

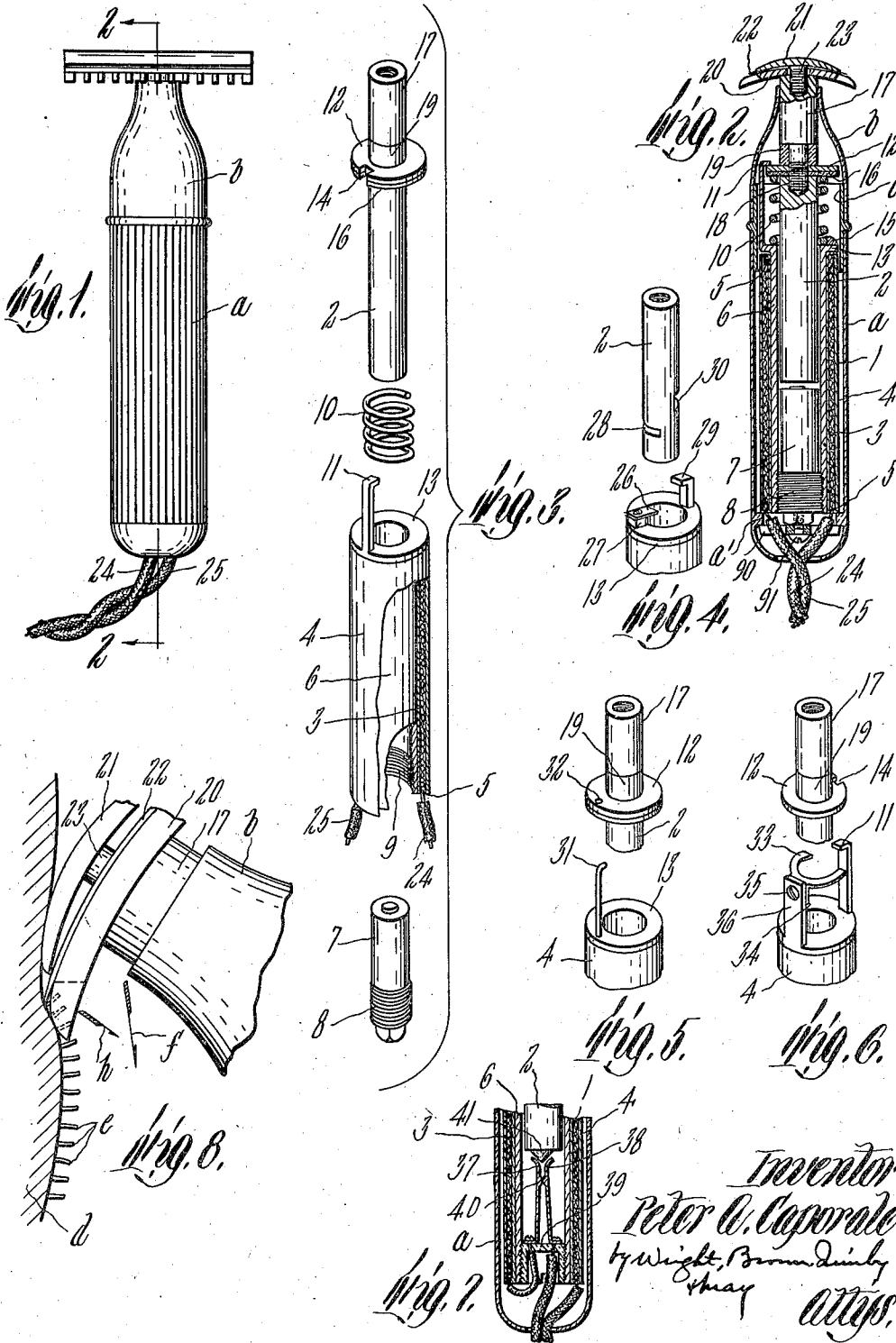
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2,067,072

ELECTRICAL SAFETY RAZOR

Original Filed Sept. 28, 1933 2 Sheets-Sheet 1



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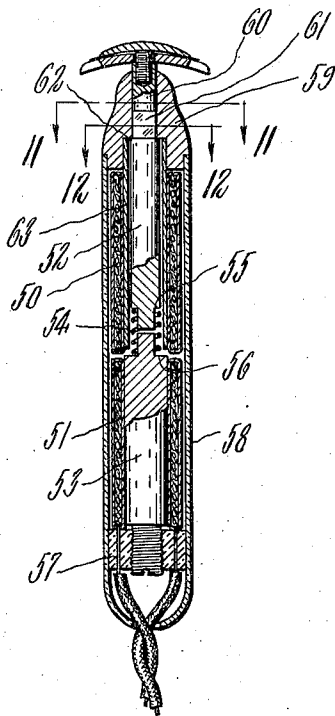


Fig. 9.

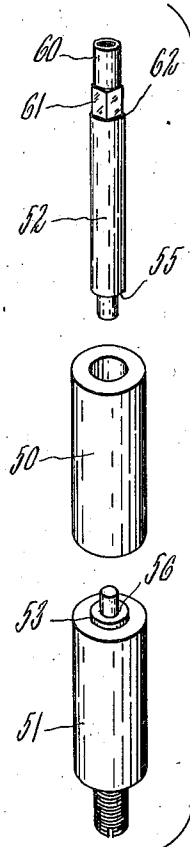


Fig. 10.

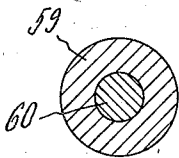


Fig. 11.

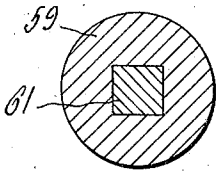


Fig. 12.

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UNITED STATES PATENT OFFICE

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ELECTRICAL SAFETY RAZOR

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15 Claims. (Cl. 30—45)

This invention relates to safety razors of the type in which movement is given to the blade by electrical action to facilitate shaving. In razors of this type heretofore produced, so far as I am aware, the movement of the blade is longitudinal, that is, back and forth in the direction in which the cutting edge extends; and to obtain this movement requires the use either of an electric motor with a rotating armature or the like, or a complication of mechanism to transmit motion to the blade in that direction from a primary moving part of which the motion is in a different direction. In order to permit such movement of the blade, the guiding means for the same, which include guards to prevent cutting of the skin, must be made free. This necessary looseness of the blade in its guides results in more or less rattling and objectionable noise; and gives opportunity for entrance of bits of hair, which sometimes wedge so as to prevent the blade from moving and require opening and cleaning of the guideways to permit the blade to operate properly. Usually the razors of this type require blades of special construction and form.

It is the object of the present invention to provide a safety razor having provisions for back and forth movement of the blade, and simple electro magnetic means for moving it by direct action, without intermediate mechanism or rotating parts. Another object is to permit the utilization with my razor of the various types of commercial razor blades now in general use and available for purchase in multitudes of retail stores; and to clamp such blades tightly so that they will not rattle. Further objects have to do with the structural characteristics of the razor and involve new and useful improvements in these particulars.

The manner in which I have realized these objects in practice, and the utility and advantages derived therefrom, are explained in the following specification with reference to the drawings. The invention comprises not only the specific structures so described and illustrated, but also all substantial equivalents thereof within the scope of the appended claims.

In the drawings,—

Fig. 1 is a side elevation of a safety razor embodying one form of this invention;

Fig. 2 is a longitudinal section of the same taken on line 2—2 of Fig. 1;

Fig. 3 is a perspective view of the internal operating parts of this razor separated from one another;

Figs. 4, 5 and 6 are perspective views showing a

number of equivalent variations for certain parts of the razor;

Fig. 7 is a sectional view showing a modification of the razor involving a make and break device whereby operation by direct current is possible;

Fig. 8 is a diagrammatic view on an enlarged scale illustrating the mode in which the electrically produced motion of the razor blade facilitates shaving;

Fig. 9 is a view similar to Fig. 2 showing another form of razor embodying the invention;

Fig. 10 is a perspective view of the disassembled interior parts of the razor shown in Fig. 9;

Figs. 11 and 12 are cross sections, on an enlarged scale, taken on lines 11—11 and 12—12 of Fig. 9.

Like reference characters designate the same parts wherever they occur in all the figures.

The razor shown in Figs. 1, 2 and 3 is constructed with an outer shell or casing, which serves also as a handle, made of two parts *a* and *b* in tandem, and connected by a sleeve *c* which projects partially into the adjacent ends of both parts. The sleeve may be fitted tightly but slidably in the parts *a* and *b*, or either of them, or it may be permanently connected to one or both by solder or the like, or it may have a screw threaded engagement with one or both parts, or a combination of either of the above described means of connection. The several parts of this casing may be fabricated in any suitable manner out of any suitable material, as metallic tubing, drawn sheet metal, or molded, cast or machined material, whether metallic or non metallic.

Within the casing is a wire coil 1 constituting the winding of a solenoid and composed of any desired number of turns of wire helically arranged in one or more coaxial layers; the size of the wire and the number of turns thereof and the length of the coil being determined in accordance with well known electrical principles to exert a sufficient force of magnetic attraction on a core 2 which is movably mounted within the coil. This coil is preferably enveloped, supported and protected by inner and outer sheaths 3 and 4 of tubing, to the ends of which are connected annular plates 5, so as to make the coil a self contained structural unit capable of being assembled as such with the other parts of the razor.

The coil unit is placed on a liner sleeve 6, and may be secured thereto by cementing, friction or other means. The liner sleeve provides a guideway for the core 2 and also supports an adjustable abutment 7 which extends into the sleeve

from one end a suitable distance to limit the inward movement of the core, and is held by a screw threaded portion 8 which engages internal threads 9 of the liner.

5 The assemblage of coil and liner is prevented from moving longitudinally in the outer casing. Various means may be provided for this purpose, and I have shown illustratively in Fig. 2 an interior flange a' , or equivalent lugs, inside 10 the part a , against which one end of the coil abuts, and is clamped by a plate or spider 90 secured to the end of the abutment 7 by a screw 91.

The core 2 is of magnetic material and is placed partly within and partly protruding from the liner sleeve and the enveloping coil; in the position where it is most powerfully attracted by the magnetic effect induced by flow of electricity through the coil. It is normally held in this position by the conjoint action of a spring 10 and a limit finger 11. The spring reacts between a flange 12 on the core and a lip or shoulder 13 on the sleeve; while the finger projects from the outer circumference of the lip 13, longitudinally of the core, outside of the spring, through a notch 14 in the flange, and its extremity is bent over to engage the outer surface of the flange. The finger cooperates with the sides of notch 14 in preventing rotation of the core and of the extension from said core which carries the razor head. The spring 10 is also prevented from turning around the core, the means for this purpose being shown in Fig. 2 as a drop of solder 15 connecting one end of the spring to the lip 13; but the same result may be obtained by other means as by bending down one end of the spring and passing it into a hole or notch in the lip 13, or similarly engaging the other end of the spring with flange 12. The reason for preventing rotation of the spring is to insure uniformity of its action in opposing the magnetic pull of the solenoid. A yielding washer 16 is interposed between flange 12 and the adjacent end of spring 10 in order to prevent noise.

An extension 17 protrudes from the core 2 45 through the outer end of casing member b and carries on its extremity a razor head. Conveniently this extension, which may be considered as the shank of the razor head, is made as a separate piece from the core having a threaded nipple 18 of reduced diameter which is screwed into the adjacent end of the core. The flange 12 may be made as a separate perforated disk or plate, which is secured and clamped against the end of the core by the extension piece 17, as shown 50 in Fig. 2. A filler sleeve 19 is here shown as interposed between the extension 17 and the flange disk, typifying any washer or filler which may be employed to enable the extension to protrude as far as desired while making a tight 60 and rigid assemblage with the core.

The razor head consists of a guard plate 20 and clamp plate 21, between which is gripped a detachable razor blade 22, this assemblage being secured to the core extension 17 by a threaded stud 23 projecting from the clamp plate through the blade and guard plate into a tapped socket in the core extension. The head here shown is the same as that provided with one of the well known commercial makes of safety razor, and may be 70 substituted by heads of other types and design, whether those now known and in use or which may be developed in future. One of the important features of the invention is that it permits the use of razor blade holders which grip the blade tightly and prevent its rattling.

When the winding of the solenoid is connected with a source of alternating current, as by the wires 24 and 25 leading from the bottom end of the outer casing, lines of magnetic force are induced with each reversal of the current. Thereby the core 2 is attracted and drawn inward against the resistance of spring 10 during each period of maximum current flow; while the spring moves it outward at the times of minimum flux when the current is reversing. Thus if a 60 cycle current is used, the core is attracted and released 120 times per second. The extent of its inward movement is limited by the abutment 7, which is so adjusted as to permit of only a small movement, say three or four times the diameter of a hair. A relatively stiff spring is used; i. e., one which, while yielding under the magnetic force, is yet powerful enough to return the combined mass of the core and razor head to the outward limit of movement in the brief intervals of diminished magnetic flux. The desideratum is a spring which exerts about half as much force as the magnetic attraction at maximum flux.

A variation in the spring and limit means is shown in Fig. 4, where the spring 26 is a leaf spring secured at one end to a step 27 on the lip 13 and protruding into a notch 28 in one side of the core. The limit finger 29 enters a notch 30 in the other side of the core. Fig. 5 shows a variation in which the limit finger 31 differs from finger 11 in being a round rod or wire passing through a hole 32 in the flange of the core, instead of being an open notch. The same type of spring is here used as the spring 10 shown in Figs. 2 and 3. In Fig. 6 the spring 33 is horse-shoe shaped having two arms adapted to embrace the core extension on the outer side of flange 12, and at its middle part is connected by a tab 34 and screw 35 with a lug 36 extending from the lip 13. The limit finger in this case is the same as the finger 11 shown in Figs. 2 and 3. Other variations may be made without departure from the invention; one important feature of all forms of interlock between the solenoid and its core being that the interlocking means (limit finger and flange or their equivalents) coact to prevent rotation of the core when the razor head is screwed on or off its protruding end.

The invention is not limited to use with alternating current, but may be adapted for direct current by the use of a suitable circuit interrupter. Fig. 7 shows such an interrupter in the form of two spring arms 37 and 38 mounted on a plug 39 which is screwed into the liner sleeve in place of the abutment 7. These spring arms are connected in series in the circuit of the solenoid winding, and normally make contact with one another at the point 40. The core has a wedge projection 41 which enters between the ends of the arms and moves them apart when the core is magnetically pulled inward. Spring means equivalent to those previously described move the core outward when the winding is deenergized by breaking of the circuit. The spring arms serve also as means to limit the inward movement of the core.

Another embodiment of the invention, employing the same principles, is shown in Figs. 9-12. Here I have provided two coils or solenoid windings 50 and 51 arranged in tandem. The movable core 52 is contained in the coil 50 only, terminating within the inner end thereof and protruding from the outer end; and an abutment 53 of magnetic material is secured stationary in the

coil 51. These coils are wound in relatively opposite directions, whereby opposite magnetic polarities are induced in the contiguous ends of the core and abutment by current flow, which greatly increases the force acting to move the core. The contiguous ends of the core and abutment are reduced in diameter and are surrounded by the spring 54 which tends to separate them by reacting against the shoulders 55 and 56. The abutment 53 is threaded through the plug 57 which is fitted tightly within the handle casing, this threaded connecting enabling the position of the abutment to be accurately determined and made fast.

The casing in this form of the invention is composed of a tube 58 which forms the major part of the handle, and a plug 59 fitted in one end of the tube and secured therein, either permanently or detachably by any suitable means. This plug has a bore through which an extension 60 of the core 52 passes. The interior end of the bore is of non circular form to fit the square, or otherwise non circular part 61, of the core extension, so as to prevent the core from rotating and enable the razor head to be screwed into and out of the tapped socket in the end of the extension; as in the design first described. The inner end of this bore obstructs a shoulder 62 on the core to limit the outward movement of the latter caused by spring 54. Of course other means than the specific square formation here described may be provided for this purpose. The extremity of the core, and that part of the bore through which it passes, are made with a sliding fit sufficiently close to prevent entrance of water, while free enough to permit the prescribed movement of the core. Similarly the core extension 17 and surrounding part of the casing member b, shown in Figs. 1 and 2, are fitted closely enough to prevent entrance of water into the casing. Plug 59 may be made of cast or molded metal or non metallic substance, and the outer part of its bore may be reamed to exact dimensions. However, my invention is not limited to details in these particulars.

A sleeve 63 is secured at one end to the center of the plug 59 and projects into the casing tube 58, providing a guide for the core and a support on which the coil 50 is mounted. Both coils 50 and 51, like the coil 1, may be enclosed between tubular sheaths and annular end plates, so as to make them self contained units, and may be secured in place by cementing or other suitable means; coil 50 on the sleeve 62 and coil 51 on the abutment plug 53.

The conductor wires pass through the end of the casing tube remote from the blade carrying head to the coil 51, as shown. The windings of both coils are connected in series.

While I have shown, and prefer to use, solenoids as the electro magnetic motive means of this razor, and indeed claim details of these parts as embodying features of the invention which I desire to protect; nevertheless I wish it understood that the broader aspects of this invention are not limited exclusively to solenoids as the electro magnetic means. Therefore the claims which recite such means broadly are to be construed as including electro magnets and other equivalent means suitable for the same purpose.

I have found in practice that the movement given by the means described to the razor blade, in a direction transverse to the length of the blade, has a highly beneficial effect in shaving. The action is illustrated in a diagrammatic way

by Fig. 8. Here *d* represents a part of the face and *e* represents protruding hairs. The razor is held at an inclination to the surface of the face and pressed against the skin so as slightly to indent it. While the razor is moved bodily by hand in the direction of the arrow *f* along the face, the blade edge is vibrated rapidly in the direction of the arrow *h* oblique to the hairs, so that it strikes the hairs suddenly and rapidly, supplementing the motion given by hand of the razor as a whole. I have found that with my razor it is possible to shave much more rapidly than with one which is moved only by hand, and that the razor can be moved along the face with a continuous motion and without the numerous short overlapping oblique strokes which are needed to obtain a smooth shave by manipulation alone. Shaving is completed more quickly and with a smoother finish with the aid of my razor than by hand razors, other things being equal, and the need of having the blade very sharp is less vital. That is, with a somewhat dull blade, my razor gives better shaving results than an equally dull blade in a hand razor.

A valuable effect resulting from my arrangement of magnetic core and blade is that the edge of the blade remains in good cutting condition for a remarkably long period of use. This condition I believe to be due to the lines of magnetic force passing through the core and blade, and completing their circuit from the edges of the blade to the further end of the core. It is my belief that the minute fibers or serrations which are known to exist at the edges of sharp razor blades (which are deflected in course of shaving and replaced in order when the blade is stropped) are held by such lines of force in the proper position for shaving; and the lines of force both resist their deflection by the resistance of the hairs and return them in greater or less degree to proper position after having been deflected. This effect is enhanced by making the extension of the core of magnetic material all the way to the razor head, and also by making one or both of the clamping members of the head out of magnetic material. But the effect described is very noticeable even when the clamp plates are of non magnetic substance.

I have shown herein for illustration a razor head adapted to hold a two edged blade; and in order that both edges may be used with equal facility, the head is mounted squarely across the core so that it makes equal angles at both sides with the core and the line of reciprocation thereof. But it is within my contemplation to mount the blade clamp or head at a more sharply acute angle at one side with the core to permit holding the razor, if desired, in a manner such that the reciprocation of the blade will be more nearly parallel to the surface of the user's face and more nearly perpendicular to the hairs, than shown in Fig. 8.

What I claim and desire to secure by Letters Patent is:

1. An electrical safety razor comprising a handle, a solenoid winding mounted within said handle, a reciprocatory core of magnetic material in said coil and protruding from one end of the handle, and a razor blade secured to said core with its plane transverse to the path of movement thereof.

2. An electrical safety razor comprising complementary guard and clamp plates, a blade detachably gripped between said plates, a solenoid core connected rigidly to one of said plates with

its length transverse to the plane of said blade, and a handle containing a solenoid winding into which said core passes lengthwise to an extent such that it is impelled inward by magnetic flux in said coil.

3. An electrical safety razor comprising a holder having a solenoid winding, a core mounted for movement endwise by the magnetic action of said winding, a spring acting on the core for moving it in the opposite direction, and a razor head in detachable screw threaded connection with said core constructed to hold a blade in a plane transverse to the core; the core and holder having cooperating means for preventing independent rotation of the core when the razor head is screwed into and out of connection with it.

4. An electrical safety razor comprising a handle, a reciprocative member contained in said handle and protruding at one end therefrom, cooperative electromagnetic and spring means for reciprocating said member under the influence of a periodic or interrupted electric current, and a razor blade holder secured to the protruding end of said member and adapted to hold a blade in such position as to be moved by and with the reciprocative member in a direction transverse to the plane of the blade.

5. An electrical safety razor comprising a blade gripping means, a handle, a reciprocative member mounted in said handle and protruding therefrom to which said blade gripping means are secured in a position such that the blade is held with its plane extending transversely to the line of movement of said reciprocative member, and means for reciprocating said member.

6. An electrical safety razor comprising a handle, a blade clamping means, a holder for said blade clamping means protruding from said handle and to which the blade clamping means are secured, and means for reciprocating said holder; the blade clamping means being arranged to secure a razor blade with its plane extending in a direction transverse to the direction of reciprocation of said holder.

7. An electrical razor comprising an electromagnet and a solenoid coil in tandem arrangement and series connection, a core movably arranged in said coil for movement therein toward and away from said magnet, and a razor blade holding head connected to said core outside of the solenoid coil; the windings of said magnet and solenoid coil being of a character to induce, when energized by flow of current, opposite polarities in the contiguous ends of the magnet and movable core respectively.

8. An electrical vibratory razor comprising two electromagnet coils located in tandem arrangement and connected for flow of electric current from a single source, a core movable endwise in one of said coils only, the windings of said coils being in respectively opposite directions whereby to induce respectively opposite magnetic polarities in the inner end of the core and the adjacent end of the coil which is not entered by said core, and a razor blade holding head connected with the core to be moved therewith.

9. An electrical safety razor comprising a handle casing, two electromagnetic coils mounted in tandem within said casing, a core contained movably in one of said windings only, and a razor blade located outside of said handle and connected to the core to be moved therewith, said coils being so wound that flow of electric current through them causes opposite magnetic polarities respectively in the inner end of said core and in the adjacent end of the coil which is not entered by the core.

10. An electrical safety razor comprising a handle casing, two electromagnetic coils in tandem arrangement within said handle, a core of magnetic material reciprocatively arranged in one of said coils only, an abutment of magnetic material contained in the other coil and arranged so that its end nearest the first coil serves as an abutment to limit inward movement of the core, the respective coils being so wound as to induce, by flow of current through them, opposite magnetic polarities in the adjacent ends of the abutment and core respectively, and a razor blade carried by said core external of the handle.

11. An electrical safety razor comprising a solenoid coil, a core of magnetic material movably mounted in said coil, and a razor blade directly connected to the core so as to form part of a magnetic circuit therewith, and so disposed that the lines of magnetic force through the core and blade extend from the edge of the blade in approximately the plane of the blade.

12. An electrical safety razor comprising a solenoid coil, a core of magnetic material movably mounted within said coil and protruding at one end therefrom, a razor blade rigidly connected to the outer end of said core with its plane transverse to the length of the core and in magnetic circuit therewith.

13. An electrical razor comprising a hollow handle, an endwise-reciprocative shank protruding from one end thereof, electro-magnetic motive means in the handle organized to reciprocate said shank, and a blade secured crosswise to the shank so as to be movable by and with the shank in the same directions.

14. An electrical safety razor, comprising a handle, a blade supported movably by said handle, and electric motive means carried by the handle and coupled transversely to the blade in a manner to give a rapid vibratory motion to the blade in directions transverse to the plane thereof.

15. An electrical safety razor comprising a handle, a solenoid in said handle, a core of magnetic material contained in said solenoid with provision for endwise movement therein, and protruding at one end from the handle, and a blade secured rigidly on said protruding end, across the longitudinal line of the core so that it is moved thereby transversely of its own plane, and that lines of magnetic force electrically induced in the magnetic circuit of core and blade extend outward from the blade edge in substantial continuation of the said plane.

PETER A. CAPORALE.