

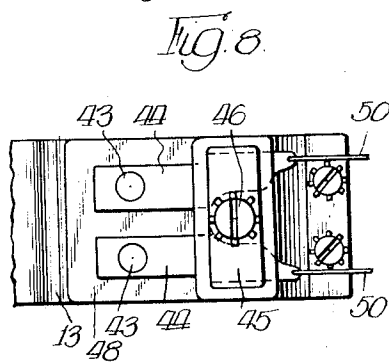
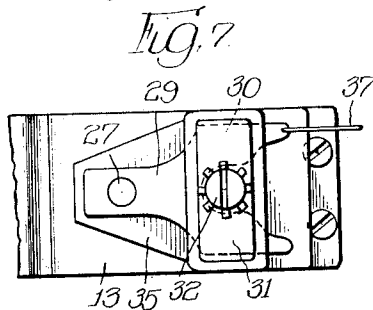
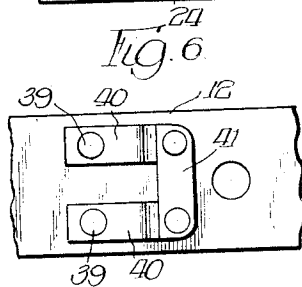
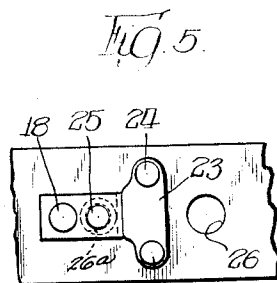
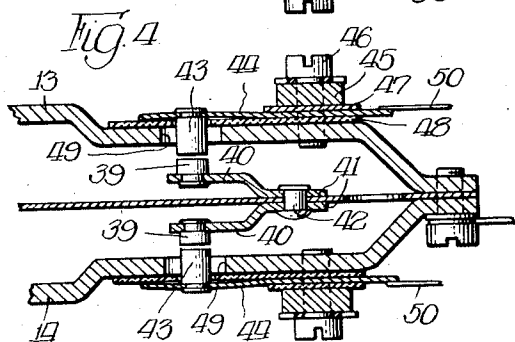
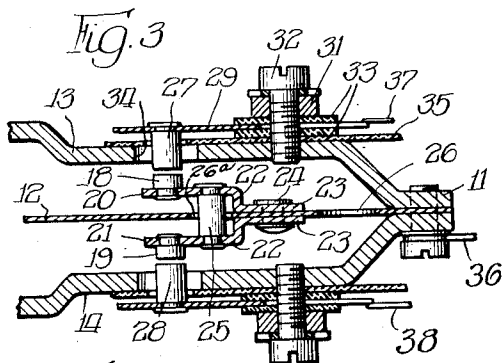
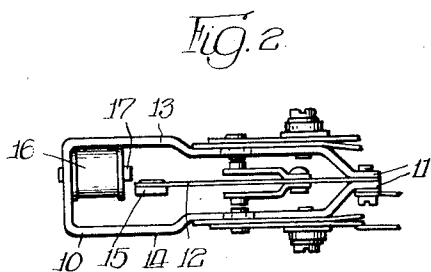
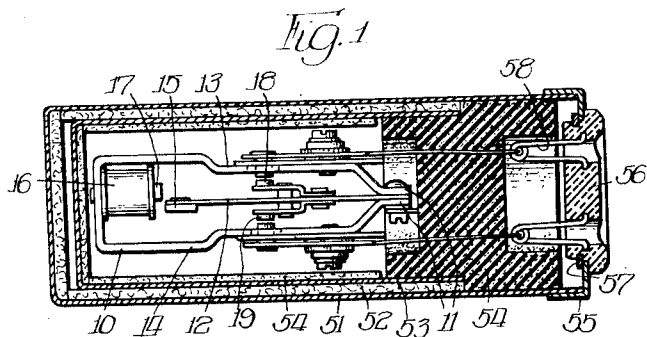
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2,247,469

VIBRATORY MOTOR

Filed March 21, 1935



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UNITED STATES PATENT OFFICE

2,247,469

VIBRATORY MOTOR

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22 Claims. (Cl. 200—90)

The invention relates generally to vibratory motors and more particularly to those of the electromagnetically actuated type especially adapted for controlling intermittent energization of circuits in such devices as "B" battery eliminators for motor vehicle installations of radio receiving apparatus.

A general object of the invention is to provide an efficiently operating motor of this character which is simple in construction and in which the parts are arranged in a novel manner enabling assembly and complete adjustment of the device with utmost ease and accuracy.

Another object is to provide a motor construction in which a novel arrangement and mounting of fixed contact elements disposes them on the outer side of a supporting frame whereby the elements are most conveniently disposed for assembly, inspection, adjustment and repair.

A further object is to provide in such a motor construction novel means for securing relatively fixed but yieldably supported contact elements on a frame which includes a frictional binding connection to avoid distortion of the yieldable supporting parts for said elements, and improved means for insulating said elements from the frame.

More specifically stated, another object resides in the provision in such a motor of a box-like frame having an intermediately disposed, contact carrying vibratory reed mounted within the confines of the frame, and contact elements mounted externally of the frame and provided with contacts which extend through apertures in the frame for cooperation with the reed contacts.

Another object is to provide a vibrator of the type embodying a vibratory reed in which the latter is of a novel character such as to minimize the starting voltage required for the device and to promote time efficiency.

Still another object is to provide a vibrator of the class set forth characterized particularly by its low starting voltage requirements.

Other objects and advantages will become apparent in the following description and from the accompanying drawing, in which:

Figure 1 is a longitudinal sectional view through the enclosing case of a motor unit illustrating a structure which embodies the features of the invention.

Fig. 2 is a side elevation of a vibratory motor of slightly modified construction.

Fig. 3 is an enlarged fragmentary central section through the contact end portion of the motor shown in Fig. 1.

Fig. 4 is a similar view of the motor shown in Fig. 2.

Fig. 5 is an enlarged fragmentary face view of the vibratory reed in the motor shown in Fig. 1.

Fig. 6 is a similar view of the motor reed in Fig. 2.

Figs. 7 and 8 are enlarged fragmentary face views of the motor frame structures shown in Figs. 1 and 2, respectively, in illustration of the structure and assembly of the fixed contact elements.

While the invention is susceptible of various modifications and alternative constructions, I have shown in the drawing and will herein describe in detail the preferred embodiment, but it is to be understood that I do not thereby intend to limit the invention to the specific form disclosed, but intend to cover all modifications and alternative constructions falling within the spirit and scope of the invention as expressed in the appended claims.

Referring to the drawing, two modified forms of vibratory motors are illustrated which differ primarily in that motors of the type shown in Figs. 1, 3, 5 and 7 are adapted to effect full wave energization of a primary winding of a transformer, while the motors shown in Figs. 2, 4, 6 and 8 are of the synchronous type which not only produce full wave interruption of circuits to a primary winding but effect full wave rectification of the alternating current flowing from the secondary winding. The present invention does not, however, deal essentially with these two types of vibratory motors.

Referring to the illustrations of the motors, each modification includes a frame member 10 preferably constructed of an elongated strip of metal bent upon itself to provide a hollow, substantially rectangular, box-like enclosure, the opposite ends of said strip being brought into abutting relation, as indicated at 11. Secured between these abutting ends is one end of a vibratory member 12 commonly known as a reed and formed of thin gage spring steel or the like. The reed extends centrally of the frame substantially parallel to the opposed side members 13 and 14 thereof and terminates near the closed end of the frame where it supports a suitable armature 15. The closed end of the frame carries an electromagnetic winding 16 having a pole piece 17 disposed in operative relation to the armature 15 but in an off-center position with respect thereto.

Referring particularly to the motor shown in

Figs. 1, 3, 5 and 7, the reed carries contact points 18 and 19 intermediate its fixed and free ends, which points constitute the movable contacts and are arranged for cooperation with relatively fixed contacts to be presently described. In this modification only two contacts are provided, since the circuits controlled thereby are those by which the halves of a divided primary winding are separately energized. Hence, the contacts are located on opposite sides of the reed so that alternate energization of the circuits is obtained.

As best shown in Figs. 3 and 5 the contact points 18 and 19 are mounted upon relatively heavy resilient arms 20, 21 respectively, which arms are immediately offset as at 22 to provide flat end portions 23 adapted for facial abutment with opposite sides of the reed. The end portions 23 are preferably transversely enlarged (see Fig. 5) to insure stability of the assembly when secured to the reed and the arms 20, 21 are jointly secured to the reed by such means as rivets 24 which extend through both end portions 23 and the reed. A connector 25, extending through a suitable aperture 26^a in the reed and joining the arms 20 and 21, may be provided to maintain a definite relative adjustment of the contact points 18 and 19. Another aperture 26 between the end portions 23 and the fixed end of the reed may be provided to adjust the vibratory characteristics of the reed.

As to the theory of operation for the reed structure disclosed, the aperture 26 serves primarily to minimize the starting voltage required for the vibrator while the aperture 26^a promotes the so-called "time efficiency." Inasmuch as the aperture 26 weakens the reed in the area where it is located, namely, the portion of the reed between its fixed end and the contacts on it, the reed is made more limber in this area so that it flexes readily at starting. Hence, the voltage required to be applied to the actuating electromagnet to start the reed in vibration is materially reduced. This is, of course, of primary importance in an automobile installation where the output voltage of the conventional car storage battery, and which serves as a source for the vibrator, may fall as much as fifty per cent below its rated output, though even under such circumstances the vibrator should be capable of proper starting. On the other hand, the aperture 26^a weakens the area of the reed where it is located, namely, that portion of the reed adjacent the contacts on it. Making this latter portion of the reed more limber, by such weakening, permits a substantial additional swing of the free end portion of the reed after the contacts have closed on the corresponding side. The contacts remain closed during the dwell period resulting from this additional swing. Thereby the time efficiency is increased, or, in other words, the ratio of time during each cycle of reed motion in which the contacts are closed to the full elapsed time for the cycle.

A pair of relatively fixed contact points 27, 28 are supported upon the frame 10 for cooperation with the movable contact points 18 and 19, respectively. Heretofore, it has been customary to support the relatively fixed contact points upon the inside of the frame in direct opposition to the cooperating movable points. It has been found, however, that such an arrangement is disadvantageous for a number of reasons. Thus, assembly has been quite difficult due to the narrow space in which the assembly operation must be performed. Moreover, it was difficult to ad-

just the position of the points after assembly or to inspect the points, and repair was economically impractical. All of these disadvantages have been overcome by supporting the relatively fixed contact points upon the outer side of the frame by means which can be conveniently assembled, inspected, or repaired. Furthermore, when the contact points are thus supported, adjustment thereof is exceedingly simple.

Referring to Figs. 3 and 7, the contact point 27 is mounted upon a resilient arm 29 near one end thereof. The opposite end of the resilient arm is laterally extended, as indicated at 30 (Fig. 7), which extended portion is centrally cut away to provide a substantially U-shaped contour. Clamping means, herein illustrated as comprising a substantially heavy clamping plate 31 and a centrally located screw 32 engaging the frame, serves to clamp the end 30 of the arm 29 tightly against the frame. The parts are so related that the legs of the U-shaped end 30 straddle, but do not contact, the shank of the screw 32. Insulating strips 33, located one on either side of the end 30, insulate the arm 29 from the frame and clamping structure.

This means of securing the resilient arm 29 to the frame is important since the arm is frictionally bound against the frame by a single securing means, thereby eliminating possible distortion of the arm and increasing the accuracy with which the parts may be initially assembled. The side frame member 13 has a properly disposed aperture 34 therein through which the contact point 27, which is preferably somewhat elongated, extends into cooperative relation with the opposed movable contact point 18. The resilient arm 29 preferably extends entirely across the aperture 34 and a strip of insulation 35, which is secured in place by the clamping means extends along the outer side of the frame throughout the entire area of the yieldable arm 29 and clamping means. The strip of insulation 35 serves to prevent possible short circuits resulting from accumulations of conductive dust between the frame and yieldable arm 29. The opposite contact point 28 is supported upon the opposite frame side 14 for cooperation with the movable contact point 19 by supporting means which is similar to that just described. In establishing the device in an electrical circuit, one lead 36 is connected with the frame and thus with the reed, while other leads 37 and 38 are connected with the end portions 30 of the resilient arms 29.

The motors shown in Figs. 2, 4, 6 and 8 embody two pairs of contact points similar to the pairs 18, 27 and 19, 28 of the previously described motor and have, in addition, two other pairs of contacts which are arranged to rectify the alternating current from the secondary. The provision of four pairs of contacts, instead of two, necessitates slight revisions of structure, but the same advantages and benefits are present in both motors. Referring to the motor shown in Figs. 4 and 6, four contact points 39 are arranged in two axially aligned pairs separated by the reed and in transversely aligned pairs on the same side of the reed. Each contact point is supported by a relatively heavy resilient arm 40 and the arms supporting the points on the same side of the reed terminate in a common end portion 41 which is offset from the arms 40 for facial engagement with the reed. A pair of rivets 42, or the like, through the bases of the end portions 41 and

the reed secure all of the contact points to the reed.

The relatively fixed contact points 43 are mounted upon the outer sides of the frame members 13 and 14 for cooperation with the movable contact points 39 by a frictional clamping means similar to that previously described. Thus, each contact point 43 is mounted upon a resilient arm 44. Since a pair of contact points 43 is carried by each of the frame members 13 or 14, there are two resilient arms 44 on outer sides of each frame member. These arms are substantially parallel and the remote ends thereof are traversed by a clamping plate 45 which is adapted to be drawn against the arms and bind them against the frame by a central screw 46 which passes between the arms. Suitable insulating means 47 is interposed between the plate and the arms, and a second strip of insulation 48 is disposed between the frame and the arms and underlies the entire area of the arms. Suitable apertures 49 in the frame sides 13 and 14 allow each contact point 43 to extend into cooperative relation with a cooperating movable contact point 39. Thus, each of the contact points 43 is mounted on the outer side of the frame by frictional clamping means which cannot distort the yieldable supporting arms 44, and the contact points 43 are electrically independent of the frame and of each other. Leads 50, to connect the contact points 43 in their respective circuits, may be suitably attached to the ends of the arms 44.

It may be seen that the contacts which have been termed relatively fixed contacts are in fact supported by resilient arms. Consequently, when the relatively fixed contacts are struck by the movable contacts, they yield somewhat under the force of the impact and subsequently have a return movement to their original position. During this time the contacts remain engaged. In some instances, it may be desirable to support the fixed contacts for free yielding and unrestrained following movement, in which event the structure illustrated in Fig. 3 is preferred. Therein, one of the pieces of insulation 33 is interposed between the resilient arm 29 and the large strip of insulation 35 to space the resilient arm 29 from the frame and underlying insulation. The resilient arm thus may have an untensioned idle position and may move in either direction from such position in yielding to the impact force exerted by the yieldable contact or in following the return movement thereof.

In other instances, it may be desirable to limit the following movement of the resilient arm so that it cannot move past its initial idle position. The structure shown in Fig. 4 is then preferred, wherein the yieldable arm 44 rests against the large underlying strip of insulation 48 and is slightly biased toward the frame to maintain such engagement. Consequently the contact points supported by the resilient arm may yield when struck by the movable contact but its following movement is stopped when it returns to its original position. It is to be understood that these modifications may be used interchangeably in either motor construction.

From the foregoing, it will be evident that the relatively fixed contacts may be easily assembled upon the frame without difficulty. The parts are all exposed so that a workman may readily reach them for assembly or inspection. If repair is necessary, only a single accessible screw must be removed to disassemble the parts. After the motors have been completely assembled, the final

adjustment may be quickly and accurately made to effect proper spacing of the cooperating contact points by merely bending the exposed yieldable arms outwardly or inwardly. Moreover, the yieldable arms may be twisted or angularly adjusted without difficulty to insure a full surface contact of the cooperating points at the moment of impact.

Referring to Fig. 1, an improved means for connecting either of the motors in circuit is illustrated. A preferred sound and vibration insulating case comprises an outer housing 51 of metal, fiber or the like, which is lined with a sound and vibration insulation material 52, such as felt, within which is located a second housing 53 also lined with similar material 54. The inner housing 53 is seated on a resilient insulating plug 54 formed of sponge rubber or the like, which plug fits snugly within the outer end of the housing 51. A rigid closure 55 of metal or fiber is provided for the end of the outer housing and this closure carries a centrally located insulating disk 56 suitably secured thereto as by a split ring 57. The disk 56 has a plurality of apertures there-through, in each of which is located a connector 58 arranged to cooperate with an inserted prong or like instrumentality. Each of the connectors 58 is electrically connected with one of the lead wires from the motor. This structure is decidedly advantageous since it provides an exceedingly simple means for connecting the vibratory motor in a circuit and does not involve the use of projecting connectors which are apt to become broken or bent.

From the foregoing, it will be evident that a new and improved structure has been devised which is simple, facilitates assembly, inspection, adjustment and repair, and in which all of the operations incident thereto may be quickly and speedily performed. The device is sturdy, operates with high efficiency, and yet due to its simplified construction may be manufactured for sale at a low cost.

I claim as my invention:

1. In a vibratory motor, the combination of a frame, a reed supported within said frame and having a contact thereon, means for imparting vibratory movement to said reed, a contact carried by said frame for cooperation with said mentioned contact, and means on the outer side of said frame and in a position readily accessible for inspection and repair for supporting the contact associated therewith.

2. In a vibratory motor, the combination of a driven vibratory reed, a box-like frame supporting said reed substantially intermediately thereof for movement towards and away from one side of said frame, a contact carried by said reed, and a cooperating contact mounted exteriorly of said frame and in a position readily accessible for inspection and repair, said frame being apertured to permit of engagement of said contacts.

3. In a vibratory motor, the combination of a driven vibratory contact, a cooperating contact, and a supporting frame including a part from opposite sides of which both of said contacts are supported.

4. In a vibratory motor, the combination of a pair of cooperating contacts, a supporting member, and means for securing said contacts to said supporting member in cooperative relation and upon opposite sides thereof.

5. In a vibratory motor, the combination of a pair of cooperating contacts one of which is

driven, and a common supporting member for both of said contacts extending therebetween and having an aperture therein permitting engagement of said contacts.

6. A vibratory motor comprising, in combination, a pair of spaced and opposed frame members having a vibratory reed extending therebetween for movement in the direction of said members, a plurality of pairs of cooperating contacts, one contact of each pair being mounted on said reed, and means for supporting the other contact of each pair on the outer side of a frame member and in a position readily accessible for inspection and repair, said frame members having apertures therein through which the contacts thereon extend for cooperation with the reed carried contacts.

7. A vibratory motor comprising, in combination, an elongated box-like frame having opposed side members, a vibratory reed mounted on said frame and extending substantially intermediate of and parallel to said side members, means for effecting vibration of said reed, a plurality of contacts yieldably supported on said reed to face toward one or the other of said side members, a cooperating contact for each of said first mentioned contacts, and yieldable means supporting each of said cooperating contacts externally of said frame and in a position readily accessible for inspection and repair, said side members having appropriately disposed apertures through which said cooperating contacts extend for engagement by said first mentioned contacts.

8. In a vibratory motor, the combination of a driven movable contact, a relatively fixed contact cooperatively related thereto, and means for supporting said fixed contact including a yieldable arm secured to said contact, a fixed support, and means electrically independent of said arm for frictionally binding said arm and support together.

9. In a vibratory motor, the combination of a driven movable contact, a relatively fixed contact cooperatively related thereto, and means for supporting said fixed contact including a yieldable arm secured to said contact, a fixed support, and a clamping member electrically independent of said arm and detachably mounted on said fixed support for clamping said arm between it and said fixed support.

10. In a vibratory motor, the combination of a driven movable contact, a relatively fixed contact cooperatively related thereto, and means for supporting said fixed contact including a yieldable arm secured to said contact, a rigid metallic member constituting a fixed support, a clamping member detachably mounted on said fixed support for clamping said arm between it and said fixed support and out of electrical circuit relation therewith, and a strip of insulation interposed between said arm and said fixed support and extending therebetween throughout the length and width of said arm.

11. In a vibratory motor, the combination of cooperating relatively fixed and driven contacts, a fixed support extending between said contacts and having an aperture therethrough permitting contact engagement, securing means yieldably mounting said fixed contact on one side of said support, a vibratory reed for supporting said driven contact in cooperative relation with said first contact, and a second securing means independent of said first named securing means for mounting said reed on the opposite side of said support.

12. In a vibratory motor, the combination of cooperating relatively fixed and driven contacts, a fixed support extending between said contacts and having an aperture therethrough permitting contact engagement, a yieldable arm connected to said fixed contact and to said support on the side of said support opposite to said driven contact, a vibratory reed for supporting said driven contact in cooperative relation with said first contact, and securing means independent of the connection between said first contact and said support for securing said reed to said support.

13. In a vibratory motor, the combination of cooperating relatively fixed and driven contacts, a fixed support extending between said contacts and having an aperture therethrough permitting contact engagement, and a yieldable arm connected to said contact and to said support on the side of said support opposite to said driven contact, said arm being substantially parallel to said support, and insulating means throughout the area between said arm and support.

14. In a vibratory motor, the combination of cooperating relatively fixed and driven contacts, a fixed support extending between said contacts and having an aperture therethrough permitting contact engagement, and a yieldable arm connected to said contact and to said support on the side thereof opposite to said driven contact, said arm being distortable to adjust the position of the contact carried thereby relative to its cooperating contact, and insulation between said arm and support.

15. In a vibratory motor, the combination of cooperating relatively fixed and driven contacts, a fixed support extending between said contacts and having an aperture therethrough permitting contact engagement, an arm connected to said fixed contact and to said support on the side thereof opposite the driven contact, and insulating means between said arm and support, said arm being biased into engagement with said insulating means.

16. In a vibratory motor, the combination of cooperating relatively fixed and driven contacts, a fixed support extending between said contacts and having an aperture therethrough permitting contact engagement, an arm connected to said fixed contact and to said support and extending along the side of said support opposite the driven contact, and insulating means between said arm and support, said arm being resilient and having a predetermined spaced relation with respect to said support.

17. In a device of the character described, the combination of a frame member having an aperture therein, a driven contact on one side of said member and opposed to said aperture, a relatively fixed contact on the opposite side of said member and extending through said aperture, resilient means supporting said fixed contact, a plate traversing said member and the end of said resilient means, a single screw for detachably securing said plate to said member to bind said resilient means in place, and insulating means between said resilient means and said plate and member.

18. In a vibratory motor, the combination of a frame having an energizable pole piece thereon, and a reed disposed for movement in response to energizations of said pole piece and having one end secured to said frame, contact means on said reed intermediate its ends, said reed comprising an elongated resilient member having weakened portions therein arranged to cause the free end to flex initially adjacent to its fixed end and to

cause the portion beyond said contact means to flex readily after the contact means has closed a circuit.

19. In a vibratory motor, the combination of a frame having an energizable pole piece thereon, and a reed disposed for movement in response to energizations of said pole piece and having one end secured to said frame, contact means on said reed intermediate its ends, said reed comprising an elongated resilient member having an aperture therein adjacent said one end to cause the free reed to flex initially adjacent said one end and having a second aperture therein adjacent said contact to cause the portion beyond said contact means to flex readily after the contact means has closed a circuit.

20. In a vibratory motor, the combination of a frame having an energizable pole piece thereon, and a reed disposed for movement in response to energizations of said pole piece and having one end secured to said frame, contact means on said reed intermediate its ends, said reed comprising an elongated resilient member having a weakened portion therein adjacent said one end to cause the free reed to flex initially adjacent said one end and having an aperture therein adjacent said contact to cause the portion beyond said contact means to flex readily after the contact means has closed a circuit.

21. In a vibratory interrupter device, the combination of a base, an electromagnet mounted thereon and a flexible vibratory reed mounted thereon, one end of said reed being clamped to

said base and the other end being free to vibrate under influence of said electromagnet, a first contact supported on said reed, a second contact supported from said base and cooperating with said first contact to open and close a circuit during vibration of said reed, said first contact being supported intermediate the clamped and free end of said reed, and said reed having a plurality of holes cut therein to increase its flexibility at a plurality of points therein.

22. In a vibratory motor, the combination of a frame having an energizable pole piece thereon, a thin, flat, resilient metal reed having its butt end fixed to the portion of said frame opposite said pole piece and with the reed projecting toward said pole piece in cantilever fashion, means for energizing said pole piece periodically and at a frequency controlled by the rate of reed vibration to maintain the reed in vibratory motion, a first contact on an intermediate portion of the reed and a cooperating second contact carried by the frame to close an external circuit upon closure of said contacts, one on the other, and said reed having a weakened portion adjacent its fixed end to cause it to flex readily at such point upon institution of vibratory motion of the reed and a second weakened portion adjacent said first contact to cause the portion of the reed beyond said contact to flex readily after the contacts have closed one against the other.

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