July 21, 1970 L. HARMS 3,521,093

OSCILLATING MOTOR DRIVING ARRANGEMENT

Filed July 11, 1969

Fig. 1

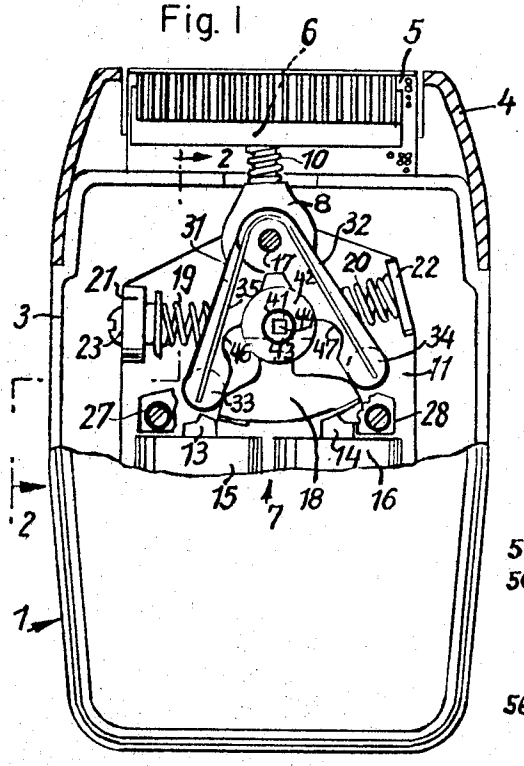


Fig. 2

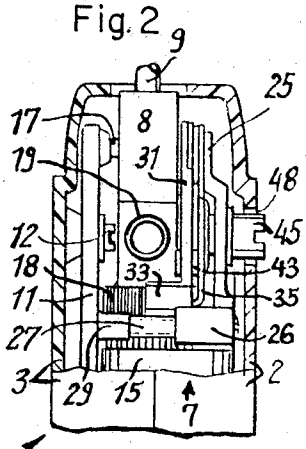
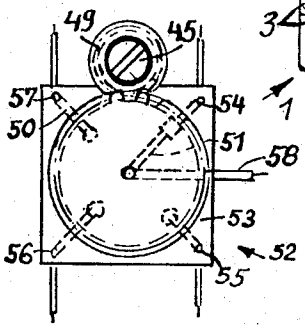


Fig. 6



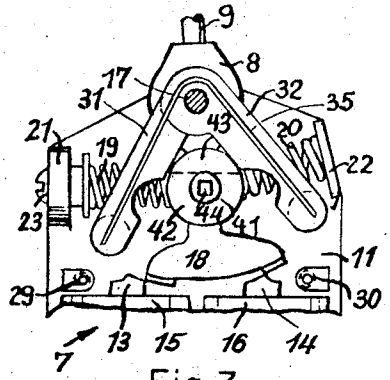


Fig. 3

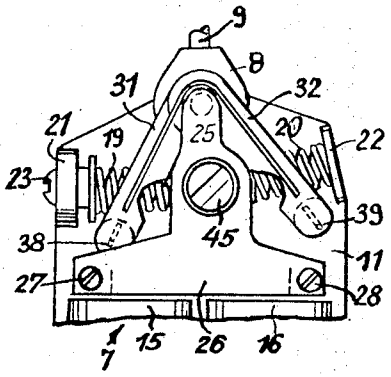


Fig. 4

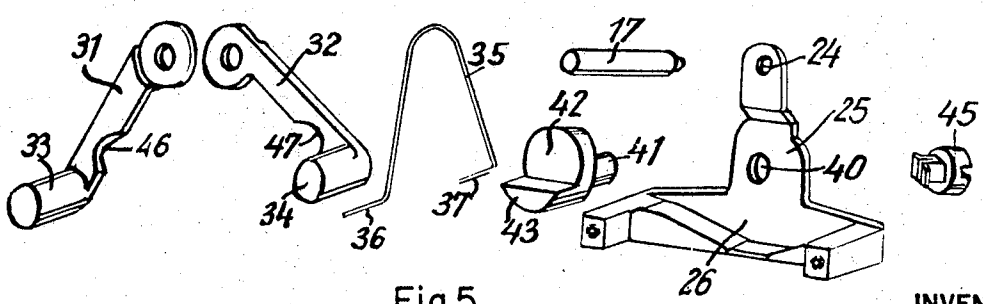


Fig. 5

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United States Patent Office 3,521,093 Patented July 21, 1970

3,521,093

OSCILLATING MOTOR DRIVING ARRANGEMENT

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Filed July 11, 1969, Ser. No. 841,009
Claims priority, application Germany, July 26, 1968, 1,763,728
Int. Cl. H02k 7/02
U.S. Cl. 310—19 12 Claims

ABSTRACT OF THE DISCLOSURE

A driving arrangement for electric hair cutting apparatus having an armature oscillatable about a predetermined axis and operative to drive the cutter of the apparatus at a predetermined frequency of oscillation determined by the mass of the armature. A weight having a predetermined mass is arranged to be selectively coupled to the armature so that the mass of the resulting oscillating assembly which includes the armature and the weight changes the frequency of oscillation.

BACKGROUND OF THE INVENTION

This invention relates to a driving arrangement for electric hair cutting apparatus and relates particularly to such driving arrangement incorporating a frequency-adjustable oscillating system.

Driving arrangements for electric hair cutting apparatus whose characteristic frequency can be adjusted and adapted to different power line frequencies are known and find special application in those countries in which the electric power system consists of a plurality of different line frequencies.

Such change of the characteristic frequency to a given line frequency may, on the one hand, be accomplished by adjusting the spring bias on the oscillating system and, on the other hand, may be effected by changing the moment of inertia of the system, i.e., by shifting or changing the predetermined mass of the oscillating system.

For example, in certain conventional oscillating systems for electric hair cutting apparatus, such as electric shavers, the characteristic frequency of the system may be changed and adapted to a given line frequency by adjusting the directive or controlling force of a return spring. In one particular embodiment of such known system, the latter consists of two movable individual systems including two magnetic arms. In this arrangement, adjustment of the controlling force of the return spring is effected in such a way that the relative positions of the two movable systems is not changed and synchronization of their points of neutral equilibrium, necessary to avoid interfering vibrations, is not disturbed.

Also known are oscillating systems in which the return springs are helical or coiled and are disposed at both sides of the swing arm, transversely relative to the armature and positioned intermediate supports which are axially adjustable and extend perpendicular relative to the spring axis. These springs are provided with a maximum or almost maximum number of windings so that their spring constants and, consequently, the characteristic frequency of the system, may be selectively varied by turnably adjusting the springs relative to the supports.

In a further known oscillating system in which the armature is connected to a leaf spring, one or more displaceable clamping strips are provided which are operative to effect the necessary adjustment of the spring constants and thereby the resonance frequency of the

system. The clamps enable adjustment of the span and the free-swinging length of the spring in such a way that the spring constant corresponds with the magnetic flux of the oscillating system.

However, as a rule, frequency adjustment of the mechanical system by changing the spring pressure or spring characteristic cannot be accomplished to such an exact degree as is required for hair cutting apparatus and this in view of the fact that, in general, the tolerances inherent with springs, are excessive. To overcome this disadvantage, a system has been adopted in which frequency adjustment of the oscillating system is effected by reducing the mass of inertia of the system. To this end, i.e., to reduce the mass of inertia, a weight in the form of a screw is added the swing arm. This screen is adjustable in direction of the pivot axis through which the mass of inertia of the system may be varied and the characteristic frequency of the oscillating system may be tuned.

However, this additional mass is permanently connected with the oscillating arm, and is not easily accessible and, during operation of the apparatus, is not adjustable with the result that tuning or alignment of the frequency by the operator is practically impossible. In addition, with such a system only relatively small frequency adjustments can be realized this in view of the fact that the space available in the housing of the apparatus, and especially in an electric shaver, usually is too limited to permit a substantial adjustment of the screw.

SUMMARY OF THE INVENTION

Object of the invention is to provide a simple driving arrangement for electric hair cutting apparatus adapted to be easily adjusted to a plurality of different line frequencies.

Such a driving arrangement according to the invention comprises an armature oscillatable about a predetermined axis, motion transmitting means operatively connected with the armature, AC current operated oscillating means adapted to oscillate the armature selectively at a plurality of different predetermined frequencies depending upon the frequency of the AC current actuating the oscillating means, a weight having a predetermined mass, and adjustable coupling means operative to selectively connect the weight to the armature so that the mass of the resulting oscillating assembly including the armature and the weight is adapted to the selected one of said frequencies.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 shows a partial front sectional view with cut open portions of a preferred embodiment of the invention, and illustrating the drive arrangement of an electric hair cutting apparatus;

FIG. 2 is a side view taken on the line 2—2 of FIG. 1;

FIG. 3 shows the driving arrangement of FIG. 1;

FIG. 4 shows the same view as FIG. 3 but with additional components;

FIG. 5 shows an exploded view of the individual components of the oscillating system incorporated in the arrangement of FIG. 1; and

FIG. 6 schematically shows further particulars incorporated in the arrangement of FIG. 1.

PREFERRED EMBODIMENT OF THE INVENTION

FIG. 1 shows an electric hair cutting apparatus which, for illustration purposes only in this instance is in the form of an electric shaver the conventional parts of which have been omitted or are not described in detail.

The shaver is seen to comprise a housing **1** consisting of two separable shell secions **2** and **3** and a detachable partially open cap section **4** in which a gauze-like sheet **5** is arcuately disposed. Cooperating with the sheet **5** is a cutter section **6** which is driven in conventional manner by an AC current oscillating system **7** via a motion transmitting member in the form of swing arm **8** and is biased against the sheet **5** by a pressure spring **10** disposed around the upper cylindrical section **9** of the arm **8**.

The oscillating system **7** is mounted on a plate **11** which, in turn, is connected to the shell **3** by means of screw members one of which is shown in FIG. 2 and indexed with numeral **12**. The system **7** comprises two electromagnets which form the oscillating members of the system and of which only the two pole shoes **13** and **14** and the coil members **15** and **16** are shown. Mounted on the plate **11** is a fulcrum **17** which pivotably mounts the swing arm **8**, the latter being integrally formed at its lower end with an oscillating armature **18** having a predetermined mass and which cooperates with and is oscillated by the pole shoes **13** and **14** with a predetermined frequency during operation of the system. Biased laterally against opposite sides of the swing arm **8** are two coil springs **19** and **20** which with their outer ends abut against projections **21** and **22** mounted on the support plate **11**. Provided in projection **21** is a screw member **23** operative to regulate the neutral or rest position of the armature relative to the pole shoes **13** and **14**. The free end of fulcrum **17** is fixedly connected in a recess **24**, FIG. 5, of a substantially T-shaped bridge member **25** whose yoke **26** is connected to two supports **29** and **30** of the plate **11** by means of two screw members **27** and **28**. This bridge has not been shown in FIGS. 1 and 3 so as to enable a clearer illustration of the more important features, which will hereinafter be described.

Pivotably mounted on fulcrum **17** intermediate the swing arm **8** and the bridge **25** is an additional weight with a predetermined mass and which consists of two metal arms **31** and **32** which at their free ends are provided with substantially cylindrical projections **33** and **34**. The metal arms **31** and **32** are biased in the direction of the armature **18** in response to presure exerted on the arms by a torsion spring **35**. To this end, the spring member at its two free ends is provided with right angular sections **36** and **37** which are received in bores **38** and **39** of the projections **33** and **34**, FIG. 4, through which arrangement the arms **31** and **32** are pressed against lateral portions of the armature **18**, as shown in FIG. 1.

The spring member **35** forms an essential part of an adjustable coupling arrangement operative to selectively connect the additonal weight to the armature.

This coupling arrangement further comprises a cam member **43** which is turnably mounted in an opening **40** of the bridge **25** via pivot **41**. As shown, the cam member **43** is integrally formed with a disc-shaped member **42** and has a substantially part circular cross section. The cam member **43** is turnable by means of an adjusting member in the form of knob **45** which is connectably received in an opening **44** in the pivot axis, FIGS. 1 and 2. The cam member **43** is disposed intermediate the arms **31** and **32**, FIG. 2, and is turnable between a first lower and a second upper position in order to connect and disconnect the weight relative to the armature. In the first position, as shown in FIG. 1, the cam member is out of engagement with the arms **31** and **32** and, under pressure of the spring member **35**, the arms operatively engage lateral adjacent portions of the armature **18**. In changing the angular position of the cam member, i.e., turning it from its first lower position to its second upper position, FIG. 3, the cam member, against the bias of spring **35**, moves the respective arms away from the armature and out of engagement therewith. With cam member **43** in its upper position the arms **31** and **32** are engaged by lateral portions of the cam member in which condition the arms are idle while with the cam member in its lower position the arms are out of engagement with the cam member in which condition the projections **33** and **34** are biassed against the armature whereby the additional predetermined mass of the respective weight sections is added to the predetermined mass of the armature, as a result of which upon actuation of the armature by the electromagnets, the resulting oscillating assembly including the armature and the respective weight sections, causes a reduction in the characteristic frequency of oscillation of the apparatus.

Further provided are recesses **46** and **47** which are formed in the arms **31** and **32** to insure that when the cam member is in its lower or weight connecting position, the arms during oscillation do not engage the cam member. However, these recesses are also dimensioned so that during oscillation of the arms with the armature, they are operative to limit the extent of oscillating movement of the assembly in case of fluctuations in the line frequency.

As shown, the knob **45** extends outwardly through an opening **48**, FIG. 2, of the respective shell **2** and, as such, is easily accessible. The knob, as will be appreciated, may have any suitable form or configuration.

Operation of the drive arrangement as hereinbefore described will now be discussed in more detail.

The driving arrangement **7** of the electric shaver which comprises the swing arm **8** with the spring member **10**, the cutter block **6** and oscillating armature **18** and the spring members **19** and **20**, has a characteristic frequency which is determined by the mass of the oscillating components and the spring members and is synchronized with a line frequency of, for example, 60 c.p.s.

The additional mass constituted by the spring member **35** and the two arms **31** and **32** with their respective projections **33** and **34**, is dimensioned so that the characteristic frequency of the oscillating system is reduced from 60 c.p.s. to 50 c.p.s. when the additional mass is coupled to the mass of the oscillating system. This condition is illustrated in FIG. 1, and the electric shaver is now ready to be connected to a line frequency of 50 c.p.s.

If, on the contrary, it is required that the arrangement **7** should be operated at a frequency of 60 c.p.s. then all that is necessary is to turn the adjusting knob **45** 100° from the position shown in FIG. 1 to the position of FIG. 3 in which condition the two arms **31** and **32** and their respective projection are expanded and disengaged from the armature **18** by cam member **43**. At this point the arms and projections do no longer oscillate and are idle as a result of which the frequency of the oscillating system is returned to 60 c.p.s.

The electric shaver further comprises conventional current selector switch arrangement operative to adapt the apparatus to the respective line voltage, for example 110 v. or 220 v.

To this end, and as shown in FIG. 6, a selector knob **45** is provided with a first gear wheel **49** operative to interlock with a second gear wheel **50**, which in turn is rigidly connected with a contact finger **51** of the switch arrangement **52**. The gear wheels are dimensioned so that rotation of the knob **45** through 180° corresponds to rotation of the contact finger **51** through 90°. The contact finger **51** sweeps over four contacts **54**, **55**, **56** and **57** which are disposed at 90° angles relative to one another on an insulating plate **53** of the switch arrangement **52** and are interconnected with corresponding windings in the coil members **15** and **16**. The contact finger **51** is in-

terconnected with one pole of a power supply plug, not show, via a wire **58**. The knob **43** is interconnected with the contacts of the power supply selector in such a way that the following combinations of line currents and frequencies are available:

Contact **54**—110 v., 60 c.p.s.
Contact **55**—110 v., 50 c.p.s.
Contact **56**—220 v., 60 c.p.s.
Contact **57**—220 v., 50 c.p.s.

Indicating means may be coupled to the gear wheels **49** or **50** so as to readily indicate the respective current setting of the shaver.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can by applying current knowledge readily adapt it for various applications without omitting features, that, from the standpoint of prior art, fairly constitute essential characteristics of the generic or specific aspects of this invention.

What is claimed as new and desired to be protected by Letters Patent is:

1. A driving arrangement for movable cutters of shaving apparatus or the like, comprising, an armature oscillatable about a predetermined axis; motion transmitting means operatively connected with said armature; AC current operated oscillating means adapted to oscillate said armature selectively at a plurality of different predetermined frequencies depending upon the frequency of the AC current actuating said oscillating means; a weight having a predetermined mass; and adjustable coupling means operative to selectively connect said weight to said armature so that the mass of the resulting oscillating assembly including said armature and said weight is adapted to the selected one of said frequencies.

2. An arrangement as defined in claim **1**, wherein said weight comprises a plurality of sections.

3. An arrangement as defined in claim **1**, wherein said coupling means comprises resilient means arranged to bias said weight in one direction relative to said armature.

4. An arrangement as defined in claim **1**, wherein said weight comprises a plurality of sections and said coupling means comprises resilient means operative to bias said sections in a direction toward engagement with said armature.

5. An arrangement as defined in claim **1**, wherein said weight comprises a plurality of sections and said coupling means comprises a resilient member having portions connected only with said sections and engaged to bias said sections in one direction relative to said armature.

6. An arrangement as defined in claim **5**, wherein said sections are pivotable about said predetermined axis and flank said armature, said resilient member being a torsion spring arranged to bias said sections against the adjacent portions of said armature.

7. An arrangement as defined in claim **1**, wherein said weight comprises a plurality of sections including a pair of sections flanking said armature, and wherein said coupling means includes a first portion operative to move said sections toward and into engagement with said armature and a second portion operative to move said sections away from engagement with said armature, one of said portions comprising resilient means and the other of said portions comprising cam means.

8. An arrangement as defined in claim **7**, wherein said sections are pivotable about said predetermined axis and have followers flanking said cam means said cam means being movable between a plurality of positions to thereby move said respective sections away from said armature in response to movement from a first to a second position thereof.

9. An arrangement as defined in claim **1**, wherein said coupling means comprises a rotary cam, and further comprising adjusting means for changing the angular position of said cam.

10. An arrangement as defined in claim **1**, wherein said weight comprises a plurality of sections and wherein said coupling means comprises a portion which is stationary relative to said sections when the weight is coupled to said armature, said position including means for limiting the extent of oscillating movement of said assembly.

11. An arrangement as defined in claim **10**, wherein said stationary portion is a rotary cam and said sections have recesses flanking said cam, said cam having a projection which extends into one of said recesses in each end position of said assembly.

12. An arrangement as defined in claim **1**, wherein said oscillating means comprises electromagnet means having a plurality of windings and further comprising selector means operative to connect a selected winding to an energy source in response to actuation of said coupling means by an adjusting member.

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U.S. Cl. X.R.

30—43.92; 310—37