Aug. 20, 1935. H. M. DRESSEL 2,012,123

VIBRATOR

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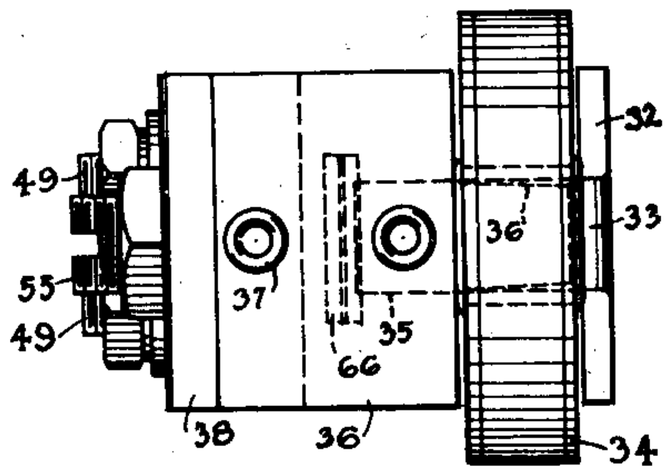

FIG. 4.

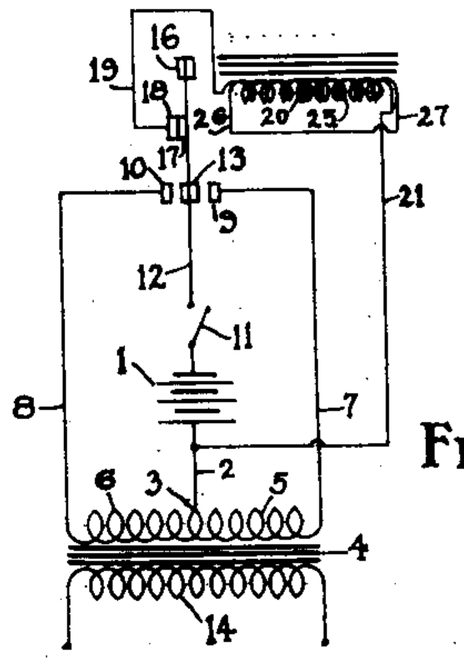

FIG. 1.

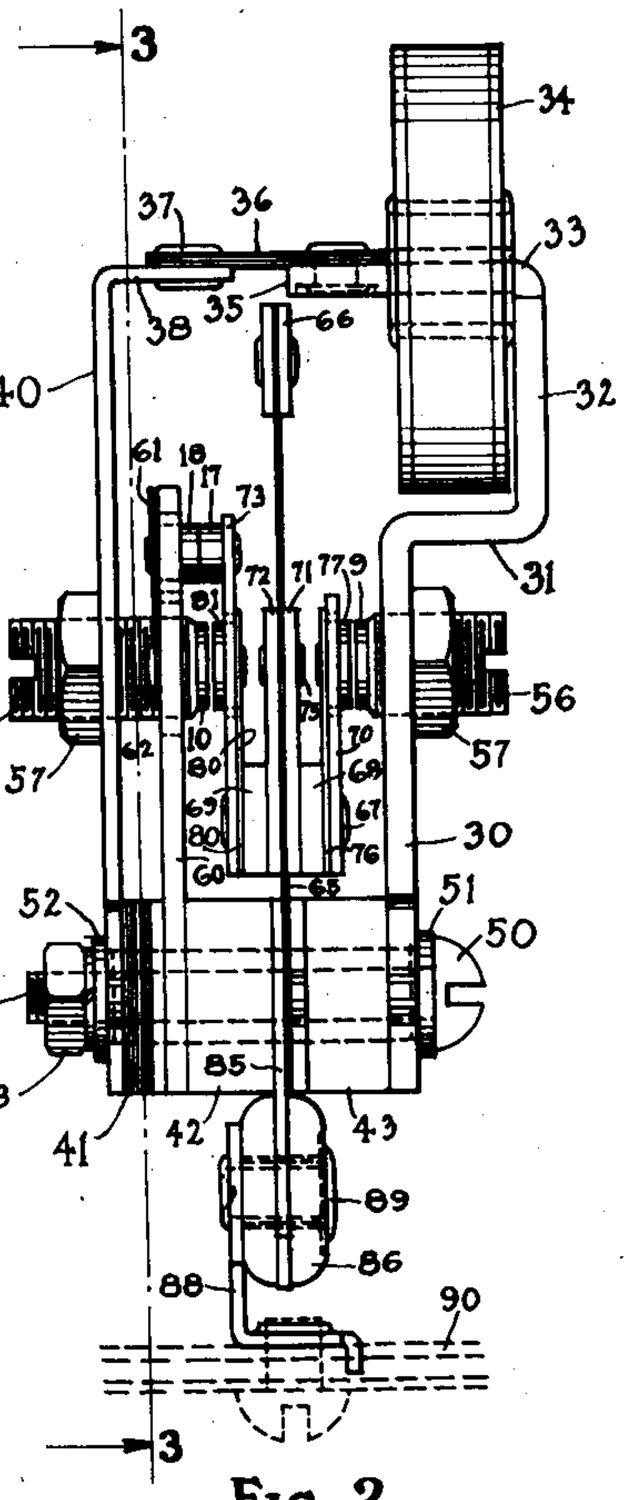

FIG. 2.

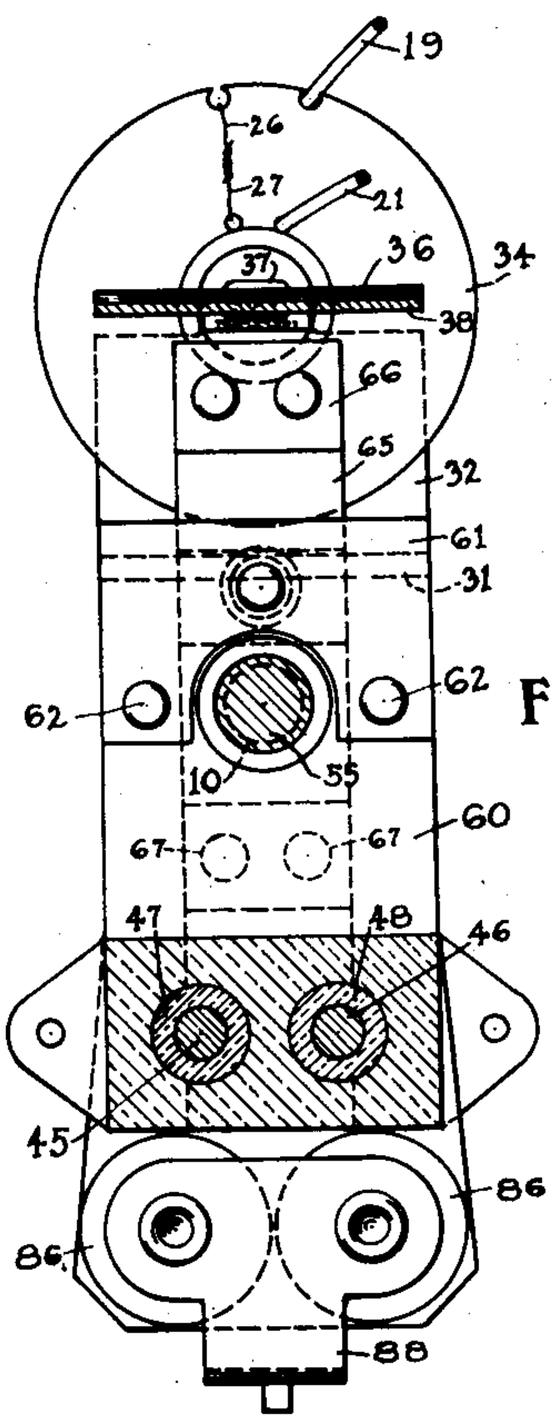

FIG. 3.

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VIBRATOR

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6 Claims. (Cl. 172—126)

This invention relates to vibrators and has particular application to vibrators used for interrupting a direct current in a system for transforming direct current to alternating current. A system of this character is customarily used in automobile radio systems for obtaining from the 6-volt storage battery a high potential supply for the vacuum tubes. In a radio receiver of this character it is necessary that a vibrator be simple, cheap, rugged, and have a long useful life.

Arcing of the driving contacts has been a serious problem in vibrators of this type. The slightest pitting of contacts results in a higher potential drop across the contacts when closed and results in erratic and unsteady performance. Furthermore, contacts frequently become frozen, that is, welded together because of the extremely heavy currents, thus rendering the vibrator completely inoperative.

The most common and, in fact, thus far, the only practical expedient to eliminate arcing at contacts has been in the use of a condenser and resistance across the contacts. This however is not entirely satisfactory.

An object of this invention is to devise a vibrator in which arcing at the driving contacts is substantially eliminated. Another object is to eliminate such arcing in a simple and cheap manner.

Arcing of the contacts of vibrators is a manifestation of the self-inductance of the magnetic system of the vibrator just at the point when the contacts tend to open and cut the current in the magnetizing coil down to zero. The decay of the magnetic field builds up a counter-electromotive force in the winding and induces a potential which tends to keep the current flowing in the winding in the same direction as before the decay of the field. Obviously the more sudden the break the faster the decay of the field and the greater the self-induced potential. In a vibrator of this type adapted to operate on about six volts, potentials as high as 100 volts have been measured across the contacts just at the opening. While a condenser or a combination of condenser and resistor will cut down arcing somewhat, nevertheless the potential peaks are still present in a large degree, so much so that they must be considered in the breakdown characteristics of the condenser used.

This invention contemplates the provision of a short-circuited winding functioning as a secondary to the magnetizing coil which serves to relieve the system of the shock, occasioned when the contacts open. By providing a short-circuited secondary, the decay of the magnetic field upon the opening of the contacts is delayed, thus delaying the self-induced potential in the winding. In fact, it has been found that the induced potential in the magnetizing coil is the same as the applied potential.

Referring to the drawing, Figure 1 is a circuit diagram of a vibrator embodying this invention. Figure 2 is an elevation of a vibrator construction embodying the invention. Figure 3 is a sectional view on line 3—3 of Figure 2 of the vibrator and Figure 4 is a top view of the vibrator.

Referring to Figure 1 a battery 1 is connected by a conductor 2 to the middle point 3 of a transformer 4. Transformer 4 has windings 5 and 6 comprising the two halves of a centre tapped primary. Windings 5 and 6 have their terminals connected by wires 7 and 8, to stationary contacts 9 and 10 of a vibrator. Battery 1 is connected to the vibrator through a switch 11 to a reed 12 carrying a movable contact 13. Transformer 4 has a secondary 14 for stepping up the potentials in primary 5 and 6. It is clear that as reed 12 vibrates between contacts 9 and 10 that parts 5 and 6 of the primary winding will be alternately energized.

In order to actuate reed 12 an armature 16 is provided at the end thereof. A movable contact 17 is also provided and this is adapted to cooperate with a stationary contact 18, which is connected by a wire 19 to a magnetizing coil 20. Coil 20 is connected by a lead 21 to the remote terminal of battery 1. In accordance with usual practice, by the cooperation of contacts 17 and 18, coil 20 becomes energized to attract armature 16 toward it. The movement of reed 12 in response to this impulse opens contacts 17 and 18. To prevent arcing, an additional coil 25, having its terminals connected together to short-circuit the coil, is provided. This coil is preferably made of the same wire as coil 20, with the wire in both coils alongside of each other. The coils are preferably similar with substantially perfect coupling.

Referring to Figure 2 to 4 inclusive, the vibrator embodying the circuit diagram of Figure 1 is shown. This vibrator comprises a magnetic member 30, having a bent portion 31, and an offset 32 and terminating in a pole piece 33. Pole piece 33 carries a spool 34 upon which are wound coils 20 and 25. Terminals 26 and 27 of coil 25 are joined together at the side of the spool. Wire leads 19 and 21 are brought out for connection to stationary contact 18 and battery 1 respectively. The inner tip 35 of pole piece 33 has riveted thereto some strips 36 of mica or similar

insulating material. These strips preferably extend into the circular space 37 inside the spool and set tightly therein to maintain the spool 34 rigidly in position. Mica strips 36 have their other ends secured rigidly at 37 to the end 38 of a nonmagnetic bar 40. Both 30 and 40 have their ends aligned and between them there is disposed a plurality of insulating blocks 41, 42 and 43. Between these blocks are supported various members to be hereinafter described. The entire structure has a pair of holes 45 and 46 therethrough, and is provided with insulating bushings 47 and 48 and bolts 49 having heads 50. An insulating washer 51 is provided to insulate head 50 from member 30 while an insulating washer 52 is provided to insulate nut 53 from member 40. In this way the insulators and the interspersed members are rigidly maintained in predetermined relationship without short-circuiting any of the metallic members.

Members 30 and 40 each have bolts 55 and 56 threaded therein approximately in the center thereof. These bolts carry fixed contacts 9 and 10 respectively at their ends and are maintained by locking nuts 57.

Between insulating members 41 and 42, a metallic supporting member 60 is disposed. This member comprises an elongated spring strip of sufficient thickness to be substantially rigid. At its free end it carries a spring 61 riveted thereto at 62. Spring 61 carries stationary contact 18, this contact projecting through a suitable aperture in supporting member 60. In this manner, stationary contact 18 is supported on a spring mounting and provided with a rigid stop.

Supported between insulating blocks 42 and 43 is a reed 65 carrying a magnetizable armature 66 at its free end. Reed 65 at a point a little above its fixed position has riveted thereto at 67 a pair of spacer blocks 68, 69 and a pair of rigid members 70, 71, 72 and 73 upon each side of said spacer blocks. Rigid members 71 and 72 extend upwardly alongside of the reed and are riveted thereto at their upper ends at 75 at a position approximately in line with stationary contacts 9 and 10. Between block 68 and rigid member 70 a spring member 76 is mounted carrying a movable contact 77. This movable contact is adapted to telescope within an aperture in rigid member 70. A spring member 80 is provided between blocks 69 and rigid member 73 and similarly carries a movable contact 81 telescoping through a suitable aperture in rigid member 73.

It will be noted that member 73 is longer in extent than member 70 and carries at its free end a movable contact 17 for controlling magnetizing coil 20.

Between insulating blocks 42 and 43 and adjacent to reed 65 a mounting member 85 is provided. This member has a plurality of apertures therethrough into which are disposed rubber grommets 86. A supporting member 88 has its end adjacent to grommets 86 and the entire vibrator structure is carried by means of the grommets 86 and a pair of rivets 89 passing through the grommets and joining members 85 and 88. Mounting member 88 may be bolted down to any base 90.

What is claimed is:

1. A vibrator adapted to operate for long periods of time without attention comprising a magnetic circuit structure including a pole piece and a vibratory reed, said reed being fixedly secured at one end and adapted to vibrate at its other end adjacent to said pole piece, a magnetizing coil for energizing said magnetic circuit, contacts controlled by said reed for making and breaking said magnetizing coil circuit and a short-circuited winding for reducing the reed amplitude during operation in electro-magnetic relationship to said magnetizing coil said two coils being wound in bifilar relationship and the wires in said two coils being of the same order of thickness.

2. A vibrator adapted to operate for long periods of time without attention comprising an elongated magnetizable member having a pole piece at one end thereof, means for rigidly supporting said member at its other end, a reed rigidly supported at said other end of said magnetic member and having a free end adapted to vibrate in proximity to said pole piece, a magnetizing coil carried by said member, contacts controlled by said reed for making and breaking said magnetizing coil circuit to cause said reed to vibrate and an additional winding for reducing the reed amplitude during operation having its ends connected together and wound in bifilar relationship with said magnetizing coil and with the two wires of substantially the same order of thickness.

3. A vibrator adapted to operate for long periods of time without attention comprising a magnetizable member, having a pole piece at one end thereof, a vibratable reed rigidly supported at one end and having its free end adjacent said pole piece and adapted to vibrate in proximity thereto, a magnetizing coil for said pole piece, a contact carried by said reed, a stationary contact co-operating with said movable contact, connections between said coil and contacts whereby said contacts open and close said magnetizing coil circuit, said reed having a normal position eccentric with respect to said pole piece and with said contacts closed, and a short circuited winding for reducing the reed amplitude during operation, said windings being wound in bifilar relationship with the wires of said two windings being of the same order of thickness.

4. A vibrator adapted to operate for long periods of time without attention comprising a magnetizable member, having a pole piece, a vibratable reed, rigidly supported at one end and having its free end disposed to vibrate in proximity to, but out of contact with, said pole piece, a magnetizing coil for said member, a contact carried by said reed, a co-operating stationary contact, connections between said contacts and coil whereby said contacts open and close said coil circuit, said reed having a normal position eccentric with respect to said pole piece and with said contacts closed, a pair of additional stationary contacts mounted on each side of said reed, contacts carried by said reed for co-operating with said additional contacts, and a short circuited winding for reducing the reed amplitude during operation closely coupled with said magnetizing coil, said short circuited coil and magnetizing coil being wound in bifilar relationship with the wires being of the same order of thickness.

5. A vibrator comprising a U-shaped magnetizable structure having a pole piece, a flat spring reed rigidly mounted at one end, within said U carrying an armature in proximity to said pole piece and adapted to vibrate back and forth past said pole piece, a plurality of contacts carried by said reed, said reed having the contacts mounted on opposite sides thereof, stationary contacts carried by said U-shaped struc-

ture on each side of said reed and cooperating with said movable contacts, a magnetizing coil on said U-shaped structure, connections from said coil to certain of said contacts for effecting vibration of the armature upon excitation of said coil and an additional short circuited coil for reducing the reed amplitude during operation wound in bifilar relationship to said magnetizing coil, the two coil wires being of substantially the same order of thickness.

6. The structure of claim 5 wherein said vibrator has one pair of cooperating contacts solely for driving said reed and additional pairs of cooperating contacts for connection in a circuit to be rapidly made and broken.

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