March 7, 1950 C. F. COAKE 2,499,632

MAGNETICALLY OPERATED OSCILLATORY SWITCH

Filed Feb. 8, 1946

Fig. 1.

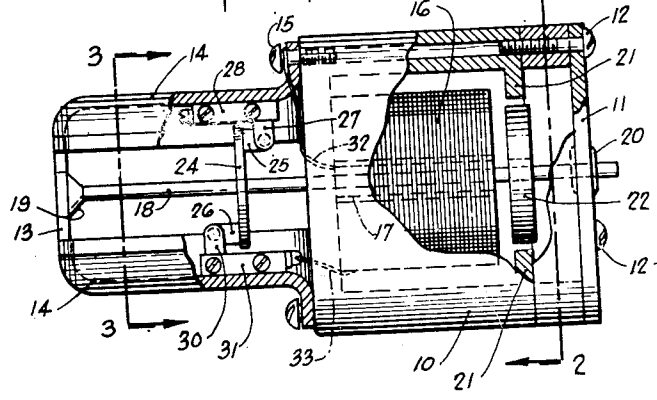


Fig. 2.

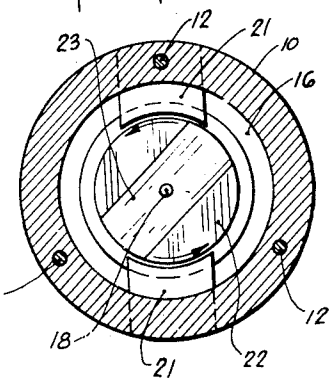


Fig. 3.

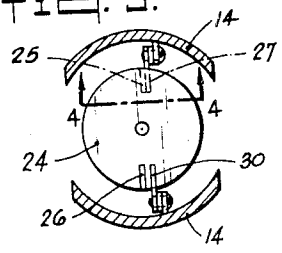


Fig. 4.

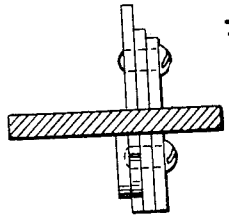
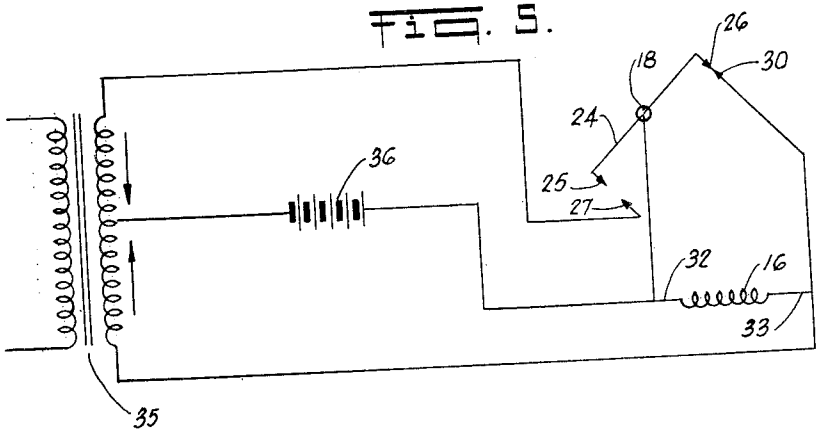


Fig. 5.



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MAGNETICALLY OPERATED OSCILLATORY SWITCH

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2 Claims. (Cl. 200—87)

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This invention relates to electromagnetic vibrators and has for its object to increase the stability and operating efficiency of such devices.

Another object of the invention is to provide a novel and improved torsion vibrator for interrupting electrical currents.

Another object is to reduce windage, and the drag due to windage, in a high frequency electromagnetic vibrator.

Still another object is to provide a vibratory circuit interrupter of the above type having novel and improved details of construction and features of operation.

Various other objects and advantages will be apparent as the nature of the invention is more fully disclosed.

Electromagnetic vibrators of conventional design, employing a vibratory reed and cooperating electrical contacts, are inefficient in many situations because of the drag on the reed due to wind resistance. This is particularly true in the case of high frequency vibrators where windage presents a serious obstacle to operating stability.

The vibrator of the present invention is particularly adapted for high frequency operation and is practically immune to the effects of windage. In the embodiment shown herein for purposes of illustration, my vibrator comprises a casing containing a driver coil, a magnetic torsion rod which extends axially through the coil and has one end fixed to the casing and the other end rotatably mounted in a suitable bearing in the casing, and an armature set in an insulating disc which is secured to the torsion rod between suitable pole pieces on the casing. A second disc secured to the torsion rod carries contacts cooperating with stationary contacts on the casing to alternately make and break an electrical circuit.

In a conventional vibrator employing a flat vibratory reed, the reed moves in a direction perpendicular to its own plane and therefore encounters considerable wind resistance, especially when it vibrates at high frequencies. In my torson vibrator, on the other hand, the torsion rod merely twists upon its axis, and the composite armature disc and the contact disc carried by the torsion rod merely move axially in their own respective planes and therefore encounter practically no wind resistance.

Although the novel features which are characteristic of this invention are set forth more in detail in the claims appended hereto, the nature and scope of the invention may be better understood by referring to the following description,

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taken in connection with the accompanying drawing forming a part thereof, in which a specific embodiment has been set forth for purposes of illustration.

In the drawing:

Fig. 1 is a plan view, partly in section, of a torsion vibrator embodying the present invention;

Fig. 2 is a transverse section taken on line 2—2 of Fig. 1, showing the armature and pole pieces of the vibrator;

Fig. 3 is a tranverse section taken on line 3—3 of Fig. 1, illustrating the mounting of the contact members;

Fig. 4 is a detail of one of the contacts, showing the disc in section taken on line 4—4 of Fig. 3; and

Fig. 5 is a digram of the electrical circuit.

In the following description certain specific terms are used for convenience in referring to the various details of the invention. These terms, however, are to be interpreted as broadly as the state of the art will permit.

In the drawing, Fig. 1 shows a torsion vibrator comprising a cylindrical casing 10 of magnetic material having an end plate 11 secured to one end by screws 12, and a magnetic frame 13 having arcuate side walls 14 secured to the other end by screws 15.

A driver coil 16 wound on a hollow core 17 of magnetic material is mounted axially inside the casing 10, and a torsion rod or shaft 18, preferably of magnetic material, extends axially through the core 17 and has one end rigidly fixed at 19 to the frame 13 of casing 10 and the other end rotatably mounted in a bearing 20 on the end plate 11, as shown in Fig. 1.

The interior of casing 10 is shaped to provide diametrically opposed pole pieces 21, and a flat composite insulating disc 22 having a central segmental magnetic insert 23 constituting the armature of the vibrator is secured to the torsion rod 18 between said pole pieces, as shown in Figs. 1 and 2.

A contact disc 24 of conducting material is secured to the torsion rod 18 within the frame 13, and diametrically opposed contact members 25 and 26 project outwardly from opposite sides of this disc adjacent the periphery thereof, as shown in Figs. 1 and 3.

The contact 25 on disc 24 cooperates with a stationary contact member 27 which is secured between strips of insulation 28 to one side wall 14 of frame 13, while the contact 26 on disc 24 cooperates with a stationary contact member 30 which is secured between strips of insulation 31

to the other side wall 14 of frame 13. One terminal 32 of driver coil 16 is secured to one of the screws 15 on casing 10 and is thereby grounded to the torsion rod 18, while the other terminal 33 of said coil is secured to the stationary contact member 30.

It will be seen from the above that while one end of torsion rod 18 is fixed at 19 to the frame 13, the other end of said rod is free to rotate in the bearing 20 in end plate 11, thus permitting said rod 18 to twist axially when the armature 23 is actuated by energization of driver coil 16, and to untwist axially to return the armature 23 to the normal position shown in Fig. 2 when coil 16 is deenergized. When rod 18 is twisted axially upon energization of coil 16, contacts 26 and 30 are closed while contacts 25 and 27 are opened; and when rod 18 untwists axially upon deenergization of coil 16, contacts 26 and 30 are opened while contacts 25 and 27 are closed. The axial movement of contact disc 24 is relatively small as compared with that of the composite armature disc 22, since disc 24 is nearer the anchorage 19 of torsion rod 18, but the movement is sufficient to insure opening and closing of the contact members at appropriate points in the operating cycle.

Fig. 5 illustrates an electrical circuit in which the vibrator may be used. In this circuit the stationary contacts 27 and 30 of the vibrator are connected to the ends of the primary winding of a transformer 35. A direct current source such as battery 36 is connected to the mid-point of transformer 35 and to the end 32 of driver coil 16, which end 32 of the driver coil is grounded to the torsion rod 18 as previously described.

The driver coil 16 is energized over a circuit extending from one side of battery 36, through coil 16 and half the primary winding of transformer 35, to the other side of battery 36. Energization of coil 16 attracts armature 23 and twists torsion rod 18, closing contacts 25 and 30 and transmitting current in one direction through said contacts and the lower half of the primary winding of transformer 35. Thereupon the coil 16, which is in shunt with contacts 26 and 30, is short-circuited and armature 23 and torsion rod 18 untwist axially, breaking contacts 26 and 30 and closing contacts 25 and 27. This causes current to be transmitted in the opposite direction through the contacts 25 and 27 and the upper half of the primary winding of transformer 35. It also removes the short-circuit from driver coil 16 and thereby energizes said coil over the circuit previously traced. This cycle of operations continues, inducing an alternating voltage of predetermined frequency and voltage in the secondary winding of transformer 35.

Since the only movement of the composite armature disc 22 and the contact disc 24 is an axial rotary movement of small amplitude, these parts are practically immune to damping due to windage. The only parts which could possibly encounter any wind resistance are the laterally

projecting contacts 25 and 26 on disc 24, and here the windage is negligible because of the small size of these contacts and their very small arc of movement.

Although a specific embodiment has been shown and described herein for purposes of illustration, it will be evident to those skilled in the art that the invention is capable of various modifications and adaptations within the scope of the appended claims.

What is claimed is:

1. An electromagnetic vibrator comprising a cylindrical casing of magnetic material, diametrically opposed pole pieces projecting inwardly from one end of said casing, a driver coil having a hollow core mounted coaxially in said casing, a U-shaped frame of magnetic material having legs attached to the other end of said casing, a torsion rod of magnetic material extending axially through said core to constitute the magnetic return path and having one end rotatably mounted in said casing adjacent said pole pieces and the other end fixed to said U-shaped frame, an armature secured to said torsion rod to oscillate between said pole pieces due to the twisting of said rod about its axis, said armature being embedded in a disc of insulating material adapted to oscillate about its axis without wind-resistance, a contact member of conductive material secured to said torsion rod at a point between said coil and the fixed end of said rod, contacts on opposite sides of said contact member adjacent the periphery thereof, and stationary contacts insulated from said casing for selective engagement with the first contacts as the armature oscillates.

2. An electromagnetic vibrator as set forth in claim 1 in which said contact member is in the form of a disc of conductive material mounted to oscillate about its axis.

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