

March 16, 1943.

J. K. CAMPBELL
MOTOR DRIVEN SHAVER

2,314,073

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Fig. 1.

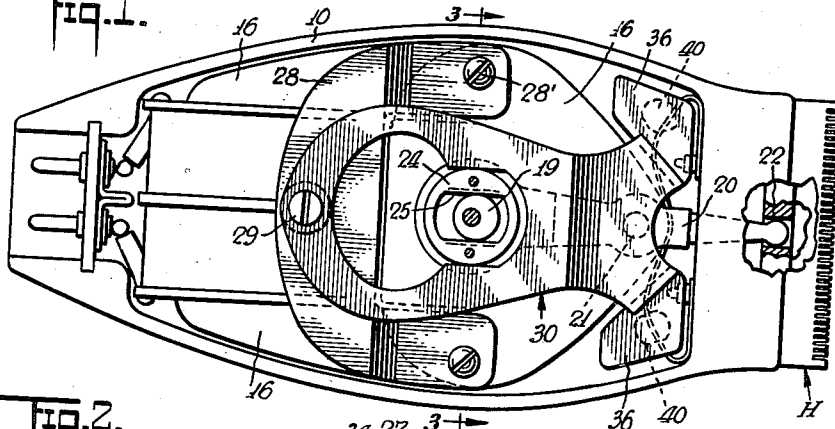


Fig. 2.

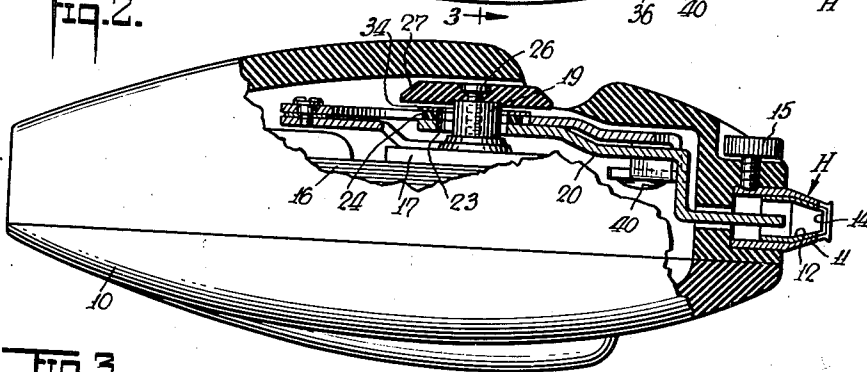


Fig. 3.

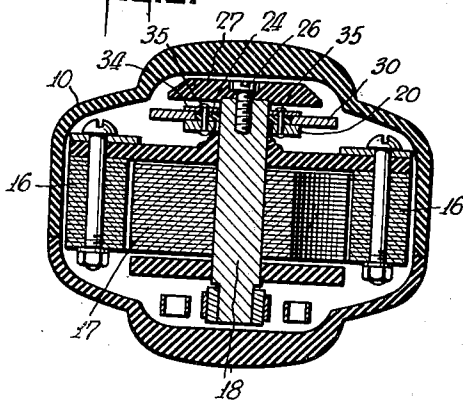


Fig. 6.

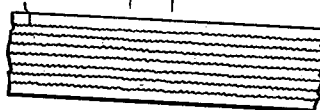


Fig. 7.

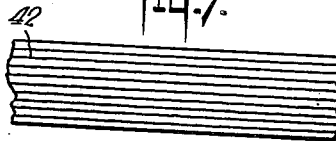


Fig. 4.

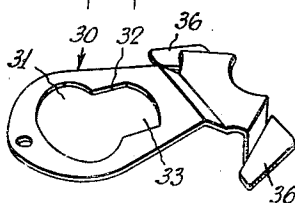
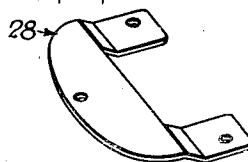


Fig. 5.



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UNITED STATES PATENT OFFICE

2,314,073

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12 Claims. (Cl. 30-43)

As conducive to a clear understanding of the invention, it is noted that in the operation of electric shavers of the type including a reciprocating plate and a corresponding reciprocating transmission, the casing is subject to vibration of small amplitude in the general direction of movement of said plate. This vibration, which is readily measured by an oscillograph is of amplitude in the order of the width of a cutting tooth. As a consequence the fixed or stationary plate which touches the face has a tendency to ride over and bend down against the face hair or stubble which would otherwise be in the path of the moving plate, thereby preventing effective shearing. It is largely due to this circumstance that commercial electric shavers of this type commonly require as long as fifteen to twenty minutes or more of operation for a reasonably satisfactory shave.

Among the objects of this invention are to provide means on the shaver which requires no alteration in the operative motor or shearing head assembly, which does not involve any appreciable increase in the weight, but which effectively and reliably obviates all vibration of the casing in the general direction of movement of the plate.

A feature of the invention is to provide a counter-balancing structure driven by the motor in phase relation opposed to that of the movable plate and its transmission, so that any inertia impulse tending to move the casing in one direction is counter-balanced by an equal impulse in the opposed direction, wherefore the objectionable vibration is completely eliminated.

In the accompanying drawing in which are shown one or more of various possible embodiments of the several features of the invention,

Fig. 1 is a plan view with part of the casing removed, of one embodiment of shaver involving the invention,

Fig. 2 is a side elevation of the shaver partly in longitudinal section,

Fig. 3 is a transverse sectional view taken on line 3-3 of Fig. 1,

Fig. 4 is a perspective view of the vibration offsetting lever,

Fig. 5 is a perspective view of the mounting yoke therefor,

Fig. 6 is a fragmentary view of an oscillogram showing the vibration of the shaver without my attachment,

Fig. 7 is a similar view of an oscillogram showing the elimination of the vibration with the use of my invention.

Referring now to Figs. 1 to 5 of the drawing, there is shown a generally conventional type of electric shaver which includes a casing 10 having at the forward end thereof a shaving head H including a stationary cutter element 11 with shear teeth therein enclosing a movable cutter element 12 with corresponding shear teeth 14, the shearing assembly being mounted by means of a set screw 15 to the forward end of the casing. Within the casing is a rotary motor including a field structure 16 and an armature 17, the latter having a shaft 18 with an eccentric end 19 to drive the movable shear plate 12 from the motor. A transmission arm 20 is provided, which is pivoted at 21 near the forward end of the casing. The forward end of arm 20 coacts with a corresponding slot 22 in the movable shear plate 12 and its opposite end has an elongated eye 23 encircling the eccentric shaft end 19. Preferably a circular non-metallic washer 24 is superposed over the eye 23 with its outer diameter somewhat smaller than that of the eye, said washer having an elongated slot with parallel sides 25 protruding inward beyond the inner periphery of the eye 23, to afford a wear resisting engagement with the eccentric shaft end 19. Affixed upon the shaft end 19 as by means of screw 26 is the starting button or wheel 27. The construction as thus far described is substantially conventional.

According to the present invention, in the specific embodiment disclosed, a mounting yoke 28 is affixed by screws 29 over the field structure 16 and extends rearwardly therefrom. Pivoted to the center of said yoke as by screw 29 is a vibration balancing lever 30 desirably generally oval in shape, provided with a large opening 31 near the rear end thereof, merging with parallel walls 32 determining a forwardly extending keyway 33 which straddles or embraces the washer 24. Superposed over the washer 24 is the further metal washer 34 of larger external diameter which is attached to the wall of the eye 23 by means of rivets 35 extending through the washer 24. The forward end of the balancing lever 30 extends to the vicinity of the shaving head and preferably has outwardly extending shoulders 36, to provide a major portion of the inertia thereof near the forward end of the casing.

The slot construction of the lever 30 facilitates assembly with respect to the previously assembled bearing structure made up of eye 23, washer 24 and metal washer 34, for the large portion 31 of the slot may readily be passed over the washers and the keyway 33 then drawn past the outer

edge of the washer 24 and between the eye 23 and the metal washer 34, whereupon the pivot pin 29 is applied. The pivot pin 29 is positioned to the rear of shaft 18, desirably by the same distance as pivot pin 21 is positioned forwardly thereof.

Since the lever 30 moves in a phase opposed to that of the arm 20 and plate 12 it will manifestly offset the inertia effect of the latter, so as to reduce vibration of the casing in the direction of movement of plate 12. It is however preferred with the design of lever described, that the latter have a moment of inertia so proportioned to that of the arm 20 and plate 12, as substantially to balance out or eliminate all vibration of the casing in the direction of movement of plate 12. Since the end of the lever in the embodiment shown has a wider amplitude of movement than the end of the arm 20 and correspondingly greater speed of movement, it is made of mass correspondingly less for equalization of kinetic energy, with resultant balancing out of vibration, since the parts as noted move in opposed phase relationship.

In practice the assembled instrument might be tested by causing an oscillograph to trace the vibration of the casing. Minor adjustments might be made, if necessary, by weighting the lever 30 with small drops of solder 49 until all vibration has been eliminated.

Fig. 6 illustrates graphically an actual oscillogram showing the vibration of the casing 10 existing without the use of the counter balance lever 30, in the form of a distinct ripple 41 of frequency equal to that of the reciprocation of the plate 12 and of amplitude in the order of .01 inch. With the same device incorporating my counter balance lever 30 these ripples are completely eliminated as shown in the straight line traces 42 in Fig. 7 and the casing is subjected only to such movement transversely of the length of the plate, as the user imparts to it in the process of shaving.

In actual practice a shaver of the type disclosed that takes fifteen minutes for a reasonably good shave, will when equipped with the counter-balance device shown, reduce the shaving time for a correspondingly good shave by about fifty per cent to as little as seven or eight minutes. The improvement is explained by the fact that the stationary plate 11 is not subjected to lateral vibration, so that the hair or stubble protruding therethrough is not bent under and remains upstanding to be effectively clipped by the action of movable plate 12.

Since many changes could be made in the above construction and apparatus and many apparently widely different embodiments of this invention could be made without departing from the scope of the claims, it is intended that all matter contained in the above description or shown in the accompanying drawing shall be interpreted as illustrative and not in a limiting sense.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. In an electric shaver of the type including a casing, a motor therein having a shaft, a reciprocating movable plate and means connecting the latter to the motor, including a lever pivoted with respect to said casing and an eccentric on said shaft for oscillating the lever and reciprocating the plate; the combination therewith of a vibration offsetting lever also pivoted with respect to said casing and coacting with said eccentric for reciprocation of said vibration offset-

ting lever, the respective pivots of the levers being spaced longitudinally of the casing and at opposite sides of said shaft to cause said elements to move in opposite phase, the moment of inertia of first lever and said plate being so proportioned to that of said vibration offsetting lever as to balance out vibration of the casing during operation.

2. In an electric shaver comprising a casing having a motor therein with a rotary shaft having an eccentric end, a shearing head including a movable plate, an oscillating lever pivoted with respect to said casing having one end thereof coacting with said plate and the other end thereof coacting with said eccentric end for oscillation of the lever and reciprocation of said plate; the combination therewith of a vibration offsetting device wholly enclosed within said casing and including a lever pivoted near one end thereof with respect to said casing and coacting with the eccentric end of said shaft for reciprocation thereby in phase relation opposed to that of the movement of said arm.

3. In an electric shaver comprising a casing having a rotary motor therein with a shaft having an eccentric end, a shearing head including a movable plate, an oscillating lever pivoted with respect to said casing, having one end thereof coacting with said plate and the other end thereof coacting with said eccentric end for reciprocation of the plate in operation; the combination therewith of a lever pivoted with respect to said casing, the axis of the shaft being interposed between the pivot of said latter lever and that of said first lever, said levers being disposed adjacent each other, the latter lever having a yoke straddling the eccentric end of said shaft, thereby to be driven therefrom in phase relation opposed to that of said plate and first lever, the moment of inertia of said latter lever being so proportioned to that of said plate and first lever as to balance out vibration of the casing during operation.

4. An electric shaver comprising a casing, a rotary motor therein having an eccentric shaft end, a shearing head including a movable plate, a lever connected at one end to said plate and having an eye at the other end straddling said eccentric shaft end and pivoted to said casing intermediate its ends, for oscillation of said lever to reciprocate said plate, said eye carrying a non-metallic washer presenting elongated parallel walls for engagement with the eccentric shaft end, a vibration offsetting lever superposed over said arm, having a pivot mount with respect to the casing, said mount being at the side of said shaft opposite that of said first lever, said vibration offsetting lever presenting a yoke straddling said non-metallic washer, and a washer superposed thereover, and riveted to said first lever to preclude the same from coming off in its motor actuated movement, whereby the movement of the vibration offsetting lever is in phase relation opposed to that of said lever, said vibration offsetting lever having a moment of inertia so proportioned to that of said lever and plate as to balance out vibration of the casing during operation.

5. An electric shaver comprising a rotary motor having an eccentric shaft end, a shaving head including a movable plate, a lever pivoted with respect to said casing adjacent to said head with one end thereof in driving relation to said moving plate and with an eye at the opposite end thereof encircling said eccentric shaft end for reciproca-

tion thereby, a counter-balancing lever in said casing having a yoke between its ends coacting with said eccentric shaft end, said lever extending forward from said shaft to the forward end of said casing, the opposite end of said lever extending rearward from said shaft, a support for said latter end rigid with said casing and a pivot pin attaching said lever to said support.

6. In an electric shaver comprising a rotary motor having an eccentric shaft end, a shaving head including a movable plate, a lever pivoted with respect to said casing adjacent to said head with one end thereof in driving relation to said moving plate and with an eye at the opposite end thereof encircling said shaft end for reciprocation thereby; the combination therewith of a yoke attached at its ends within said casing adjacent to said motor and extending rearward therefrom, a counter-balancing lever pivoted at one end to the rear of said yoke and extending forward therefrom to the vicinity of said head, the median part of said lever having a yoke coordinated with said eccentric shaft end to be oscillated thereby, the moment of inertia of said lever being so proportioned to that of said first lever and plate, as to balance out vibration of the casing during operation.

7. In an electric shaver comprising a rotary motor having an eccentric shaft end, a shaving head including a movable plate, a lever pivoted with respect to said casing adjacent said head with one end thereof in driving relation to said moving plate and with an eye at the opposite end thereof encircling said shaft end for reciprocation thereby; the combination therewith of a yoke attached at its ends within said casing adjacent to said motor and extending rearward therefrom, a counter-balancing lever pivoted at one end to the rear of said yoke and extending forward therefrom to the vicinity of said head, the median part of said lever having a yoke coordinated with said eccentric shaft end to be oscillated thereby, said lever being a rigid sheet metal structure with wings near the forward end thereof, the moment of inertia of said lever being so proportioned to that of said first lever and plate as to balance out vibration of the casing during operation.

8. The combination recited in claim 7 in which the eye of said first lever has a circular non-metallic washer thereover with an elongated slot

corresponding generally to that of said lever but with its parallel sides extending inward for direct contact with the eccentric shaft end to take the thrust thereof in driving, in which the yoke of the counter-balancing lever straddles said washer and in which a further washer is superposed over the latter and secured with respect to said eye to maintain the lever in coaction with said washer.

9. An electric shaver comprising a casing, a rotary motor therein having a shaft with an eccentric end, a shearing head including a movable plate, a lever pivoted with respect to said casing adjacent said head, connected at one end to said plate and having an elongated eye at the other end, a circular non-metallic washer superposed over said eye, having an elongated slot presenting parallel walls in engagement with said eccentric shaft end to serve for transmitting the driving impulse to said lever, a vibration balancing sheet metal lever generally oval in shape, having an elongated opening near the larger end thereof adapted to be straddled over said washer, said opening terminating in a slot straddling the edges of said washer, the forward end of said lever extending over said first lever to adjacent said head and presenting wings, and means for pivoting the rear end of said lever with respect to said casing, the moment of inertia of said lever about its pivot being so proportioned to that of said first lever and plate with respect to the pivot of said first lever as to balance out vibration of the casing during operation.

10. The combination recited in claim 9, in which the pivots of said levers are spaced at substantially equal distances from the axis of said shaft and the mass of said vibration balancing lever is correspondingly less than that of said other lever and plate.

11. The combination recited in claim 9, in which the vibration balancing lever has wings near its forward end adapted to carry drops of solder for minor adjustment to assure complete balance.

12. As an article of manufacture, a vibration balancing lever for an electric shaver, said lever having a large oval opening near one end, a central pivot hole near said opening and a slot extending from the forward end of said opening.

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