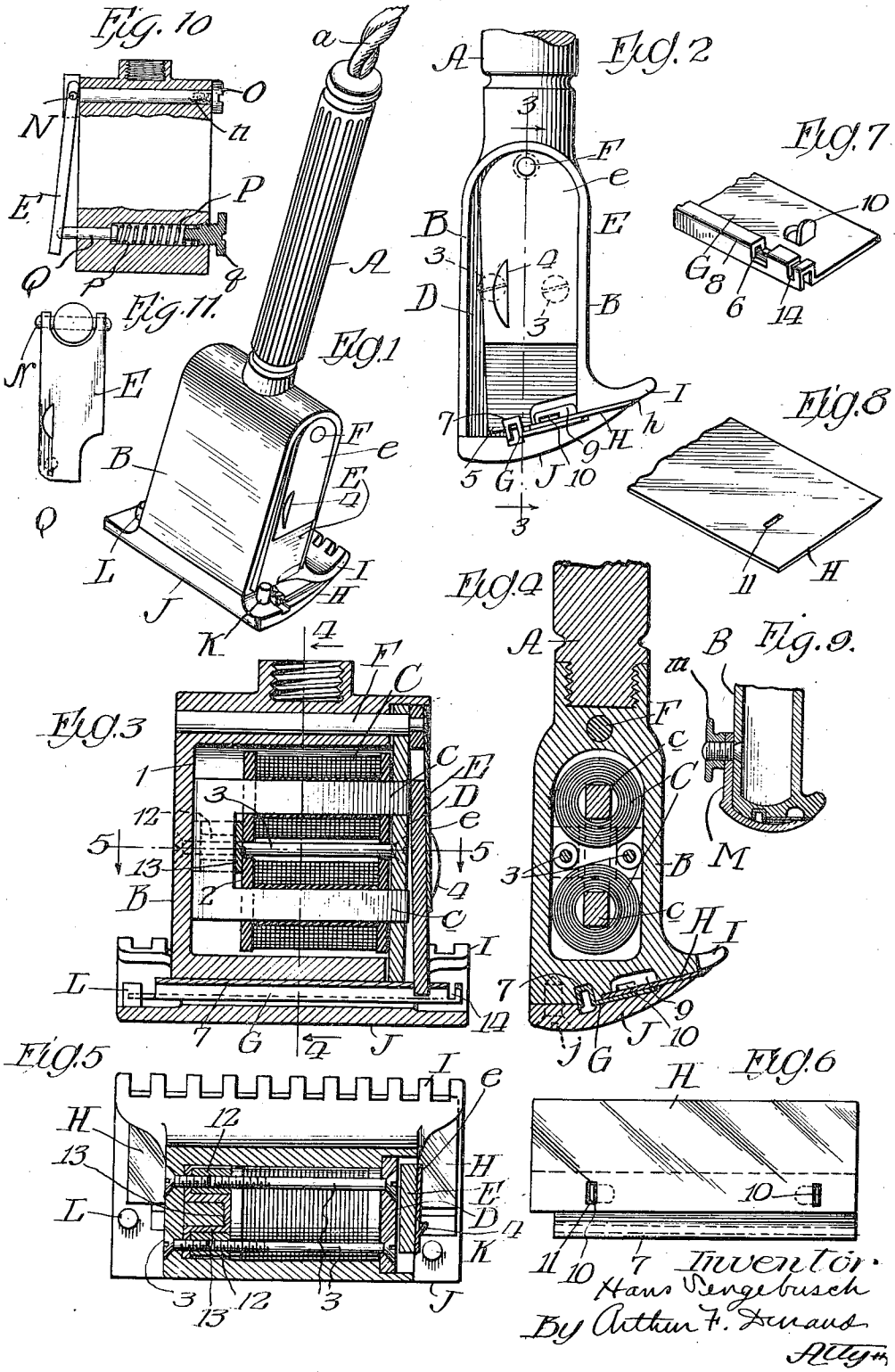
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ELECTRIC SAFETY RAZOR.

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UNITED STATES PATENT OFFICE.

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To all whom it may concern:

Be it known that I, HANS SENGEBUSCH, a citizen of the United States of America, and resident of Chicago, Cook county, Illinois, have invented a certain new and useful Improvement in Electric Safety-Razors, of which the following is a specification.

My invention relates to electric safety-razors of that kind in which the blade has a very rapid reciprocation or vibration, endwise thereof, during the use of the razor in shaving, so that the cutting edge of the razor moves back and forth on the guard of the razor.

Generally stated, the object of my invention is to provide a novel and improved electric safety-razor of the foregoing general character.

Special objects are to provide an improved construction and arrangement whereby the blade can be easily inserted in the razor, and whereby the blade can be easily disconnected from the electrically-operated actuating-mechanism to permit the removal of the blade from the razor; to provide an improved construction and arrangement whereby the electrically-operated actuating-mechanism can be inserted within the razor and removed therefrom as a unit, and whereby the electro-magnet is entirely inclosed and protected against moisture; and to provide an improved construction and arrangement whereby a razor of this kind may be conveniently operated and used.

It is also an object to provide certain details and features of construction and combinations tending to increase the general efficiency and desirability of an electrically-operated safety-razor of this particular character, and tending to reduce the cost of manufacture thereof.

To these and other useful ends, my invention consists in matters hereinafter set forth and claimed.

In the accompanying drawings:—

Figure 1 is a perspective of a safety-razor embodying the principles of my invention.

Fig. 2 is a side elevation, on a larger scale, of the head-portion of said razor.

Fig. 3 is a longitudinal section of the head-portion of said razor on line 3—3 in Fig. 2.

Fig. 4 is a transverse section on line 4—4 in Fig. 3.

Fig. 5 is a horizontal section on line 5—5 in Fig. 3.

Fig. 6 is a plan-view of the blade and the blade-retainer or guide.

Fig. 7 is a perspective of one end-portion of said blade-retainer or guide.

Fig. 8 is a perspective of one end-portion of the blade.

Fig. 9 is a sectional view similar to Fig. 4, showing another form of my invention.

Fig. 10 is a view similar to Fig. 3, showing another form of my invention.

Fig. 11 is a side elevation of the armature shown in Fig. 10.

As thus illustrated, my invention comprises a handle A provided with a hollow head B for inclosing the electro-magnet C, which latter comprises a U-shaped iron magnet-core having parallel pole-pieces *c*, and windings 1 and 2 of any suitable character for said pole-pieces. The ends of said pole-pieces are arranged to extend through the brass plate D, the head B being also of brass, and parallel screws 3 extend through said plate and the back wall *b* of the head, parallel with the pole-pieces of the magnet, to hold the latter in place. The armature E is secured to a flat steel spring *e*, and the latter is secured to the outer end-portion of a pin F inserted through the plate D and the head B, so that the other end of this pin is exposed at the outer surface of the wall *b* at the other side of the razor. The spring *e* has a portion 4 to be engaged by the thumb when it is desired to rotate the pin F in the head of the razor to swing the end-portion 5 of the armature out of engagement with the notch 6 in the blade-retainer or guide G, in a manner that will be hereinafter explained. The end of the head B forms one jaw of the blade-holder, being provided for this purpose with a groove 7 to receive the trough-shaped portion 8 of the blade-retainer or guide G, and with clearance 9 for the lugs 10 on said blade-retainer G, which lugs extend through the openings 11 of the thin steel blade H, whereby the vibration of the armature E will reciprocate the blade-retainer G in the groove 7, and thereby reciprocate or rapidly vibrate the blade endwise. The head B of the razor is provided at the front edge of the blade-seat with a guard I, of any suitable form or character. The other jaw of the blade-holder consists of an end-plate J shaped to rest upon the smooth surface of the blade-retainer G and the blade H, and held in place by screws *j* inserted through the rear edge of this blade

and into the solid end portion of the head B, whereby the blade is held tightly between two opposing jaws, but is free to reciprocate endwise in the manner stated. The magnet is held firmly in place, and inclosed within the head, so that water and moisture cannot enter, in the manner shown and described, it being understood that the oppositely inserted screws 3 have their ends screwed into the threaded sleeves 12, which latter bear against the strap 13 by which the U-shaped iron magnet-core is clamped to the back wall *b* of the head.

When it is desired to remove the blade, the armature E is swung out of engagement with the notch 6, by rotating the pin F therewith, and by inserting an instrument, or even the thumb nail, in the notch 14 on the end-portion of the blade-retainer G, both the latter and the blade can then be pulled out endwise. It will also be seen that, by removing the screws 3, the entire magnet and its armature can be removed as a unit. The armature can be removed alone, after being disengaged from the notch 14, by pulling out the pin F, should this be necessary. A stop K on the head limits the outward movement of the armature, and a similar stop L on the back of the other end of the blade-seat engages the other end of the blade-retainer G to limit the movement of the latter in this direction.

The magnet C can be of any suitable character, but as shown it is preferably so wound, and the cores or pole-pieces are preferably of such character, that the said armature will be rapidly vibrated when an alternating current of the proper character is caused to flow through said coils or windings. The alternating-current-vibrator thus provided reciprocates the blade endwise, in the desired manner, with a sawing motion, causing the cutting edge *h* of the blade to slide back and forth lengthwise thereof on the guard I, so that the cutting action is increased or facilitated, causing an action similar to that which takes place when an ordinary razor is moved endwise as well as forward, as will be readily understood.

In Fig. 9, the construction is similar to that previously described, except that in this case the plate J, which forms the other jaw of the holder, is provided with a rear portion M which is removably secured to the back of the head B by a thumb-screw *m*, so that this plate can be readily removed.

In Figs. 10 and 11, the construction is similar to that previously described, except that in this case the armature E has a pivot N by which it is secured to the outer end of the pin *n*, and the latter is provided with a removable head O, by which it is secured in place after being inserted through the head or body-portion of the razor. Furthermore, a coil-spring P, inclosed in the cavity *p* in the head or body-portion of the razor, is arranged to bear against a plunger Q which engages the armature. The other end of said spring is engaged by a removable thumb-screw *q*, whereby said spring is held under compression, thus holding said armature normally away from the magnet. When the armature is attracted, the plunger Q moves inward, thereby compressing the spring P, and when the current is reversed and the armature released, the spring then expands and forces the plunger outward, causing the armature to move away from the magnet.

With the construction thus shown and described, the blade H can consist merely of a thin flat section of sheet-steel, with openings punched therein, and in this way the blades can be manufactured very cheaply. The blade retainer or guide G can be made of any suitable sheet-metal, such as brass or steel or aluminum, or any other metal. As stated, however, the blade-holder and the body of the razor are preferably of brass or other non-magnetic metal, and the handle A can be of any suitable material. With this construction, the blade is easily inserted and removed and the entire electro-magnet-actuating-mechanism is also easily removed, when such is necessary, notwithstanding that the magnet-coils are tightly inclosed within the head of the razor, so that moisture cannot enter. Also, the razor can be easily cleaned after use, as the armature is the only portion of the actuating-mechanism which is exposed, and this is simple in form and is so arranged that it can be easily cleaned and dried. This is also true of the blade and the blade-retainer, as they can be withdrawn and wiped dry. The inner opposing surfaces of the blade-holder can be wiped and dried by removing the end-plate J, and the entire construction is of such character that, although it can be made cheaply, the razor will give good results and not be liable to get out of order.

As shown, the cord *a* containing the circuit-wires passes into the end of the handle and through the latter to the head of the razor, and the connections from the cord to the coils or windings of the magnet are then made in any suitable or desired manner.

If desired, a thin layer or film of non-magnetic metal, or of any other material, can be provided to cover the outer ends of the U-shaped core or pole-piece, to prevent oxidation and rusting thereof. In this way, and with the construction previously described, the electro-magnet is inclosed in a water-tight compartment or chamber. The armature, however, is mounted outside of said chamber and operated through one of the walls of the chamber by the magnet.

With the foregoing construction, it will

be seen that the blade reciprocates in the blade-holder, so that its cutting edge is maintained a fixed distance from the edge of the guard I, whereby the relation between the blade and the guard is not changed or varied, practically, by the reciprocation of the blade. Furthermore, the blade reciprocates with and in the direction of vibration of the swinging armature, so that the blade and armature practically vibrate in unison. Again, the magnet C is inclosed in a water-tight compartment, but with the vibratory armature E and all other operative parts disposed outside of said compartment, so that the magnet is properly protected without interfering with the adjustment and manipulation of the movable or operative elements of the mechanism, including the reciprocating blade.

From the foregoing, it will be seen that the armature E vibrates freely and unrestrictedly at high-speed, in unison with the blade, without exercising any control over the electric current. This avoids the use of circuit controlling contacts or similar devices, which would be liable to get out of order or be broken or make trouble in other ways. Also, the entire electric circuit is inclosed, in a solid water-tight structure, but with all movable parts left outside. In this way, short-circuiting of the electric current, through the hands or face of the user, is precluded, and the razor can be immersed in water without danger while the circuit is closed, or no water can reach the conductors which constitute the electric circuit.

With the foregoing construction, it will be seen that the momentum of the armature E, while in operation, is substantially in the same direction as that of the blade, so that the vibration is all in a direction transverse of the handle A of the razor, and parallel or substantially or practically parallel with the edge of the blade I of the safety razor thus constructed and operated. In this way, there is no vibration, or tendency toward vibration, in a direction longitudinal of the handle, or in a direction transverse of the blade; for, as explained, the moving parts all travel practically in the same direction, and hence the vibration is all in a direction parallel or substantially or practically parallel with the length of the blade.

What I claim as my invention is:—

1. An electrically operated safety razor wherein a removable blade is reciprocated endwise by an intermittently energized electro-magnet having a vibrating armature, and in which the cutting edge of the blade is maintained a fixed distance from the edge of a guard by guiding means to cause the blade to slide in a straight line, whereby the cutting edge of the blade has a sawing action while in use, characterized by this, to-wit:—that means are provided to movably support said armature at one end and to detachably connect the free end thereof with said blade, so that the armature and blade vibrate in unison, and with the momentum of the armature substantially in the same direction as that of the blade; that the magnet is disposed in position to act upon the middle portion of said armature and wound to receive alternating current, to electrically cause said endwise sliding movement of the blade relatively to the guard in one direction; and that a spring is provided for mechanically actuating said armature and said blade in the opposite direction.

2. A structure as specified in claim 1, and means providing an axis parallel with said blade and about which said armature is movable to disconnect said blade.

3. A structure as specified in claim 1, and means for removably supporting said electro-magnet close to the underside of said guiding means, said magnet having a core which is parallel with said blade, so that the magnetic pull is in the same direction as the reciprocation of the blade.

4. A structure as specified in claim 1, said armature consisting of a flat strip of metal which is movable in the plane thereof to disconnect the blade, and said guiding means including a reciprocating blade-holder having a recess at one end thereof to detachably engage the vibratory end of said armature.

5. A structure as specified in claim 1, and means forming a water-tight head in which said magnet is inclosed, with said armature removably carried on the outside of said head, and a handle rigid with said head.

6. A structure as specified in claim 1, and a cylindric member extending parallel with said blade, forming a support for said armature, and means forming a socket for said member, so that said member is removable endwise, and said armature having its vibratory end adjacent one end of said blade.

7. A structure as specified in claim 1, said guiding means comprising a support provided with a guide and a blade-holder movable endwise in said support, said blade-holder having means to detachably hold the blade, and said blade-holder having a bent rear edge portion to engage said guide.

8. An electrically operated safety razor comprising a blade, an operating magnet, a water-tight head inclosing said magnet, means on said head to support said blade, and a vibratory armature detachably carried on the outside of said head to operate said blade so that both the blade and the armature are removable without opening said water tight head, and a handle rigid with said head.

9. In a safety razor, the combination of a handle, a head on said handle, a razor blade, guiding means carried on said head

to support said blade for endwise reciprocating movement parallel with the cutting edge thereof, electro-magnetic means supported by said head to actuate the blade in one direction, spring means to actuate the blade in the opposite direction, and a guard for the cutting edge of said blade.

10. A structure as specified in claim 9, having means to removably hold said guiding means and said spring means on said head, with provisions to permit ready disconnection of said blade from said actuating means, the electro-magnet alone being permanently mounted in a water-tight chamber in said head.

11. A structure as specified in claim 9, said electro-magnetic means including a solenoid having its core disposed parallel with said blade, and an armature arranged to vibrate with and in the same direction as the blade.

12. A structure as specified in claim 9, having an armature forming the connection between the blade and said electro-magnetic means, and between the blade and said spring means, in combination with means to permit said armature to be swung out of engagement with said blade.

Signed by me at Chicago, Illinois, this 15th day of February, 1917.

HANS SENGEBUSCH.