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3,270,219

VARIABLE-STROKE ELECTROMAGNETIC VIBRATORS

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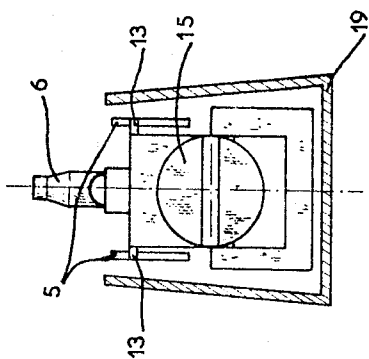


Fig. 2.

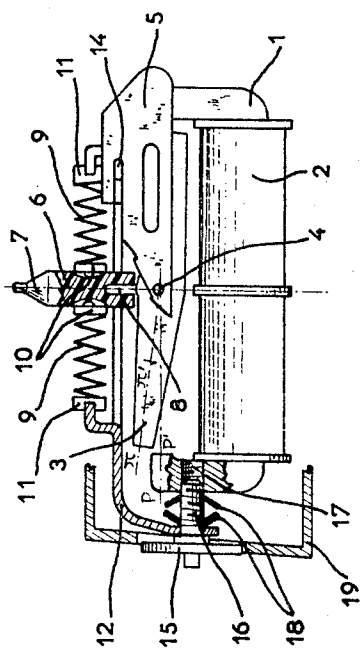


Fig. 1.

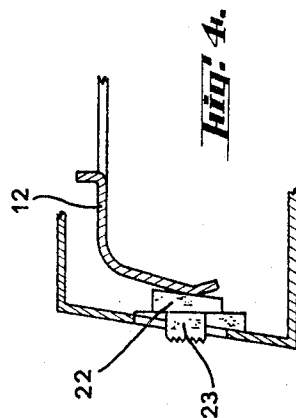


Fig. 4.

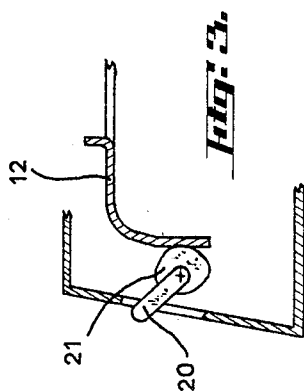


Fig. 3.

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VARIABLE-STROKE ELECTROMAGNETIC VIBRATORS

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8 Claims. (Cl. 310—29)

The essential objects of the present invention are a variable-stroke electromagnetic vibrator and the apparatus equipped therewith, such as electric shavers of the reciprocating cutter type.

The principle of electromagnetic vibrator is well known: this device comprises an electromagnet energized with alternating current and a movable armature rotating in front of the pole pieces of said electromagnet and constantly urged by resilient means, such as a spring, to its inoperative position.

As a consequence of the energization of the electromagnet receiving the alternating current therethrough, on the one hand, and of the return spring action, on the other hand, a sustained oscillatory motion is imparted to the armature.

In fact, in an apparatus of this type it may be said that the movable member called oscillating armature is urged on the one hand by an alternating electromagnetic pull exerted by the alternating field developed in the magnetic gap, as a consequence of the delivery of alternating current to the coil, and on the other hand by a resilient return force supplied as a rule by one or a plurality of springs of the torsion, flexion, compression or traction type. Thus, the apparatus consisting of the assembly of movable parts having a certain inertia and subjected to the motion sustaining forces constitute mechanical oscillators of the sustained oscillation type. It may be proved that in systems of this character, for given values of the energizing and return forces applied to said movable assembly, the amplitude of oscillation of the movable assembly is constant and varies proportionately to what will be termed hereinafter the angular setting or permissible shift of the movable armature in relation to the poles of the electromagnet.

The present invention is concerned with vibrators of the general type set forth hereinabove, which is remarkable notably in that it comprises a device for adjusting the amplitude of oscillation of the movable assembly which acts upon the angular setting or permissible shift of the movable assembly, that is, by modifying the angle formed between the axis pp' of one pole of the electromagnet with the axis $\pi\pi'$ of the corresponding pole of the movable armature when the latter is inoperative or, in other words, when no electric current flows through the coil or coils.

According to another feature of this invention, the aforesaid adjustment device acts upon the member creating the said resilient return force.

According to a complementary feature of this invention, the aforesaid member creating the resilient return force, which may be for example a spring, is secured on a slider or like member the position of which determines the magnitude of the return force.

According to a further feature characterizing this invention the position of said slider is controlled by means of any suitable device acting upon said slider accessible from outside to the user and consisting notably of an adjustment knob having a screw-threaded shank engaging the fixed armature, a lever solid with a cam, a knob solid with a cam face or ramp, etc.

According to a typical form of embodiment of said

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vibrator, the movable armature may comprise a stud inserted therein or solid therewith, which transmits the vibration to any member adapted to be associated with the vibrator, such as the cutter head of an electric shaver or a vibration massage apparatus.

This invention is also concerned by way of novel industrial products with the apparatus incorporating the vibrator broadly set forth hereinabove, notably electric shavers or the like, as well as with any other applications of this vibrator.

Other features and advantages of the invention will appear as the following description proceeds with reference to the accompanying drawing illustrating diagrammatically by way of example a typical form of embodiment of this invention. In the drawing:

FIGURE 1 is a fragmentary elevational and part-sectional view showing a specific form of embodiment of the adjustment device contemplated;

FIGURE 2 is a part-sectional side elevational view of the same device; and

FIGURES 3 and 4 show by way of example two different forms of embodiment of the device of this invention.

In the example illustrated in FIGURES 1 and 2 of the drawing the device comprises an electromagnet 1 for example of the laminated type with its coil winding 2.

This assembly constitutes the fixed or earthed portion of the device.

There is further provided a movable armature 3 consisting for example of a stack of laminations and adapted to revolve about or bodily with a pivot pin 4 rotatably supported by a pair of stationary plates 5 solid with the core of the electromagnet 1 and consisting preferably of non-magnetic material.

In the form of embodiment illustrated by way of example a driving pin 6 is provided on the movable armature 3. This pin 6 consists preferably of a driving member 7 of moulded material such as polyamid which is slipped over a stud 8 consisting of a cut portion of the central laminations of the movable armature 3. However, this driving pin may also be made in a different manner, notably by constituting an insert secured on the movable armature.

The movable armature is constantly urged to its inoperative position by resilient means consisting in the form of embodiment illustrated in FIGURES 1 and 2 of a pair of antagonistic compression coil springs 9 bearing on the one hand through the medium of a pair of centering end pieces 10 against the aforesaid driving pin 6 and on the other hand through another pair of centering end pieces 11 against a member 12 constituting a slider or the like. This slider 12 made preferably of non-magnetic metal is adapted slidably to engage, for example by means of lugs 13, a pair of slots 14 formed to this end in the aforesaid fixed plates 5. Thus it will be seen that any movement of slider 12 will alter the angular inoperative position of armature 3 and therefore what is termed hereinabove the setting of this armature.

A screw-threaded shank 16 of the adjustment knob 15 extends through a suitable aperture formed in the casing of the apparatus and engages a down-turned portion of the slider 12. On the other hand, this shank 16 is screwed in a tapped hole 17 formed through the core laminations 1. Finally, the slider 12 is urged to a fixed position in relation to the main body 1 by means of an intermediate resilient system consisting in this example of spring washers 18 which may be replaced by any other suitable device, notably a traction or compression spring, for returning the slider to said fixed position.

Thus, it will be seen that by screwing in or out the knob 15 accessible to the user from outside through the

casing 19 of the apparatus, the user may alter at will the angular setting of the movable armature in relation to the fixed body and thus obtain any suitable and desired amplitude of oscillation.

In case this vibrator were used notably for driving the cutter head of an electric shaver, the stroke of the movable cutter of said head may be adjusted by means of the device of this invention. Thus, the user may set the efficiency and the mode of operation of the apparatus to suit his specific requirements.

This adjustment may be obtained in many other ways, two of which are illustrated by way of example in FIGURES 3 and 4 of the drawing, without departing from the scope of the invention.

In FIGURE 3, the adjustment knob 15 with its screw-threaded shank 16 is replaced by a lever 20 solid with a cam 21 controlling the movement of the slider or like member 12.

In FIGURE 4, the same displacement of slider 12 is obtained by means of a cam face 22 formed on the inner side or end of the adjustment knob 23.

It would not constitute a departure from the spirit of this invention to bring one or more changes in the practical actuation of the forms of embodiment described and illustrated herein. Thus, for example, any suitable resilient return device inserted between the slider 12 and the main body 1 may be used satisfactorily.

Similarly, in lieu of the slider 12 illustrated any other member adjustable in position by translation or rotation and thus adapted to alter the position of the whole or part of the fixation points of the resilient return system acting upon the movable armature, and adapted therefore to alter the characteristics of its return forces, may prove adequate for the purpose.

In a different manner it would also be possible, with or without modifying the resilient return forces, to alter the angular setting by determining a relative angular shift between the fixed and movable armatures, this angular shift being obtained if desired by angularly shifting the exciter electromagnetic core in relation to the plates 5 which in this case remain the only fixed reference part in this specific form of embodiment (not shown).

Of course, the present invention should not be construed as being limited by the forms of embodiment described and illustrated herein, which are given by way of example only.

Thus, notably, the invention is applicable to any vibrators incorporating a fixed armature and a movable armature together with a resilient return device.

Whatever the form of embodiment of this generator of oscillatory motion, it is possible according to a characteristic feature of this invention to provide means for causing the controlled displacement or shift of the fixed point or points of the resilient return devices with a view to alter the setting and therefore causing the stroke of the oscillating member to the variable and adjustable at will.

What I claim is:

1. An electromagnetic vibrator device comprising an armature extending between pole faces of a stator for energization by an alternating current, said armature being pivotally mounted for oscillatory motion about an axis intermediate its length and being engaged by a pair of springs each of which engages said armature on opposite sides of its point of pivotal mounting and so as to tend to rotate the armature in opposite directions about said axis, wherein said springs extending substantially parallel to the imaginary line joining the opposite poles of said stator, are supported on a slider member which is capable of translation adjustment in a direction perpendicular to said axis for adjustment of the return force exerted by said springs, a control device being provided for fixing said sliding member against translation movement in any position of adjustment thereof.

2. A vibrator device according to claim 1, wherein said device is enclosed in a casing which is formed with a hole through which said control device is accessible from outside of said casing.

3. A vibrator device according to claim 2, wherein said control device consists of an adjustment knob substantially located in the plane of said hole provided in said casing pivotally mounted on said slider and solid with a screwthreaded shank adapted to be screwed in a tapped hole formed in said fixed stator.

4. A vibrator device according to claim 2, wherein said control device consists of a lever passing through said hole provided in said casing, said lever being solid with a cam rotating about a stationary axis parallel with the rotation axis of said armature, said slider member being resiliently urged against said cam.

5. A vibrator device according to claim 2, wherein said control device consists of a knob substantially located in the plane of said hole provided in said casing and solid with a cam profile movable in translation in a plane substantially perpendicular to the direction of movement of said slider which is resiliently urged against said cam.

6. A device according to claim 2, comprising driving means integral with said movable armature and on which act said springs.

7. A device according to claim 6, wherein said driving means consists of a cutout portion of said movable armature.

8. A device according to claim 7, wherein a member of moulded material is fitted over said cutout portion, said springs engaging said member.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,270,219

August 30, 1966

Maurice Marie-Achille Trouilhet

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

In the heading to the printed specification, line 9, for "93,917" read -- 931,917 --.

Signed and sealed this 5th day of September 1967.

(SEAL)

Attest:

ERNEST W. SWIDER

Attesting Officer

EDWARD J. BRENNER

Commissioner of Patents