April 29, 1941. R. S. PRESCOTT 2,239,931

VIBRATORY MOTOR

Filed July 31, 1939

Fig. 1

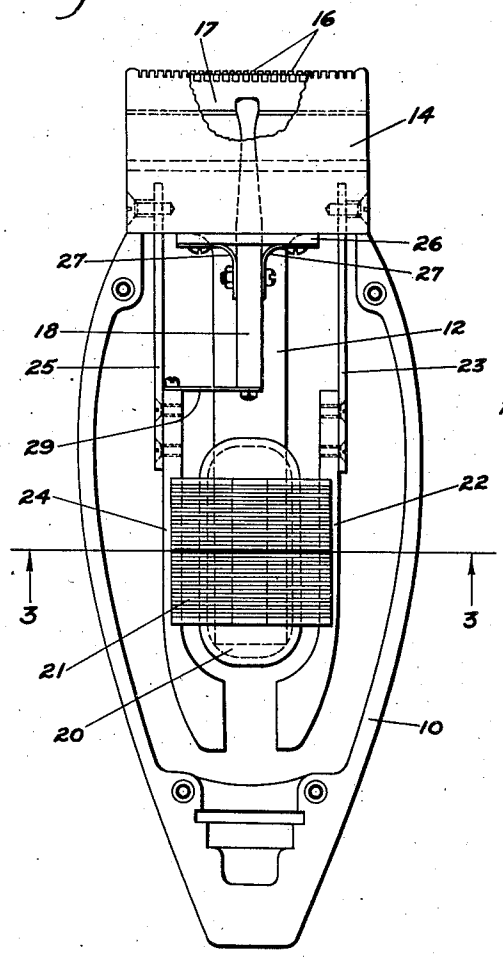


Fig. 2

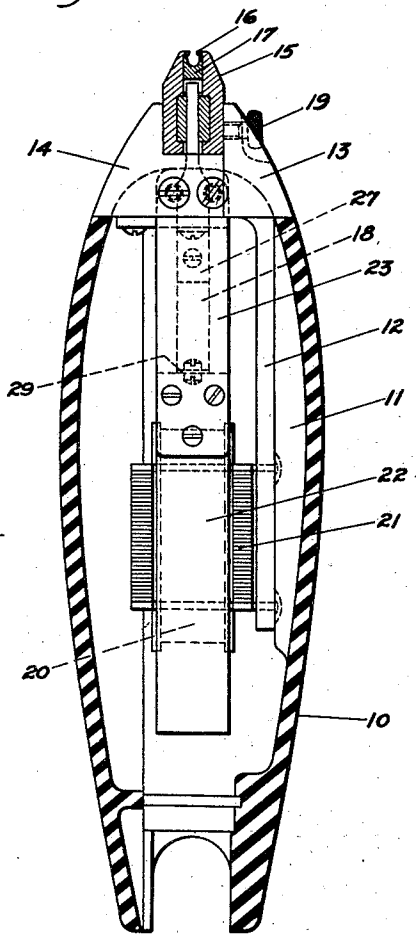
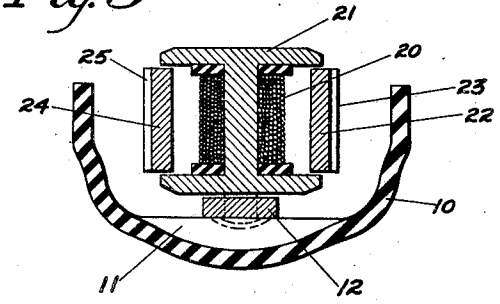


Fig. 3



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VIBRATORY MOTOR

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4 Claims. (Cl. 172—126)

This invention relates to vibratory motors employing an electro-magnet arranged to be energized by an alternating current corresponding in cycle substantially to half the natural frequency of the armature so that the latter is maintained in vibration with the expenditure of minimum energy. In one aspect the present invention consists in an improved motor of this type having certain novel characteristics which particularly adapt it for use in dry shaving implements or other compact installations where economy of space is an important consideration.

My invention is herein shown by way of illustration as embodied in a dry shaver having a movable cutter at one end which it is desired to vibrate transversely and in substantially symmetrical relation to the longitudinal axis or center line of the implement. For economy of space and in order to conform to the general contour of the dry shaver it is desirable to locate the electro-magnetic core of the motor in the longitudinal center line of the implement and accordingly the armature or armatures must be located in offset relation to such center line.

An important object of the present invention is to solve the problem of transmitting high speed oscillation of small amplitude from an armature located in this unsymmetrical manner to a symmetrically located vibrating arm or driven member, without the necessity of pivots or rocking parts which in such relationship are unavoidably subjected to serious wear so that the implement becomes noisy and the accuracy of its shearing action is impaired. To this end, an important feature of my invention consists in an arm supported for vibration or rocking movement upon the frame by means of symmetrically disposed springs which accurately locate the arm, hold it normally in a predetermined initial position and by their flexing permit the desired vibration all, of course, without the employment of pivots or bearings. Another important feature of the invention consists in co-operating members mounted for rocking movement about different axes and having an operative connection which comprises a flat inextensible spring. This is effective to transmit full movement of one rocking member to the other without lost motion and without the employment of pivotal connections which in this connection it is desirable to avoid.

These and other features of the invention will be best understood and appreciated from the following description of a preferred embodiment thereof, selected for purposes of illustration and shown in the accompanying drawing, in which—

Fig. 1 is a view of the implement in front elevation showing the cover of the casing removed and a portion broken out of the head;

Fig. 2 is a view of the implement in side elevation with portions of the casing and head shown in cross-section; and

Fig. 3 is a view in cross-section on the plane 3—3 of Fig. 1.

The vibrating motor of my invention is herein shown as mounted within and enclosed by a hollow casing 10 of "Bakelite" or similar mouldable material which is shaped to act not only as a housing for the motor but a handle for the implement. The casing includes a convex cover portion which is represented as having been removed in Fig. 1 and is shown in section in Fig. 2. Formed integral with the inner wall of the body of the casing is a web 11 and to this is permanently secured an elongated metal bed piece 12 which carries the motor presently to be described. The bed piece merges at its upper end into a metal block 13 conforming in contour to the curvature of the casing and shaped to supply one side of a socket in the end of the implement. The other side of the metal head is formed by a correspondingly shaped block 14 which is permanently secured by dowels and screws to the block 13 and forms with the latter an open socket for the reception of the shearing head 15. The latter is provided at its upper end with inturned flanges which are slotted to provide stationary transverse shearing teeth 16. An elongated movable cutter 17 comprising a rectangular bar having two series of teeth formed in its upper face and co-operatively arranged with respect to the stationary teeth 16 is mounted for longitudinal reciprocation in the shaving head 15 and actuated by a resiliently mounted lever or arm 18 which will be described more particularly hereinafter. The construction of the shearing members is no part of the present invention but may be conventional.

An electro-magnet 20 is permanently secured by rivets or otherwise to the lower end of the bed piece 12. It comprises an insulated coil wound on a bobbin and surrounding a laminated core 21 which is shaped to provide a central web portion and substantially flat transversely extending flanges above and below the coil of the electro-magnet 20. The parts described are, of course, the stationary parts of the motor.

An armature bar is arranged to vibrate on each side of the electro-magnet 20 in the spaces provided by the overhanging upper and lower flanges of the magnet core. The right-hand

armature bar 22 is connected at its upper end by screws to a spring leaf 23 which in turn is connected at its upper end to one end of the metallic head 14 of the casing by means of screws which are threaded into the ends of the head. The left-hand armature bar 24 is similarly connected and carried by a spring leaf 25 fastened to the left-hand end of the head of the casing. The springs 23 and 25 are so shaped and adjusted as to maintain their two armature bars initially or normally in a position slightly outside the contour of the flanges of the core 21. It will be understood that when the electro-magnet is energized by an electric current the magnetic field thus created tends to vibrate the spring supported armature bars equally and oppositely toward and from each other and at each reversal of the current the armature bars spring apart. By properly shaping and mounting the armature bars these may be tuned for vibration in twice the natural cycle of the energizing alternating current. The balanced vibration secured in this manner produces the maximum physical movement of the armature with the expenditure of the least amount of energy possible.

The cutter actuating lever 18 is located and mounted for rocking movement upon the under or inner side of the metallic head 13—14 by a pair of flat curved springs 27. These supporting springs are bolted to the opposite sides of the lever 18 slightly below midposition as shown in Fig. 1 and are then curved in opposite directions and attached to the under face of the block 14. The springs 27 are flexible and well tempered so that the lever arm 18 is well supported and accurately located and is free to vibrate transversely about a fixed axis while requiring only a very slight flexing of the springs. The lower end of the actuating lever 18 is directly connected by means of a transverse spring link 29 with the upper end of the left-hand armature bar 24 and consequently, movement of the bar 24 is transmitted as a rapid vibration to the lever 18. Here again it will be noted that no rocking or oscillating parts are involved and that flexing of the spring link 29 compensates for the movement which would ordinarily be required in a connecting link between the two such oscillating parts as the lever 18 and the armature bar 24. Moreover, the construction described eliminates the necessity of lubricating any moving parts in the motor because it includes no sliding or rotating parts. This is a very desirable feature of motors designed for use in dry shaving implements which are to be used by those indifferent to the necessity for lubricating the moving parts or unable properly to effect such lubrication.

Having thus disclosed my invention and described a preferred embodiment thereof for illustrative purposes, but not in any limiting sense, I claim as new and desire to secure by Letters Patent:

1. A vibratory motor comprising a frame having at one end a transversely extending head, an electro-magnet carried by the frame, flat springs secured to opposite ends of the head, armature bars disposed adjacent to opposite sides of the magnet, curved springs secured to the under face of the head, an arm supported for rocking movement by said curved springs, and a spring leaf extending transversely between one of the armature bars and the arm below its point of connection with said springs.

2. In a dry shaver motor, the combination of a head and a cutter-actuating arm, with a pair of oppositely curved leaf springs movably supporting said arm upon the head, a stationary electro-magnet mounted in the shaver beyond the end of said arm, armatures arranged to vibrate at either side of the magnet, springs on which said armatures are mounted, and a flat pivotless spring directly connecting one of said armatures with said cutter-actuating arm.

3. In a dry shaver, a vibratory motor having a frame shaped to provide at one end a transversely extending support, an elongated electro-magnet carried by said frame, springs secured to the support, armature bars carried by said springs and disposed on opposite sides of the magnet, oppositely curved springs secured to the support, an arm mounted between said curved springs for rocking movement about an axis in line with the longitudinal axis of said magnet, and a transverse spring connecting one armature bar with the spring mounted arm in a location between the magnet and said springs.

4. A dry shaver motor comprising a frame having at one end a support, an electro-magnet carried by the frame, springs secured to the support at separate points, armature bars carried by said springs and disposed upon opposite sides of the magnet, an oscillatory arm having an independent spring connection with the support intermediate the separate points at which the armature bars springs are secured, and a pivotless link connecting one of said armatures with said oscillatory arm.

ROBERT S. PRESCOTT.