the fixed electrode 216 by the expansion of the spring. Suitable platinum or the like contact points 218 are arranged on the contact faces of the respective electrodes to prevent pitting thereof by the sparking resulting from opening and closing the electric circuit.

In order to provide an electromagnetic force to attract the movable electrode and thereby interrupt the electrical circuit, I arrange and completely enclose the iron core, spring and electrodes in a solenoid coil 220 of suitable electric conductor wire.

The entire unit is immersed in wax, to thereby provide an air-tight and waterproof coating 221. An electrical circuit is made by inserting the interrupter terminal members 222 and 226 in a conventional source of current supply. Current then passes from the terminal member 222 through the contact member 207, thence through the terminal member 29 through the cord 28 and the electromagnet to the terminal member 31. The circuit is then completed through the contact member 209 which is connected to the solenoid coil by the wire 223 and thence through the wire connection 224 to the iron core. Current then passes through the spring to the movable electrode which normally is in contact with the fixed electrode to which the other terminal 226 is connected by the wire 227, thus completing the circuit.

Upon completing the circuit, the iron core and movable electrode are magnetized, attracting and thereby urging the movable electrode toward the iron core against the tension of the spring. As the movable electrode moves away from the fixed electrode, contact therewith is broken, thereby interrupting and opening the electrical circuit. Interruption of the circuit demagnetizes the iron core and permits the tension of the spring to return the movable electrode to its normal position in contact with the fixed electrode, thereby again closing the electrical circuit and causing the cycle to be repeated. When inserted in a direct current circuit, my novel converter produces an interrupted or fluctuating direct current which will operate the electric operating means, whether vibrator or motor.

In order not to short circuit the operative parts and permit the circuit to be broken by the contact breaker, I arrange the insulating sleeve 228 between the solenoid coil and the core and electrodes so that current cannot flow to the fixed electrode after the circuit breaker is attracted away therefrom.

The initial sparking, resulting from operating the converter, removes the oxygen from the air in the converter chamber by oxidation, causing the parts to operate in a nitrogen atmosphere, which further muffles the noise of the slapping electrodes.

The greatest factor causing the relatively excessive noise emanating from prior devices results from the slapping of the circuit breaker electrodes in the large hollow chamber formed by the motor housing and handle and which intensifies the noise of the slapping parts in much the same way as the reverberations in a drum.

The noise of the slapping electrodes in my interrupter or converter, on the other hand, is lessened by reason of the fact that they are housed in an exceedingly small chamber and which chamber in addition is enclosed by many parts which serve to practically completely muffle the slapping sound and to provide a comparatively noiseless device. It will be apparent that the substantial elimination of noise in my device results not only from the novel arrangement of the parts comprising my interrupter, but

also from its arrangement away from and remote from the motor housing.

It will be further apparent that I have provided a novel hair clipper and shaving device, which is relatively inexpensive to manufacture, comparatively convenient to operate and use, resulting from the combination of the various elements described and their relative arrangement together.

While I have described my invention in detail with specific examples, it will be understood that such examples are illustrative and are not given as limitations since other modifications within the spirit and scope of my invention will be apparent to those skilled in the art. Hence, the invention is to be understood as limited only as indicated, in the appended claims, in which the intent is to set forth all the novelty over the prior art.

I claim:

1. In a mechanically operated hair clipper and shaving device, a movable cutter having a longitudinal groove arranged thereon, electrically actuated cutter operating means including an armature, said armature freely movable in the operating means, a member disposed in the said cutter groove and secured to the armature for connecting the armature to the cutter and spring influenced means for maintaining the member in the groove in engagement with the cutter.

2. A hair clipper and shaving device comprising, in combination, hair cutting means arranged on the device, electrically actuated operating means secured to the hair cutting means, an electrical current conductor cord secured to the operating means and having a terminal plug remote from the operating means, terminal members extending from the plug and means, detachably associated with said terminal plug, for successively interrupting the operating means electrical circuit, said means including a casing having recesses adapted to removably receive said terminal members.

3. In a hair clipper and shaving device, a stationary member comprising a slotted element shaped from a comparatively thin heat treated flexible perforated stamping to thereby provide a flat face plate having a plurality of spaced slots forming teeth therebetween on opposed edges of the face plate and integral side walls depending from the edges of the face plate inwardly thereof and each of said side walls having a plurality of spaced slots adjacent to and entering corresponding slots on the face plate, said face plate normally collapsible under shaving pressure and an enclosing frame secured to the side walls along the lower edges thereof and to the face plate along the ends thereof whereby the face plate is rendered substantially rigid and inflexible under shaving pressure.

4. In a hair clipper, a stationary member comprising a frame including a base, side walls extending upwardly from the base and transverse straps joining said frame side walls at each end of the frame and a slotted element shaped from a thin heat treated ordinarily flexible perforated stamping to thereby provide a flat slotted face plate normally collapsible under shaving pressure, having integral side walls depending inwardly therefrom, the side walls of said slotted element secured to the frame side walls and the ends of the face plate secured to corresponding straps of the frame whereby the face plate is rendered substantially inflexible under shaving pressure.

5. In a hair clipper and shaver, a movable member comprising a base, a flat plate having a plurality of teeth arranged on opposed edges thereof, and side walls depending from said plate and secured to the base, said side walls being completely cut away adjacent the said teeth and above the base.

6. In a hair clipper and shaving device, a handle, operating means arranged in the handle, a stationary cutter member secured to the handle, a movable member arranged in the stationary member, means for operatively securing the operating means to the movable cutter and resilient means for manually releasably locking the movable cutter in the stationary cutter member to the connecting means.

7. In a hair clipper and shaving device, a stationary cutter, a movable cutter detachably arranged in the stationary cutter, means for operating the movable cutter and spring means on the movable cutter for manually releasably locking the movable cutter in the stationary cutter member to the operating means.

8. In a hair clipper and shaving device, operating means, a connecting rod arranged thereon and having a recess, a movable cutter, a spring secured to the movable cutter and a pin on the spring engaging the recess.

9. In a hair clipper and shaving device, a stationary member comprising a slotted element, shaped from a heat treated comparatively thin flexible perforated stamping to form an ordinarily flexible and collapsible under shaving pressure face contacting plate and depending side walls, and an enclosing frame for securing said slotted element therein, said frame including a base and a pair of transverse straps extending upwardly therefrom, said slotted element secured to the base along the lower edge of the side walls and to the transverse straps along adjacent edges of the side walls and the face-contacting plate, whereby the face contacting plate is rendered substantially rigid and inflexible under shaving pressure.

10. In a hair clipper and shaving device, a stationary cutter formed from a comparatively thin heat treated stamping having a plurality of perforations arranged thereon and bent along the perforations to form an ordinarily collapsible under shaving pressure slotted face contacting plate and integral slotted inwardly curvilinear walls depending from sides of the face contacting plate, each slot on the curvilinear walls entering a corresponding slot on the face contacting plate, and a frame enclosing the formed stamping and secured thereto throughout the outermost edges thereof to thereby render the face-contacting plate rigid and inflexible under shaving pressure, a movable cutter cooperating with the stationary cutter and means for operating the movable cutter relatively to the stationary cutter.

11. In a hair clipper and shaving device, a stationary cutter formed from a comparatively thin heat treated stamping having a plurality of perforations arranged thereon and bent along the perforations to form an ordinarily flexible and collapsible under shaving pressure slotted face contacting plate and slotted walls depending inwardly from the sides of the face contacting plate, each slot on the inwardly depending walls entering a corresponding slot on the face contacting plate, and a frame enclosing the formed stamping and secured thereto throughout the outermost edges thereof to thereby ren-

der the face-contacting plate rigid and inflexible under shaving pressure, a movable cutter cooperating with the stationary cutter and means for operating the movable cutter relatively to the stationary cutter.

12. A hair clipper and shaving device comprising, in combination, hair cutting means arranged on the device, electrically actuated operating means secured to the hair cutting means, an electrical conductor cord secured to the operating means, a terminal plug permanently secured to the conductor cord and means for successively interrupting the operating means electrical circuit comprising a solenoid and an opposed spring influenced movable electrode and a fixed electrode, said electrical circuit interrupting means completely enclosed in an air-tight and water-tight casing, means arranged on said casing and connected to one of the electrodes for detachably associating the casing in an electrical circuit and means connected to the other electrode for detachably associating the said casing with the said terminal plug.

13. A hair clipper and shaving device comprising, in combination, hair cutting means arranged on the device, electrically actuated operating means secured to the hair cutting means, an electrical current conductor cord secured to the operating means and having a terminal plug remote from the operating means for connecting the operating means to an electric circuit, terminal members extending from the plug and operatively connected to the cord, a casing having recesses adapted to removably receive said terminal members, means arranged in the casing and operatively associated with said recesses for changing the electrical characteristics of the electrical circuit to which the operating means is connected and electrical contact members operatively associated with said electrical circuit characteristic changing means, extending from said casing, said members adapted to removably associate said electrical circuit characteristic changing means with an electric circuit.

14. In a device of the character described, a casing, a stationary cutter member arranged on the casing, a movable cutter adjacent the stationary cutter, a connecting rod engaging the cutter, means for concurrently urging the rod against the movable cutter and the movable cutter against the stationary cutter, and a plate having an aperture, said rod extending through said aperture, said casing having recesses for removably retaining said plate in the casing.

15. In a hair clipper and shaving device, a stationary member comprising a slotted element, said element shaped from a comparatively thin flexible sheet to form an ordinary flexible and collapsible under shaving pressure face contacting plate and depending side walls, and an enclosing frame for securing said shaped element therein, said frame including a base part and a pair of transverse straps extending upwardly therefrom, said shaped element secured to the base part along the lower edge of the side walls and to the transverse straps along adjacent ends of the said side walls and the face contacting plate, whereby the face contacting plate is rendered substantially rigid and inflexible under normal shaving pressure.

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