July 20, 1948. R. J. AUST 2,445,382

HIGH-FREQUENCY VIBRATOR

Filed April 14, 1944

Fig. 1.

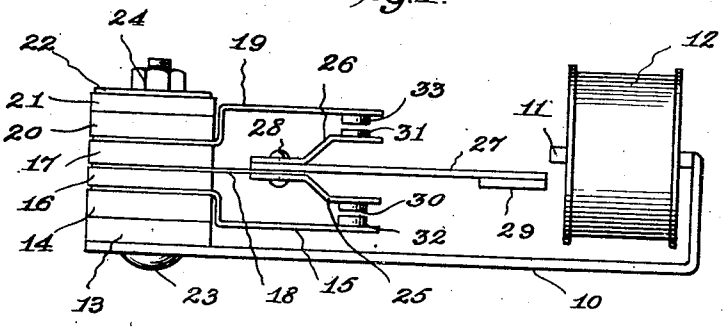
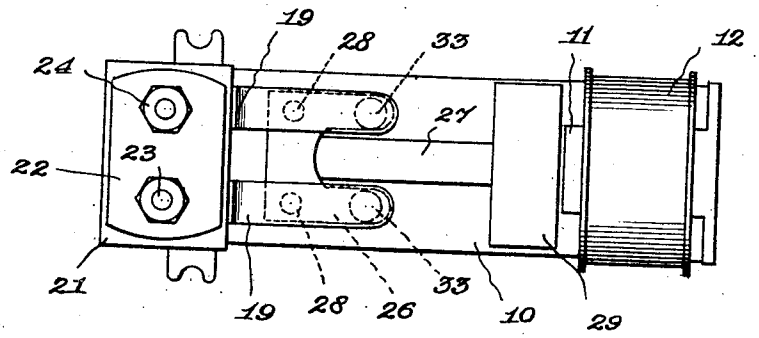


Fig. 2.



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HIGH-FREQUENCY VIBRATOR

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5 Claims. (Cl. 200—90)

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The present invention relates to vibrators, and, more particularly, to vibratory electromagnetic interrupters adaptable to operation at relatively high frequencies.

It is an object of the present invention to provide a vibrator of the electromagnetic interrupter type capable of converting the magnetic deflecting force of the driver coil into mechanical energy with which to actuate a system of contacts with greater efficiency than this was heretofore possible.

It is another object of the present invention to provide a vibratory electromagnetic interrupter of novel and improved character in which a relatively rigid lever or rod is employed for transferring deflecting force from the armature, or weight, to the vibratory contacts.

It is also within the contemplation of the invention to provide a novel vibratory interrupter organization in which practically all of the compliance of the vibratory system is concentrated in the side springs whereby spurious oscillations of the contact supporting members, characteristic of conventional vibrator structures, are substantially eliminated.

The invention also contemplates a vibratory interrupter capable of producing relatively high interruptory rates, which is simple in character, reliable in operation, and which may be readily manufactured and sold on a practical and commercial scale at a low cost.

Other and further objects and advantages of the present invention will become apparent from the following description taken in conjunction with the accompanying drawing; in which

Fig. 1 illustrates a side elevational view of a vibrator embodying the principles of the present invention; and

Fig. 2 depicts a top elevational view of the vibrator shown in Fig. 1.

While a preferred embodiment of the invention is described herein, it is contemplated that considerable variation may be made in the method of procedure and the construction of parts without departing from the spirit of the invention. In the following description, and in the claims, parts will be identified by specific names, for convenience, but they are intended to be as generic in their application to similar parts as the art will permit.

Referring now more particularly to the drawing, reference character 10 denotes a ferromagnetic frame member having the end of its hook portion narrowed down to a horizontally extending pole piece 11 around which there is mounted

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a driver coil 12. On the other end of the frame member there is mounted a stack which progressing from the frame member comprises a pair of insulative spacers 13 and 14, a pair of side springs 15, a pair of insulative spacers 16 and 17 between which there is clamped one end of a hinge plate 18, a second pair of side springs 19, a pair of insulative spacers 20 and 21, and a metal plate 22. The stack is held together by means of bolts 23 and nuts 24 in the conventional manner, said bolts being insulated from the side springs by means of conventional insulating bushings (not shown), as those skilled in the art will readily understand.

The vibratory system is carried by the aforesaid hinge section or plate 18 made of flexible spring material to which there are secured a pair of side arms 25 and 26 and also one end of an elongated rigid lever arm or rod 27 by means of rivets 28. The free end of lever 27 carries an armature or weight 29 extending into cooperating position with pole piece 11 of the driver electromagnet 12. Side arms 25 and 26 respectively carry vibratory contacts 30 and 31, adapted to cooperate with relatively fixed contacts 32, 33, respectively carried by side springs 15 and 19.

It will be noted that in the vibratory system of the present invention the reed section from the point of attachment of the side arms 25, 26, to armature 29 is made of material of sufficient thickness that practically no bending of this section is obtained in normal operation. On the other hand, the lower or hinge section of the reed is made from flexible spring material so that normal starting conditions are obtained. Likewise, the side springs are from elongated flexible material of such character that practically all of the compliance of the system is in the side springs.

From the foregoing description the operation of the vibrator embodying the invention will be readily understood by those skilled in the art. The circuit organization being of conventional character does not require any further explanation. In operation, the stiff section of the vibratory system, arm 27, acts as a lever operating about a pivoting point, some place in the reed hinge section 18. The length of said lever, the mass of armature 29 at its end, the contact spacing distance, and the compliance of side springs 15, 19 then determine the operating frequency at any given coil energy. Experience has demonstrated that the principles of the invention make it possible to obtain relatively high operating frequencies without any manufacturing difficulties.

It has been also found that the rigid lever rod is capable of very efficiently transforming the available coil energy, which is normally of the order of 3.5 watts maximum, into mechanical energy with which to deflect two pairs of contact springs, as this is necessary in self-rectifying vibrators. Of course, the principles of the invention are also readily applicable with equal or similar results to non-synchronous vibrators having only one pair of contacts.

A further important advantage of the vibrator embodying the invention is that it tends to eliminate spurious oscillations of the contact-supporting members, particularly during the closed contact intervals, which are unavoidable in conventional vibrators having compliant reeds. Moreover, the vibrator of the invention is much more effective in producing high contact pressure and deflection of its side springs than prior structures.

While the present invention, as to its objects and advantages, has been described herein as carried out in specific embodiments thereof, it is not desired to be limited thereby but it is intended to cover the invention broadly within the spirit and scope of the appended claims.

What is claimed is:

1. A vibratory electromagnetic interrupter which comprises in combination a flexible hinge plate clamped at one of its ends and carrying a set of vibratory contacts at its other end, a plurality of compliant side springs clamped at one of their ends and each carrying a contact at its other end for cooperation with a vibratory contact, a non-compliant actuating rod having one of its ends connected to said set of vibratory contacts and having its other end extending away therefrom and carrying a ferromagnetic weight, and a driver electromagnet applying deflecting force to said weight.

2. A vibratory electromagnetic interrupter which comprises in combination a stack, a flexible hinge plate having one of its ends clamped in said stack and carrying a pair of side arms at its other end, at least one vibratory contact on each of said side arms, a plurality of relatively compliant side springs having one of their ends clamped in said stack and each carrying a relatively fixed contact at its other end adapted to respectively cooperate with said vibratory contacts, a non-compliant actuating rod having one of its ends connected to said side arms and having its other end extending away from said stack and carrying a ferromagnetic weight, and a driver electromagnet applying deflecting force to said weight.

3. A vibratory electromagnetic interrupter which comprises in combination a ferromagnetic frame having a stack mounted at one end thereof and having its other end bent back and carrying a driver coil, a flexible hinge plate having one of its ends clamped in said stack and having a pair of side arms secured to its other end and extending away therefrom, vibratory contacts on each of said side arms, a plurality of relatively compliant side springs having one of their ends clamped in said stack and each carrying a relatively fixed contact at its other end adapted to respectively cooperate with said vibratory contacts, and a non-compliant actuating rod having one of its ends connected to said side arms and carrying an armature at its other end extending into the magnetic field of said driver coil for transferring deflecting force to said vibratory contacts.

4. A vibratory electromagnetic interrupter which comprises in combination a ferromagnetic frame having a stack mounted at one end thereof and having its other end bent back and carrying a driver coil, a flexible hinge plate having one of its ends clamped in said stack and having a pair of side arms secured to its other end and extending away therefrom, vibratory contacts on each of said side arms, a plurality of relatively compliant side springs having one of their ends clamped in said stack and each carrying a relatively fixed contact at its other end adapted to respectively cooperate with said vibratory contacts, and a non-compliant actuating rod having one of its ends connected to said side arms and carrying an armature at its other end extending into the magnetic field of said driver coil for transferring deflecting force to said vibratory contacts, the length of said actuating rod being a multiple of that of the free portion of the said hinge plate.

5. A vibratory electromagnetic interrupter which comprises in combination a stack, a flexible hinge plate having one of its ends clamped in said stack and carrying a pair of side arms at its other end, at least one vibratory contact on each of said side arms, a plurality of compliant side springs having one of their ends clamped in said stack and each carrying a relatively fixed contact at its other end adapted to respectively cooperate with said vibratory contacts, a non-compliant actuating rod having one of its ends connected to said side arms and having its other end extending away from said stack and carrying a ferromagnetic weight, and a driver electromagnet applying deflecting force to said weight, substantially all of the compliance of said interrupter being in said side springs whereby the production of spurious oscillations of the contact-supporting members is prevented.

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