June 10, 1941. J. A. HANLEY 2,244,877

CURRENT INTERRUPTER

Filed Dec. 27, 1940

Fig. 3

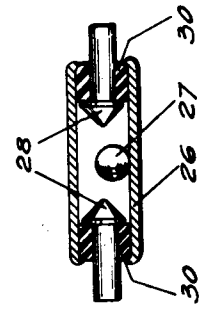


Fig. 2

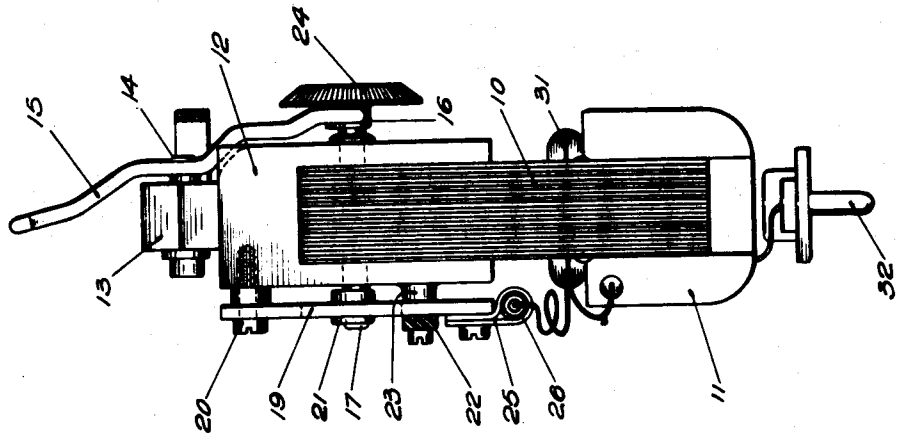
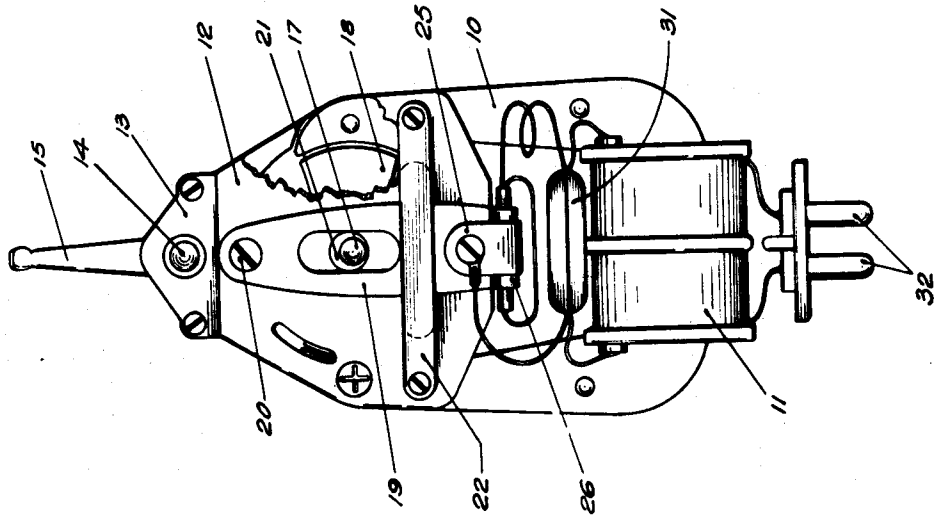


Fig. 1



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Patented June 10, 1941 2,244,877

UNITED STATES PATENT OFFICE

2,244,877

CURRENT INTERRUPTER

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Application December 27, 1940, Serial No. 371,839

6 Claims. (Cl. 172—36)

This invention consists in a new and improved current interrupter for use in motors of the magnetic type operating on alternating or direct current. It is particularly useful in small motors used in dry shavers and the like but is not limited to them in its field of use.

In motors of this type as heretofore constructed tungsten contact points have been employed and these have been carried by levers, one or both of which are moved to make and break an electric circuit at the proper time with relation to the position of the armature to the magnetized field poles. Such mechanism has proved to be noisy on account of the cam action of the levers and the hammering effect of the points as well as the noise of the spark on breaking the circuit. A further objection to the prior construction is that since the spark is free and unenclosed it is likely to set up high frequency waves affecting radio apparatus. Moreover, the uniform operation of motors of this type depends upon the critical adjustment of the points and gap. The points wear away under the continued arcing which occurs in use and the power and speed of the motor is consequently impaired because of this condition. Frequent compensating adjustments have, therefore, been necessary to keep the motor in satisfactory operating condition.

In the device of my invention as herein disclosed current interruption is obtained by the synchronous oscillation of a cylinder or other appropriate enclosure containing a freely movable conductor and having sealed insulated contacts or electrodes spaced upon opposite sides of the conductor. The operation of the device depends upon the inertia of the conductor which tends to hold it at rest while the cylinder is moved. As this is oscillated from side to side the intermediate conductor, because of its tendency to remain motionless or to delay in its motion with respect to the cylinder, makes alternate contacts between the cylinder and one or other of the insulated electrodes.

The cylinder may be carried at the end of an insulated rocker or arm which itself is oscillated in a fixed time relation to the armature shaft as, for example, by a cam on the armature shaft timed with respect to the armature so that contact is established when the armature is in the proper position with respect to the field poles. The interval of contact and the length of the break in the circuit may be controlled by the space or clearance between the electrodes and the intermediate connector or by the degree of oscillation of the enclosure as determined by its operating cam. Since the contacting parts are located in a metal enclosure a minimum of high frequency radiation results and no objectionable effect upon radio apparatus is apparent. The enclosed feature of the contacting parts also results in motor operation free from the usual contact noises. Uniform speed and freedom from the necessity of critical adjustment are other advantages gained by the device of my invention as compared to the conventional construction, since in my construction the gap is a function of the speed of oscillation of the enclosure or tube instead of the usual fixed gap sought in interrupters heretofore used.

An optional feature which contributes to the uniform running and accurate performance of the interrupter of my invention is that the contacting surfaces of the electrodes are inclined so that the metallic body may make a wedging engagement therewith as the enclosure is oscillated. The metallic body may be a ball or a slug with rounded or converging walls. If the metallic body is of appreciable mass I have found that the interrupter may be successfully operated with the enclosure held in any position.

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 motor in front elevation;

Fig. 2 is a similar view in side elevation; and

Fig. 3 is a cross-sectional view on an enlarged scale of the interrupter.

My invention is herein shown as embodied in a motor designed specially for the use in a dry shaver, although the invention is in no way limited to this or to any particular type of motor but is useful wherever a current interrupter is required. The illustrated motor includes a laminated field magnet 10, substantially U-shaped in outline and provided at its bend with field windings in a coil 11. The free ends of the magnet are secured to a frame 12 having an upwardly projecting bracket 13 in which is journaled a transverse shaft 14. To this shaft is secured an operating lever 15 shaped at its upper end to reciprocate the cutter of a dry shaver, or for any similar duty. At its lower end the operating lever 15 is forked to engage an eccentric 16 on the armature shaft 17 which is journaled in the frame 12. A segmental armature 18 is carried by the armature shaft and arranged to rotate between the poles of the field magnet 10. The

construction heretofore described is no part of my invention and merely typical of a motor such as my invention contemplates.

Pivotally mounted upon the opposite side of the frame 12 from the operating arm 15 is a rocker 19, herein shown as an arm arranged to oscillate about the axis of a pin 20. The rocker is slotted to receive an eccentric 21 on the end of the armature shaft and is guided in its oscillations by an outer transverse guide piece 22 and inner guide piece 23 both of which are bolted to the face of the frame with sufficient space between them to permit the free oscillation of the rocker 19. At the opposite end from the eccentric 21 the armature shaft carries a corrugated starting wheel 24.

At the lower end of the rocker 19 is provided metal clamping member 25 in which is retained an elongated enclosure herein shown as a metal tube 26 mounted for endwise oscillation. The tube has an insulated seal 30 at each end in which is fixed a contact or electrode 28. Freely movable in the tube 26 is a metal conductor herein shown as a ball 27 of such diameter as to make contact at either extremity of its path with one or the other of the electrodes 28. The tube 26 is herein shown as straight sided but may bulge somewhat at the center, so that the ball 27 will tend naturally to roll downwardly and away from the electrodes when permitted to do so. The electrodes are provided with flexible connections extending to the fixed parts of the motor, that is to say to a condenser 31 mounted above the coil 11 and to the windings of the coil, and an intermediate flexible connection extends between the condenser and the clamp 25 which, as will be understood is in electrical contact with the body of the tube 26.

A desirable shape for the electrodes is that shown in Fig. 3, that is to say, generally conical or at least having inclined contact surfaces which are so disposed with respect to walls of the tube 26 that the ball 27 will make wedging engagement with the contact surfaces thereby improving the electrical connection established between the inside of the metal tube 26 and the electrode.

The specific arrangement of the circuit is of secondary importance only, so long as current delivered to the tube 26 through the clamp 25 is taken out through the end electrodes as they are moved alternately into contact with the intermediate ball. As herein shown the two electrodes are connected by a common lead looped below the tube 26 and that side of the circuit is then connected to one terminal of one of the field coils 11 and one terminal of the condenser. The clamp 25, which is in conductive engagement with the tube 26, is connected to a terminal of the other field coil and to the other condenser terminal. Service connections are made to the proper terminals of the respective coils. When the armature shaft is spun by the starting wheel one electrode is brought into contact with the ball and current flows through the field magnets until the armature 1 as rotated nearly to its straight-across position. Thereupon the cam 21 throws the rocker in the other direction and the current is interrupted until the ball is engaged by the electrode at the opposite end of the tube 26. When this occurs connections are established with the current flowing in the coils in the same direction as before its interruption.

Without in any way implying a limitation in range of use, it may be noted that the illustrated device operates with good efficiency at from 4000 to 5000 R. P. M. of the motor shaft.

Having thus disclosed my invention and described an illustrative embodiment thereof, I claim as new and desire to secure by Letters Patent:

1. In a motor of the magnetic type having field windings and a movable armature; a current interrupter characterized by a rocker oscillated in timed relation to the movement of the armature, a metal cylinder carried by the rocker and having spaced contacts therein wired in circuit with the field windings of the motor, and a metal ball located between said contacts and arranged to engage them alternately as the cylinder is oscillated with the rocker.

2. In a motor of the magnetic type having field windings and a rotary armature shaft carrying an armature; means for interrupting current flowing in the field windings characterized by a rocker oscillated in timed relation to the armature shaft, a conductive enclosure carried by the rocker and having an insulated contact at each end in circuit with the field windings, and a metal body freely movable within the enclosure to establish circuit between the enclosure and one or the other of its insulated contacts.

3. In a motor of the magnetic type having field windings and a rotary armature; a current interrupter characterized by a rocker oscillated in fixed relation to the rotation of the armature and carrying a hollow metal cylinder, an insulated contact at each end of the cylinder having flexible connections with the field windings of the motor, and a metal ball within the cylinder tending to remain at rest by reason of its inertia while the cylinder is oscillated to bring first one contact and then the other in engagement therewith.

4. In a motor of the magnetic type having field windings and an armature; a current interrupter characterized by a rocker oscillated in timed relation to the armature movement and carrying an enclosure having a conductive bottom, a rounded body resting freely on said bottom, insulated contacts located in spaced relation on opposite sides of the metal body and having flexible connections with the windings, a condenser also in circuit with said windings, and an intermediate connection to said enclosure.

5. In a motor having field windings and a movable armature; a current interrupter characterized by a rocker mounted for oscillation in timed relation to the movement of the armature, an elongated metal tube with closed ends carried by the rocker, movable in an endwise manner and having an insulated electrode in each end, both of which are included in an electric circuit with said tube, a rolling metal connector located within the tube and arranged to roll toward one of the electrodes when the tube is moved with respect to said connector, and flexible connections between the electrodes and the field windings.

6. A current interrupter comprising an oscillatory rocker carrying an elongated metal enclosure having within each end an electrode presenting an inclined contact surface, and a freely movable metallic body located within the enclosure and shaped to make wedging engagement alternately with the inclined contact surfaces of the respective electrodes as the enclosure is oscillated with the rocker.

JOHN A. HANLEY.