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MEANS FOR DAMPING ELECTROMECHANICAL VIBRATOR REEDS

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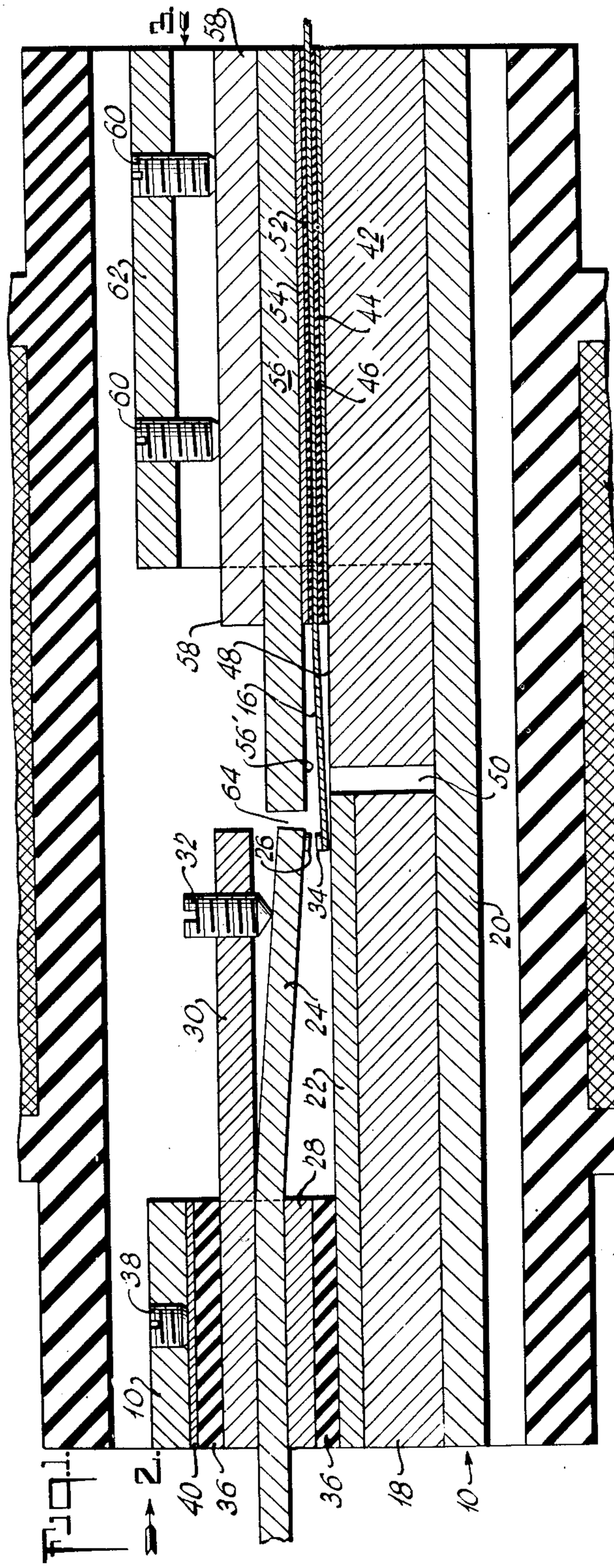

FIG. 1.

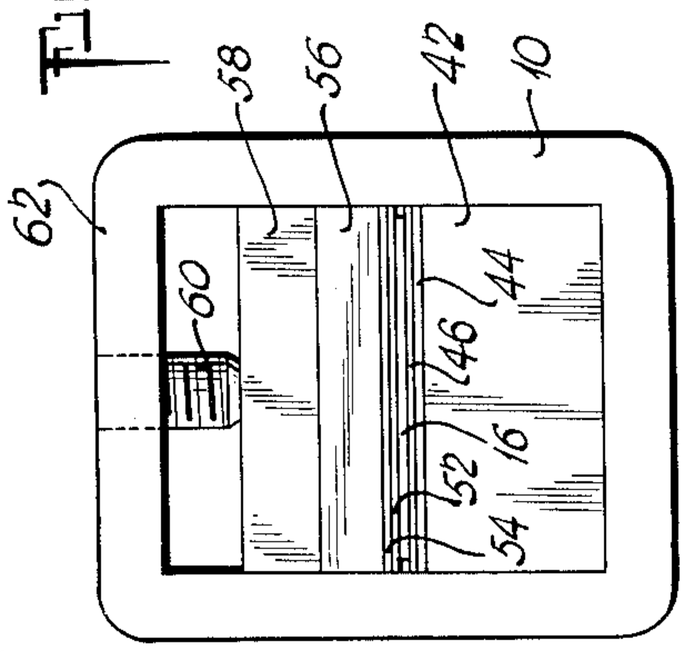

FIG. 3.

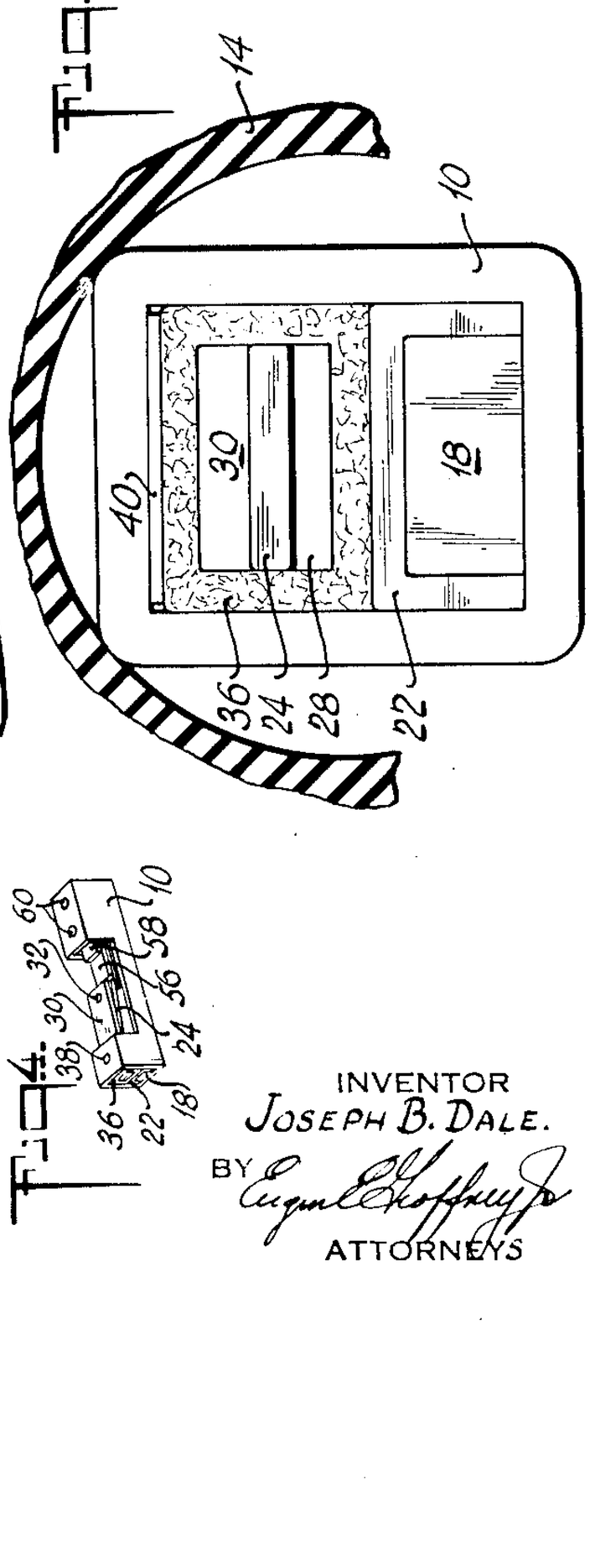

FIG. 2.

FIG. 4.

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MEANS FOR DAMPING ELECTRO-MECHANICAL VIBRATOR REEDS

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2 Claims. (Cl. 200—90)

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This invention relates to electromechanical choppers or vibrators for periodically making and breaking an electric circuit and more particularly concerns a method and apparatus for controlling the action of the vibrating reed to eliminate bouncing and chattering of the contacts and provide smooth, uniform vibratory motion of the reed to obtain a positive make and break action of the contacts and lengthen the life of the reed.

The above and other objects of the invention will become more apparent from the following description and accompanying drawings.

In the drawings,

Fig. 1 is a greatly enlarged cross-sectional view of a vibrator in accordance with the invention;

Fig. 2 is an end view of the vibrator shown in Fig. 1 taken in the direction of arrow 2;

Fig. 3 is an end view of the vibrator shown in Fig. 1 taken in the direction of the arrow 3;

Fig. 4 is an approximate full size perspective view of the vibrator of Fig. 1.

One of the important difficulties experienced in vibrating devices used for periodically opening and closing electric circuits and which embody a reed with a contact on the free end thereof for cooperation with a fixed contact is the production or generation of spurious vibratory motion in the reed which generally causes the contacts to chatter or bounce when making and breaking the circuit.

Means have been suggested for preventing or damping undesirable reed vibrations which employ either an auxiliary reed or other similar member engaging the main reed, or a main reed of composite structure. These methods of damping the reed have not been found to be entirely satisfactory as they merely eliminate one or two of the spurious or unwanted secondary vibrations of the reed. Moreover, these methods do not provide a shock absorbing action to slow down the reed just prior to the making of the contacts that would prevent any tendency for the contacts to bounce upon impact.

In the present invention means are employed in connection with the reed to effect air damping of the reed over substantially its entire length and which damping not only prevents the production of low amplitude secondary vibrations of the reed but also causes the reed to slow down at each end of its stroke so that substantially all bounce of the contacts due to the making action is eliminated.

Briefly this air damping may be effected by placing a rigid member in close proximity to each side of the reed with such members extending over substantially the entire length thereof or by completely surrounding the reed by a tubular member. The spacing is preferably made as close as possible but in any event should not limit the normal motion of the reed nor touch the reed during its vibration. This simple and effective reed damping system has been found to effectively reduce spurious reed vibrations and provide shock absorbing action which so successfully eliminates undesirable contact bounce.

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The invention is illustrated in the drawings as applied to a vibrator having a permanent magnet in combination with an electromagnet for alternately supplementing and opposing the magnetic field of the permanent magnet to produce vibration of a reed.

In the drawings 10 denotes the vibrator housing preferably made of a non-magnetic material such as brass, Phosphor bronze and the like which holds the vibrating element. This housing 10 in normal operation is placed within a surrounding magnetic coil 12 supported on a suitable coil form 14.

The housing 10 is preferably of rectangular shape with a central section of the side and top walls removed to expose the vibrating reed 16.

In the lefthand end of the housing 10 as shown in Fig. 1 is an elongated permanent magnet 18 that is approximately half the length of the housing 10 and lies flat against the bottom wall 20 thereof. A brass channel 22 is fitted over the magnet to enclose the top and sides thereof to prevent the vibrator 16 from directly contacting the magnet 18. Overlying the magnet within the lefthand end of the housing 10 is a contact carrying member 24 having a contact 26 mounted on the inner end thereof. The other end of this member 24 extends beyond the end of the housing 10 to form an electric terminal for connecting the vibrator in an electric circuit. On top of the member 24 is a relatively heavy member 30 having a set screw 32 threaded in the inner end thereof and adapted to bear against the upper side of the member 24 for the purpose of adjusting the physical relationship of the contact 26 with the reed carrying contact 34. The members 24 and 30 together with a metal spacer 28 underlying the member 24 are insulated from the housing 10 by insulating material 36 completely encircling the members. The members 30, 24 and the magnet 18 together with the non-magnetic channel 22 are held firmly within the housing by a set screw 38 threaded in the top wall of the housing 10 and bearing against a metal plate 40 overlying the insulation 36. To

prevent the set screw from loosening up during the operation of the vibrator it is preferable to peen the set screw slightly to deform the edge.

In the other end of the housing 10 a metal block 42 is positioned on the base 26 and extends from the righthand end of the housing to a point in close proximity to the righthand end of the magnet 18. The height of the block is substantially equal to the combined height of the magnet 18 and the enclosing channel 22. On the top of the block 40 rests a metal plate 44 and a thin sheet of insulation 46 which are co-extensive but somewhat shorter than the length of the block 42. The plate 44 and insulation 46 govern the spacing between the reed 16 which overlies the insulation 46 and the top face 48 of the block 42 and the upper side of the channel 22. The spacing 50 between the adjoining ends of the block 42 and the magnet 18 is preferably made as small as possible and the block 42 is preferably formed of a non-magnetic material so as not to interfere with the action of the magnet 18.

Overlying the reed 16 is another layer of insulating material 52 and a metal plate 54 which are identical with the corresponding elements 44 and 46 previously described and which determine the spacing between the reed 16 and an overlying metal plate 56 which extends from the righthand edge of the housing 10 to a point in close proximity to the righthand end of the fixed contact carrying member 24.

In actual practice it has been found that with a reed having a thickness of about .003 inch and a free vibrating length of approximately $1\frac{1}{64}$ inch, the spacing of the fixed metal members from the reed (42 and 56 of Fig. 1) should be approximately .004 inch.

Overlying the metal plate 56 is another relatively heavy plate 58 which cooperates with a pair of screws 60 threaded in the top wall 62 of the housing 10 for holding the reed and its associated elements firmly in position.

In the operation of the vibrator which may be designed for operation of frequencies as high as 400 cycles to 800 cycles and even higher, the confinement of the air between the face 48 of the metal block 42 and the lower face 56' of the block 56 successfully dampens spurious vibrations of the reed by impeding the flow of air in and about the reed itself. This action is also accomplished in part by the upper face of the channel 22 and it is for this reason that the air gap 50 should be made as small as possible. Similarly the gap 64 between the members 56 and 24 should also be maintained as small as possible to obtain maximum damping effect. Moreover with the use of air damping the damping effect increases as the reed approaches one or the other of the damping

surfaces, so that a shock absorbing action results and this action coupled with damping of the spurious vibrations of the reed produces uniform and positive making and breaking the contacts 26 and 34 and also results in lengthening the life of the reed. Furthermore by the elimination of damping means which actually contacts the reed and the avoidance of a reed of composite structure a material reduction in the manufacturing cost of the vibrator results with attendant improved operating characteristics.

An approximate full-sized view of a vibrator in accordance with this invention is shown in Fig. 4 of the drawings and like numerals have been used to designate similar elements in this and the other figures previously described.

I claim:

1. In an electromechanical chopper having a contact carrying reed, a fixed contact for cooperation with the reed contact and means including a pair of interacting magnets for vibrating the reed, damping means for the reed comprising means substantially coextensive with the reed and positioned closely thereto but out of contact therewith to impede the movement of air between said means and the reed.

2. An electromechanical vibrator comprising an elongated hollow housing of non-magnetic material, a permanent magnet mounted in one end of the housing, a contact supporting member including a fixed contact mounted in said one end of the housing in spaced relation to and overlying the magnet, a reed including a contact on its free end mounted in the other end of the housing with the free end of the reed overlapping the magnet and its contact in operative relationship with said fixed contact, and a pair of parallel members spaced equidistantly on each side of the reed to confine the air in and about the reed during the vibration thereof.

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