Dec. 23, 1941. H. AARON ET AL 2,267,582

HAIR CLIPPER AND SHAVER

Filed April 22, 1937 2 Sheets-Sheet 1

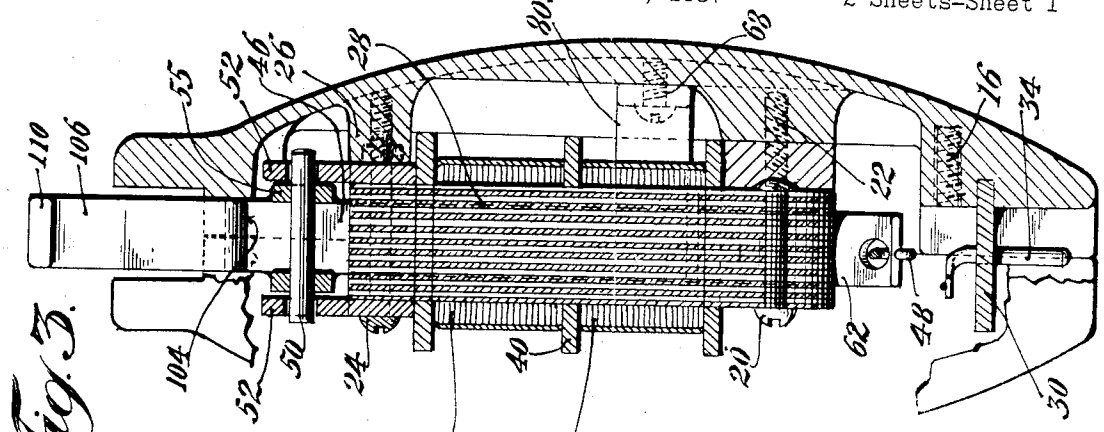

Fig. 3.

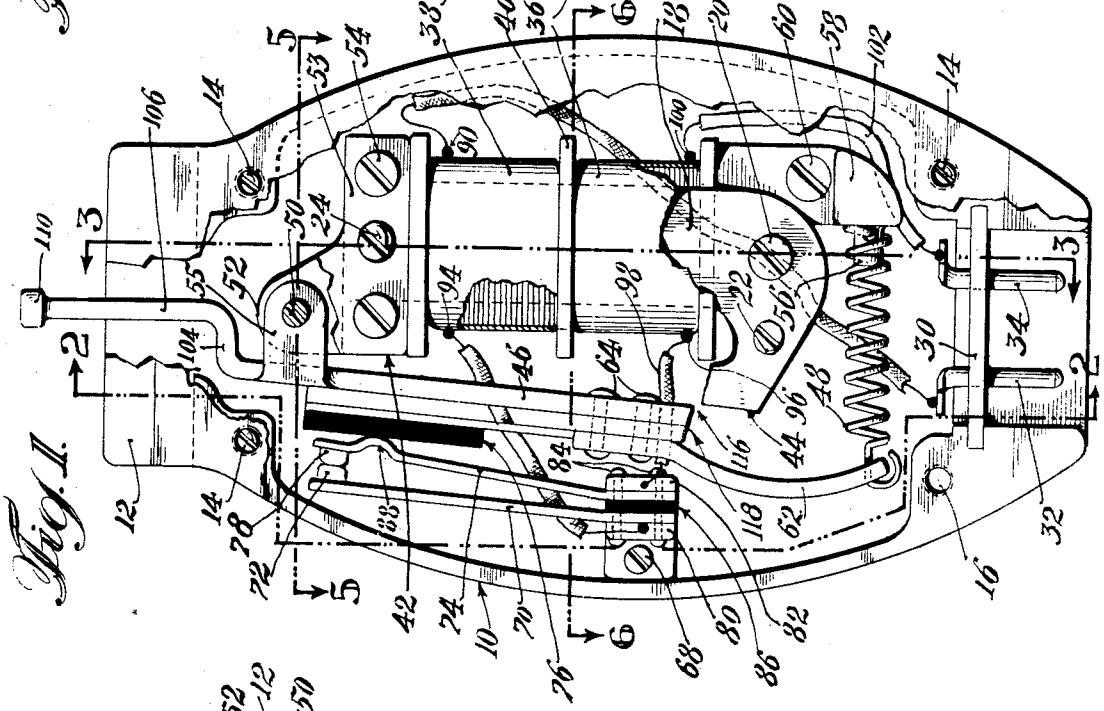

Fig. 1.

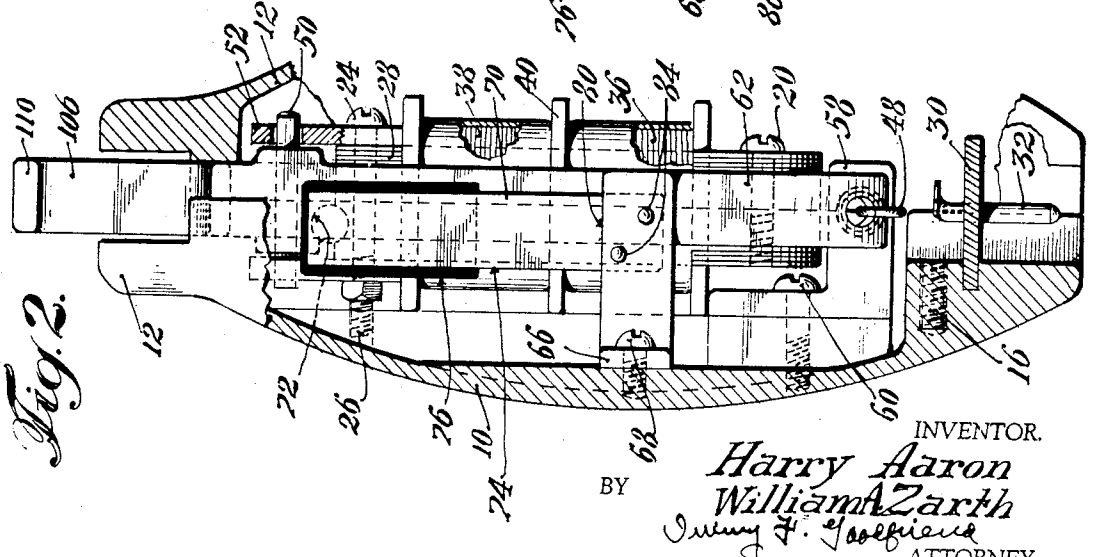

Fig. 2.

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Fig. 6.

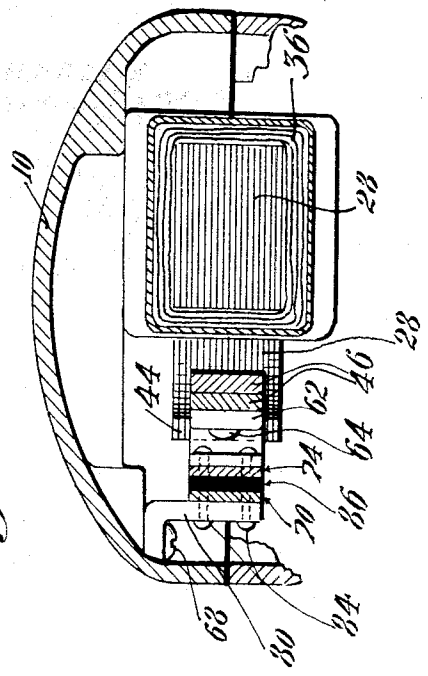


Fig. 4.

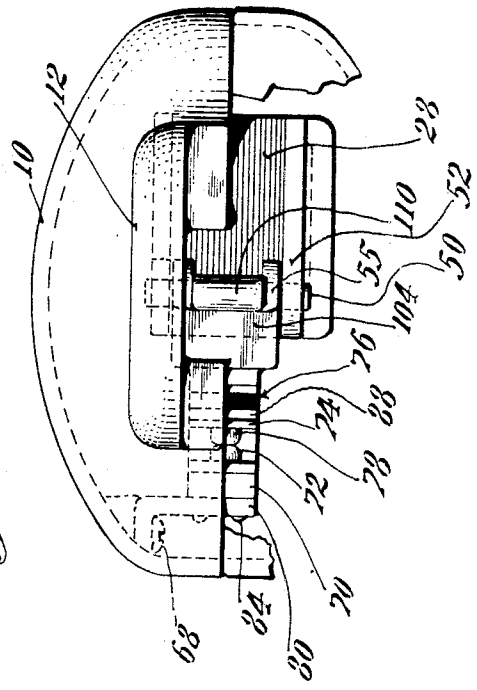
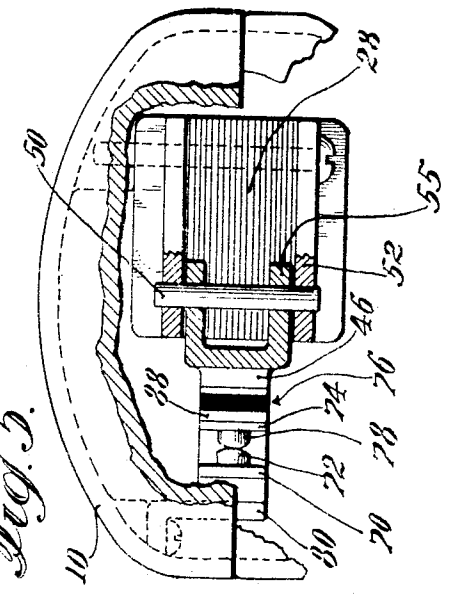


Fig. 5.



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UNITED STATES PATENT OFFICE

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HAIR CLIPPER AND SHAVER

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7 Claims. (Cl. 172—126)

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 electrically powered mechanism.

The hair clippers and shaving devices of this kind heretofore found in the art have been comparatively costly to manufacture by reason of the utilization of electrical motors for the mechanical operating mechanism, which motors are comparatively complex and costly in construction.

Our invention contemplates the provision as the operating means therefor in a hair clipper and shaving device of an efficient and inexpensive vibrating armature tractive electromagnet.

Our invention further contemplates the provision of a tractive electromagnet in which the vibrations of the armature serve to operate the hair cutting mechanism to which it is directly secured.

Our invention still further contemplates the provision of a vibrating armature tractive electromagnet which is arranged to generate maximum tractive force at some point of travel of the armature from the initial position thereof.

Our invention further contemplates the provision of a vibrating armature tractive electromagnet in which a comparatively large operating stroke is provided and yet in which the operative air gap between the magnet pole piece and the armature is short enough for efficient operation.

Our invention still further contemplates the provision of a tractive electromagnet in which the moving armature is so arranged that it does not strike any other part at the end of the stroke, thereby providing a vibrating mechanism which is comparatively quiet in operation.

Our invention still further contemplates the provision of a simple and inexpensive current interrupter arranged in combination with the electromagnet to thereby permit operation of the power mechanism with either alternating or direct current.

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

Figure 1 is a front elevation of our novel electromagnetic vibrator arranged in the combined motor casing and shaver handle.

Figure 2 is a section on the line 2—2 of Figure 1.

Figure 3 is a section on the line 3—3 of Figure 1.

Figure 4 is a top plan view of Figure 1.

Figure 5 is a cross section on the line 5—5 of Figure 1.

Figure 6 is a cross section on the line 6—6 of Figure 1.

Referring now to the drawings, the electrical power mechanism is arranged in a motor casing which, in addition, provides a handle for the shaving device and which combined casing and handle comprise the bottom cover 10 and the top cover 12 which is secured thereto by the screws 14 arranged in suitably threaded grooves 16.

The electromagnet core 18 is preferably secured at one end thereof to the bottom cover 10 of the casing by the cap set screw 20 which engages a suitably threaded groove in the land 22 integral with the cover and at the other end by a similar set screw 24 engaging a suitably threaded groove on the land 26.

In order to reduce eddy currents and resulting heating of the core, it is constructed, in a manner well known in the art, from laminations 28 of soft magnetic iron.

Arranged in suitable grooves provided in the casing at the lower end thereof and preferably frictionally retained therein is the plate 30 in which are provided the socket terminal members 32 and 34, adapted to detachably engage a conventional cord terminal plug for connecting the device to a source of electrical current.

In order to operatively magnetize the core, we arrange preferably two or more solenoid coils 36 and 38, separated by the electrical current insulator plate 40 on the iron core 18 between the legs or magnetic poles 42 and 44. A plurality of solenoid coils is preferred to a single coil in order to reduce the voltage impressed across any coil.

The electromagnet core and poles are magnetized by passing through the coils an electrical current, thereby attracting the pivoted armature 46 toward the electromagnet against the influence of tension member 48. In order to provide an oscillating member which may be directly connected to the movable member which it operates, the armature 46 is normally inclined away from the core, the angle of which is determined by the stroke selected and the dimensions of the armature. Upon demagnetization of the electromagnet, the armature will be urged about the pivot rod 50 to which it is secured by the tension member to its original or normal position.

The pivot rod 50 is rotatably supported in the ears 52 upstanding from the brackets 53 which are secured to the pole piece 42 by the cap screws 54 and is frictionally retained in the arms 55 extending from the armature.

In order to provide means for returning the armature about the pivot to its original or normal

position, the tension member 48 comprising a compression spring is secured at one end thereof to an aperture arranged in the ear 56 extending outwardly from the bracket member 58, which is secured to the bottom cover 10 by a suitable cap screw 60, and at the other end thereof to the skirt 62 depending from the armature 46 and secured thereto by the rivets 64. It will be understood, however, that if desired the skirt may be an integral continuation of the armature.

The skirt is preferably outwardly arched in section so that as to avoid striking the extending pole piece 44 as the armature reaches its innermost position of travel under the influence of the electromagnet.

In order to arrange the magnetic vibrator for operation with direct current, we provide a current interrupter, the base 66 of which is secured to the bottom cover 10 of the motor casing by the cap screw 68, engaging a suitably threaded groove in the casing. This current interrupter comprises a substantially stationary electrode 70, which has arranged at the upper end thereof the contact point 72 made from any suitable material such as iridium or platinum and a resiliently movable electrode 74, which presses inwardly against the insulator plate 76, secured in any suitable manner to the armature 46 and which resilient arm is provided with a similar contact point 78. The contact points are normally held in mutual engagement against the influence of the resilient electrode by the armature at its original or normal position.

As the armature 46 is urged about its pivot by the attraction of the electromagnet, the tension of the movable electrode 74 impels it toward the moving armature which it follows, thereby breaking electrical contact with the stationary electrode 70 and as will be seen interrupting flow of the electrical current through the solenoid coils to demagnetize the electromagnet. Upon return of the armature to normal position as the electromagnet is demagnetized, the resilient electrode is returned by the armature into contact with the stationary electrode, thereby again closing the electrical circuit in the solenoid coils and causing the cycle of operation to be repeated.

The stationary electrode is preferably somewhat flexible in order to absorb the shock occasioned by the resilient electrode striking the stationary electrode as it returns to normal position.

The operative members of the interrupter are secured between the upstanding bracket walls 80 and 82 arranged on the base 66, by the rivets 84, and are insulated from each other by the plate 86 formed from any suitable insulating material.

In order to reduce friction and wear of the engaging members, we preferably provide a slide bearing on that portion of the movable electrode 74 which rests against the insulation plate by depressing a portion of the movable electrode 74 inwardly just beneath the contact point 78 to provide the bearing surface 88.

The electromagnet electrical circuit is completed through the interrupter by connecting one end 90 of the electrical coil 38 to the terminal member 32 by the electrical wire 92, the other end 94 of the coil 38 being connected to the substantially stationary member 70 of the interrupter, contact between the members of the interrupter being normally made by the points 72 and 78.

The movable member 74 of the interrupter is electrically connected to the end 96 of the coil 36 by the electrical wire 98, the other end 100 of the coil 36 being connected to the other terminal member 34 by the wire 102, thereby completing an electrical circuit when the terminal members are inserted into a conventional electrical plug leading from a source of current supply.

The armature 46 has arranged thereon at its upper extremity above the ears 55, the horizontal arm 104 which disposes the vertical connecting rod 106 centrally of the movable cutter member 108. Arranged on the upper extremity of the connecting rod is the connecting boss 110 which engages the slot 112 arranged on the underside of the movable cutter member. Oscillation of the armature about its pivot under the influence of the vibrating electromagnet will cause reciprocation of the movable cutter member adjacent the stationary cutter member 114. We have found that for satisfactory shaving an operating stroke for the movable cutter of .040 inch is desirable.

In order to obtain such a comparatively long stroke and simultaneously provide a short air gap between the magnetic pole pieces and the armature, which is highly desirable for efficient operation and which enables the provision of a comparatively powerful vibrating electromagnet of relatively small dimensions, we prefer to arrange the iron core in a C-shape.

The length of the armature from the pivot 50 preferably is greater than the length of the connecting rod 106 from the said pivot, and, therefore, the distance traveled by the lower edge of the armature being greater than the horizontal stroke of the connecting rod. We have found that for satisfactory operation a ratio of two to one is desirable for the dimensions.

It will be apparent that the inclination of the armature to the iron core positions its lower extremity at some distance from the lower extremity of the iron core.

In order, therefore, to reduce the air gap 116 between the lower extremity of the armature and the lower leg of the core, the pole piece 44 is preferably somewhat longer than the upper pole piece 42. The extremity of the lower pole piece extends toward the armature slightly inwardly thereof.

Such construction provides in effect two successive magnets, each with the desirable short air gap. As the lower edge 118 of the armature is attracted by the electromagnet, a portion of the magnetic flux is increasingly shunted into the armature.

When the lower extremity 118 of the armature is brought into alignment with the pole piece 44, the magnetic flux adjacent thereto is completely shunted between the armature and the pole piece 44; the air gap between the armature and the pole piece 42 having been so reduced in dimension as to provide an efficient secondary magnet, the upper portion of the armature now being to a greater degree influenced by the pole piece 42 urging it further inwardly toward the magnet.

It will be apparent that as the armature moves towards the iron core under the influence of the magnetic flux, the tractive effort effected by the shorter pole piece 42 increases as the tractive effort of the lower pole piece 44 decreases.

We have found that the tractive effort effected by the pole piece 44 increases in greater proportion than the decrease in tractive effort effected

by the pole piece **42** so that the maximum tractive effort is obtained as the armature approaches the iron core, at which position the interrupter is preferably arranged to open the solenoid electric circuit.

It will be understood that, if desired, the extending pole piece **42** may be eliminated to provide an L-shaped iron core, the upper face of which would be likewise effective as a secondary magnet pole.

It will be apparent that we have provided a vibrating armature tractive electromagnet which develops its greatest tractive effort at the initial armature position and which, in addition, by in effect operating as two successive magnets, provides a comparatively powerful vibrating electromagnet having a minimum operating air gap between the armature and pole pieces.

It will be recognized that the resilient electrode of the interrupter opposes the return of the armature to normal position under the influence of the tension member **48**.

Such spring resistance of the resilient electrode **74** may be utilized to dampen the expanding force of the tension member **46** by providing the said electrode with sufficient opposing tension.

If desired, however, a secondary spring may be arranged in opposition to the main spring at the lower extremity of the skirt **62** on the other side thereof to thereby provide a similar armature stroke limiting device.

It will be apparent that we have further provided an efficient and inexpensive vibrating tractive electromagnet.

It will be further apparent that we have provided such a vibrating armature tractive electromagnet which is arranged to generate maximum tractive effort at some point of travel of the armature from the initial position thereof.

It will be still further apparent that we have provided a vibrating tractive electromagnet in which the moving parts are so arranged that they do not at any time strike other parts of the magnet, thereby providing such a mechanism which is comparatively quiet in operation.

It will be still further apparent that we have provided such a vibrating tractive electromagnet which is readily adapted for use with hair clippers and shaving devices and in which connecting linkage and levers are eliminated.

It will be still further apparent that we have provided a single integral vibrating electromagnet and simple and inexpensive current interrupter, thereby making the mechanical razor operating means operable on either alternating or direct current.

While the invention has been described in detail with specific examples, such examples are illustrative and are not given as limitations since other modifications within the spirit and scope of the 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.

We claim:

1. An electromagnetic motor unit for power operated shavers and the like, said motor unit being arranged in an enclosing handle and comprising an electromagnetic core, magnetic poles at each end of the said core, one of said poles extending outwardly from said core a longer distance than the other pole, a vibrating element pivoted intermediate its ends above the shorter magnetic pole, said vibrating element constituting, above the pivot, a connecting rod having a free extremity and, below the pivot, an armature having a free extremity, the free extremity of said connecting rod arranged to operatively engage the shaver, the armature being of greater length than the connecting rod, the free extremity of the armature being disposed adjacent to and a relatively small distance above the longer magnetic pole and a tension member, secured to the armature, and arranged to normally dispose the vibrating member at an inclination to the core and poles whereby the movable member is normally disposed at one end of its operative stroke.

2. A power operated hand tool comprising a hollow handle having a movable member operatively arranged thereon, electromagnetic motor means for operating the movable member, said electromagnetic motor means enclosed within the handle and comprising an electromagnetic core, a pair of magnetic poles extending outwardly from the core at each end thereof, one of said poles being longer than the other, a bracket arranged on the shorter pole, a vibrating member pivoted intermediate its ends on the bracket above the shorter pole, that portion of said vibrating member disposed above the bracket being shorter than that portion of said vibrating member disposed below the bracket, the shorter portion of the vibrating member arranged to operatively engage the movable member, the extremity of the longer portion of the vibrating member being disposed adjacent to and slightly above the longer magnetic pole, a tension member arranged to normally dispose the vibrating member at an inclination to the core and poles whereby the movable member is normally arranged at one end of its operative movement, said electromagnetic core being adapted to be arranged in an electric circuit and means for successively interrupting the electrical current in the said circuit comprising a stationary and substantially rigid electrode, and a flexible electrode arranged to press against the longer portion of the vibrating member in opposition to the said tension member.

3. A power operated hand tool comprising a hollow handle having a movable member operatively arranged thereon, electromagnetic motor means for operating the movable member, said electromagnetic motor means enclosed within the handle and comprising an electromagnetic core, a pair of magnetic poles extending outwardly from the core at each end thereof, one of said poles being longer than the other, a bracket arranged on the shorter pole, a vibrating member pivoted intermediate its ends on the bracket above the shorter pole, that portion of said vibrating member disposed above the bracket being shorter than that portion of said vibrating member disposed below the bracket, the shorter portion of the vibrating member arranged to operatively engage the movable member, the extremity of the longer portion of the vibrating member being disposed adjacent to and slightly above the longer magnetic pole, a tension member arranged to normally dispose the vibrating member at an inclination to the core and poles whereby the movable member is normally arranged at one end of its operative movement.

4. A power operated hand tool comprising a hollow handle having a movable member arranged thereon, electromagnetic motor means for

operating the movable member, said electromagnetic motor means enclosed within the handle and comprising an electromagnetic core, a pair of magnetic poles extending outwardly from the core at each end thereof, one of said poles extending outwardly from said core a longer distance than the other pole, a vibrating element pivoted intermediate its ends adjacent the shorter magnetic pole, said vibrating element constituting, above the pivot, a connecting rod having a free extremity and, below the pivot, an armature having a free extremity, the free extremity of said connecting rod arranged to operatively engage the movable member, the armature being of greater length than the connecting rod, the free extremity of the armature being disposed adjacent to and a relatively small distance above the longer magnetic pole, a tension member secured to the armature and arranged to normally dispose the vibrating member at an inclination to the core and poles whereby the movable member is normally disposed at one edge of its operative stroke, a substantially stationary electrode arranged in the handle and electrically connected to one extremity of the magnetic core and a resilient electrode electrically connected to the other extremity of the magnetic core, said resilient electrode in engagement with the said armature and normally maintained thereby in contact with the fixed electrode.

5. An electromagnetic motor unit for power operated shavers and the like having a movable member, said motor unit being arranged in an enclosing handle and comprising an electromagnet including an iron core and a vibrating member free at each end, said vibrating member pivoted to the electromagnet between said electromagnet and said movable member, said core having a pair of pole pieces, one of the pole pieces being longer than the other, said vibrating member arranged, at one of its free ends, in operative engagement with said movable member and, at its other free end, arranged adjacent to and slightly above the longer pole piece and tension means secured to the vibrating member and arranged to normally dispose the vibrating member at an inclination to the electromagnet and spaced from the pole pieces, the said vibrating member, when normally disposed, being thereby spaced a shorter distance from the longer pole piece than from the shorter pole piece, so that the longer pole piece is arranged to attract the vibrating member more intensely than the shorter pole piece during the first part of the inward stroke of the vibrating member and so that the shorter pole piece is arranged to attract the vibrating member more intensely than the longer pole piece during the later part of the inward stroke of the vibrating member.

6. In a device of the character described, including a movable member, an electromagnetic motor unit including a C-shaped iron core having a pair of poles and a vibrating member, free at each of its ends, said electromagnetic motor arranged in an enclosing handle, one of said poles being shorter than the other, said vibrating member being pivoted adjacent the shorter pole and between said electromagnet and said movable member, said vibrating member being arranged at one of its ends in operative engagement with the movable member, and, at its other end, adjacent the longer pole, and a tension member secured to the vibrating member and arranged to normally dispose the vibrating member at an inclination to the electromagnet and spaced from the poles, the said vibrating member, when normally disposed, being thereby spaced a shorter distance from the longer pole than from the shorter pole so that the longer pole is arranged to attract the vibrating member more intensely than the shorter pole during the first part of the inward stroke of the vibrating member, and, during the later part of the stroke of the vibrating member, the shorter pole is arranged to attract the vibrating member more intensely than the longer pole.

7. In a device of the character described, including a movable member, an electromagnetic motor unit including a solenoid core having a pair of poles and a vibrating member, free at each of its ends, said electromagnetic motor unit arranged in an enclosing handle, one of said poles being shorter than the other, said vibrating member being pivoted adjacent the shorter pole between said electromagnet and said movable member, said vibrating member being arranged at one of its free ends in operative engagement with the movable member and, at its other free end, adjacent the longer pole and a tension member secured to the vibrating member and arranged to normally dispose the vibrating member at an inclination to the electromagnet and spaced from the poles, the said vibrating member, when normally disposed, being thereby spaced a shorter distance from the longer pole than from the shorter pole so that the longer pole is arranged to attract the vibrating member more intensely than the shorter pole during the first part of the inward stroke of the vibrating member, the magnetic flux adjacent the longer pole being increasingly shunted into the vibrating member during the inward stroke thereof so that during the later part of the stroke the vibrating member is more intensely attracted by the shorter pole than by the longer pole.

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