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SWITCHING APPARATUS

Original Filed Oct. 2, 1933

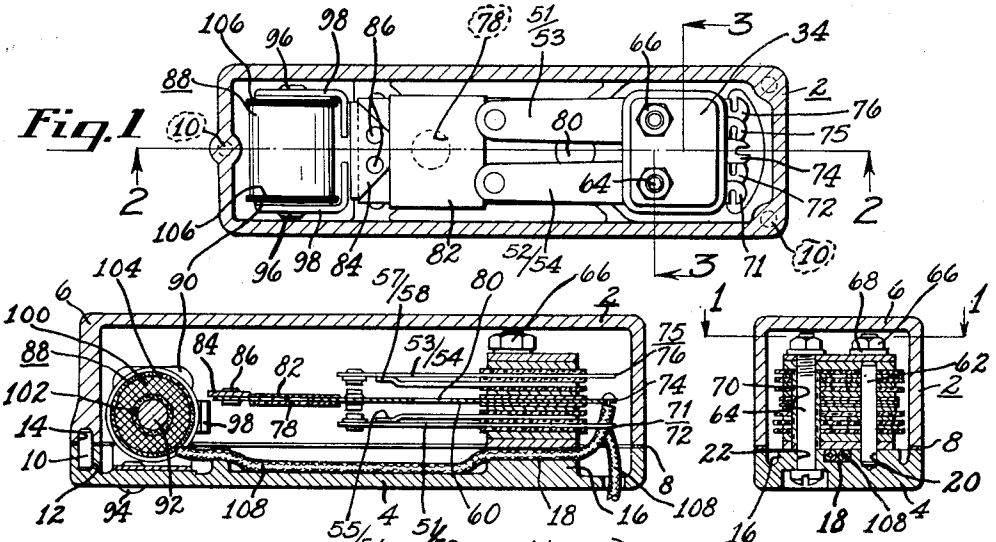


Fig. 1

Fig. 2

Fig. 3

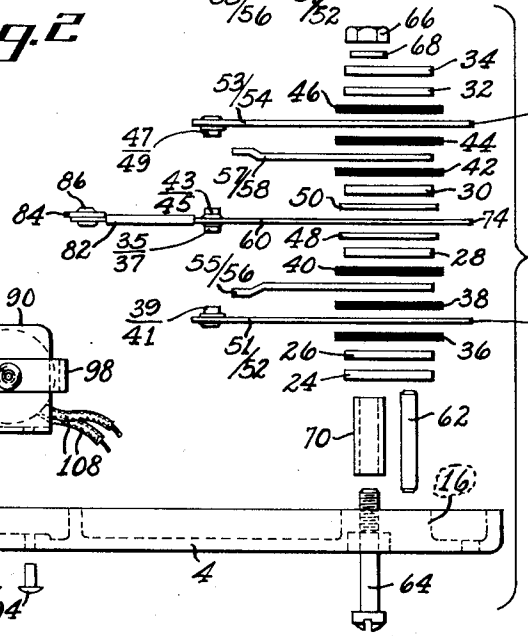


Fig. 4

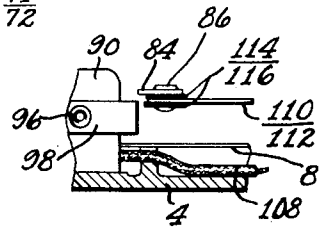


Fig. 6

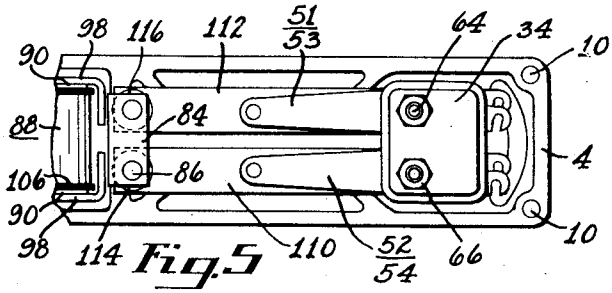


Fig. 5

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SWITCHING APPARATUS

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Original application October 2, 1933, Serial No. 691,786. Divided and this application March 8, 1935, Serial No. 9,983

10 Claims. (Cl. 200—90)

This invention relates to switching apparatus, and more particularly to switching apparatus having a vibratory member for controlling an electrical circuit.

Quite a number of mechanical devices have been devised for purposes similar to that of transforming a voltage from a direct current source such as a battery; but due to the mechanical structure and circuit connections of these devices, their life has been short, and their efficiency low. Beside these faults, the devices have been quite noisy. Furthermore, some of the previous devices utilize rectifier tubes, which tubes are a source of trouble and expense.

One particular field in which an efficient and durable apparatus of this type finds utility, although the present invention is not limited thereto, is in the elimination of the "B" batteries for automobile radio sets. In such an application, the apparatus is called upon to efficiently produce high voltage direct current from the low voltage storage battery source.

This application is a division of our copending application Serial No. 691,786, filed October 2, 1933, in which application the electrical circuit and operation of the device are explained more fully than in this application.

It is an object of this invention to provide switching apparatus for mechanically interrupting and rectifying a direct current potential, so as to produce a direct current from a lower voltage direct current source.

Another object of this invention is to provide switching apparatus to be used in direct current voltage transformation apparatus, which switching apparatus is not only durable and efficient in operation, but is also low in production cost.

Another object of this invention is to provide switching apparatus that can be used for interrupting and rectifying the voltage from a direct current source, which apparatus may be confined to a small space.

Another object of this invention is to provide switching apparatus including a vibratory element that is comparatively quiet in operation.

Another object of this invention is to provide switching apparatus embodying a vibrating reed for actuating contacts, which contacts are utilized for both interrupting a direct current potential before it is transformed and rectifying the transformed potential, which vibrating reed is electromagnetically actuated.

Another object of this invention is to provide switching apparatus embodying an electromagnetically actuated vibratory member, in which apparatus the effect of temperature variations is minimized.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawing wherein a preferred embodiment of one form of the present invention is clearly shown.

In the drawing:

Fig. 1 is a top cut away view of a preferred embodiment of this invention, and is taken substantially on the line 1—1 of Fig. 3, and in the direction of the arrow.

Fig. 2 is a side sectional view of a preferred embodiment of the present invention taken in the direction of the arrow and substantially on the line 2—2 of Fig. 1.

Fig. 3 is a sectional view taken in the direction of the arrows and substantially on the line 3—3 of Fig. 1.

Fig. 4 is an exploded view showing the principal parts of the device shown in Fig. 1.

Fig. 5 is a fragmentary top view illustrating a modification in the structure of the apparatus shown in Fig. 1.

Fig. 6 is a fragmentary side view, also illustrating the modification shown in Fig. 5.

With particular reference to Figs. 1, 2, 3 and 4, an enclosure 2 is provided by a base 4 that is preferably made of brass or some material having a comparatively low temperature coefficient of expansion, and a cooperating cover 6 that is preferably made of lead or some other comparatively good sound deadening material. A gasket 8 of paper or some similar material is preferably utilized between the adjoining surfaces of the base 4 and cover 6, to provide for deadening the sound of the vibrating parts. The cover 6 is held in position on the base 4, preferably by pins such as 10 that fit into apertures such as 12 and 14 in the base 4 and cover 6 respectively. A mounting pedestal 16 is preferably integrally formed with the base 4, which pedestal has a recess or groove 18, a recess 20 and an aperture 22 therein. This pedestal 16 provides a mounting for the contact and vibrator assembly.

The contact and vibrator assembly comprises metallic spacers 24, 26, 28, 30, 32 and 34; insulating spacers 36, 38, 40, 42, 44 and 46; and metallic shims 48 and 50; as well as resilient contact carrying springs 51, 52, 53 and 54; contact spring reinforcing and stop members 55, 56, 57 and 58; and a vibrating reed 60. The contact carrying springs 51, 52, 53 and 54 have contacts 39, 41, 47 and 49 respectively, mounted thereon, and

in alignment for engagement with contacts 35, 37, 43 and 45 respectively, that are mounted on the reed 60. This assembly is held in position by a pin 62 that is preferably made of insulating material, and is clamped together by screws 64 having cooperating nuts 66 and washers 68, or other suitable fastening means. The screws 64 are insulated from the metallic parts of the assembly by insulating sleeves or spacers 70 that fit over the screws and pass through apertures in the parts of the assembly. The insulating spacers 36, 38, 40, 42, 44 and 46 separate the current carrying parts of the assembly so that they are thereby insulated from each other. The contact carrying springs 53, 54, vibrating reed 60 and contact carrying springs 51 and 52 have, respectively, projecting therefrom at the ends thereof opposite to the contacts, terminal portions 71, 72, 74, 75 and 76, which terminal portions are provided for making circuit connections to the contacts.

The vibrating reed 60 has apertures 78 and 80 therein, which apertures, it has been found, are beneficial in reducing the operating noise of the reed. Also beneficial to the reduction of noise of the reed, is a layer of cloth or paper or similar textile or fibrous material 82, preferably wound around the vibrating reed and secured thereto by gluing or other suitable means. The position of this layer of material is preferably near the free end of the reed.

An armature 84 of magnetic material is secured to the end of the reed by rivets 86 or other suitable fastening means. An electromagnet 88 having a core 92 and a winding 100 is secured to the base 4 and supported by a bracket member 90, preferably in a position such that the axis of the core 92 of the electromagnet is substantially parallel to the base, and is substantially perpendicular to the longitudinal axis of the vibrating reed 60. The bracket 90 is secured to the base by rivets 94 or other suitable fastening means, and the electromagnet is preferably secured to the bracket by riveting end portions of the core 92, such as at 96. Also secured to the ends of the core 92 by the riveted portions 96 are angle members 98 of magnetic material that project toward each other outside of the electromagnet 88, and have an air gap between their ends, so that they provide a partially complete magnetic circuit between the ends of the core outside of the electromagnet. The magnetic angle members 98 are magnetically associated with the armature 84 for actuating the vibrating reed, and as viewed in Fig. 2, the upper surface of the members 98 is preferably even with or slightly below the lower surface of the armature 84, so that when the electromagnet is energized, the armature and the vibrating reed are moved downwardly by virtue of the magnetic force. The distance between the ends of the members 98 is adjustable by bending those members, so that the flux linking the armature may be somewhat controlled by adjusting that distance. The distance between the armature 84 and the members 98 may also be adjusted by bending the members 98, and by the normal position of the vibrating reed 60. One of the important reasons for using a material of the base 4 which has a low temperature coefficient of expansion is to prevent appreciable variations in the distance between the members 98 and the armature 84 due to temperature changes. As a detail of construction of the electromagnet itself, it is preferable to separate the winding 100 from core 92 by a layer of insulating material 102, and to cover the electromagnet winding by a layer of insulating material 104, as well as to protect and support the ends of the winding by insulating members 106. The connections between the electromagnet winding 100 and its controlling contacts are made through suitable insulated leads 108 that are conveniently placed in the groove or recess 18.

Even though considerable precaution is taken in the design and construction of the vibrator apparatus itself for eliminating noise, it is understood that to further quiet the apparatus, the unit may be enclosed in a second container that is lined with a suitable vibration damping and sound absorbing material such as sponge rubber or felt.

In the modification shown in Figs. 5 and 6, parts bearing reference numerals similar to those previously used are similar. However, in this form, separate vibrating reed members 110 and 112 are utilized instead of the single reed in the previously described form. These vibrating reeds 110 and 112 are insulatingly separated, but are tied together and kept in synchronism by the armature 84, which, in this instance, is insulated from the reeds by insulating washers 114 and 116. This particular form of switch apparatus is preferable where it is desirable to insulatingly separate or segregate two electrical circuits that are interrupted in synchronism.

In the operation of this switching apparatus, the reed 60 is preferably normally unbiased. However, the armature 84 is biased toward the members 98 when the electromagnet is energized, as previously described. This biasing force that is effected by the electromagnet actuates the reed to a position such that the contacts 35 and 37 engage the contacts 39 and 41 respectively. In order to allow engagement of these contacts for an interval of time without vibratory interruption, the contacts 39 and 41 that are mounted on the springs 51 and 52 respectively, follow the movement of the contacts 35 and 37 after the engagement of the contacts, and by virtue of the resilience of the springs 51 and 52. The contacts 39 and 41 also follow the contacts 35 and 37 in their return movement until the springs 51 and 52 engage the stop members 55 and 56 respectively. This return movement of the reed 60 is effected by the deenergization of the electromagnet 88. The deformation of the reed 60 and its mass, together with the mass of the armature 84 cause the reed to move in a direction such that engagement of the contacts 43 and 45 with the contacts 47 and 49 respectively, is effected. The resilience of the springs 53 and 54, upon which the contacts 47 and 49 respectively, are mounted, permits the contacts 43 and 45 to remain engaged with the contacts 47 and 49 respectively, for an interval of time, in a manner similar to that explained with regard to the springs 51 and 52. The physical dimension of the reed, the material of which it is made, its mass and the mass and position of the parts attached thereto are factors which, to a large degree, control the frequency of vibration of the reed. The positions of the contacts 39, 41, 47 and 49 relative to those mounted on the reed are adjustable by bending the stop members 55, 56, 57 and 58, and, of course, biasing the spring 51, 52, 53 and 54 into engagement with their respective stop members. The biasing of the springs 51, 52, 53 and 54 also affects the interval of time that the contacts remain in engagement, by changing the resistance that the springs offer to the movement of the reed.

It has been found that, in some instances, it is desirable for minimizing sparking and improving efficiency to adjust the position of the contacts so that engagement of one set of contacts on each side of the reed occurs before the engagement of the other set of contacts on the same side of the reed. Such adjustment effects breaking of the contacts at different times, also.

While the embodiment of the present invention as herein disclosed, constitutes a preferred form, it is to be understood that other forms might be adopted, all coming within the scope of the claims which follow.

What is claimed is as follows:

1. In an electrical device, a vibrating reed having a flexible portion, means for actuating the reed, and means for quieting the operation of the reed, the last mentioned means comprising a covering of fibrous material secured to the flexible portion of the reed and covering a portion thereof.

2. In an electrical device, a vibrating reed having a flexible portion and apertures therein for quieting the operation thereof, and strip of fibrous material secured to the surface of the flexible portion of the reed, also for quieting the operation thereof.

3. In an electric device, a resilient reed member supported at one end and having its other end free to vibrate, an armature of magnetic material secured to the free end of the reed, an electromagnet axially spaced from the end of the reed for actuating the reed, said electromagnet having a core extending parallel to the surface of the reed and perpendicular to the axis of the reed, said electromagnet being near the free end of the reed, magnetic members secured to the core and magnetically associated with the armature and forming a partial magnetic circuit between the ends of said core, said magnetic members being at one side of the normal position of the armature and providing means for adjusting the electromagnet flux linking the armature.

4. In an electrical device, a resilient reed member supported at one end and having its other end free to vibrate, an armature of magnetic material secured to and projecting beyond the free end of the reed, an electromagnet axially spaced from the free end of the reed for actuating the reed, said electromagnet having a core extending parallel to the surface of the reed and perpendicular to the axis of the reed, magnetic members secured to the core and having ends projecting toward each other at one side of the normal position of the armature so as to have a gap therebetween and so as to form a partial magnetic circuit outside of the electromagnet and near the armature, said magnetic members being adjustable to control the gap, and being magnetically associated with the armature so that the flux at and near the gap links the armature to urge the reed from its normal position.

5. In an electrical device, a plurality of insulatingly separated vibrating reed members for controlling separate circuits, a common armature secured to each of said reeds and providing a substantially rigid tie between the reeds, said armature being electrically insulated from the reeds by insulating members, and a single magnet motor magnetically associated with the armature for actuating the reeds.

6. In an electrical switching device, a vibrating reed anchored at one end, an armature secured to the other end of the reed, said reed having an aperture therein intermediate the anchored end and the armature, a wrapping of fibrous material covering a portion of the reed intermediate the ends thereof, and an electromagnet adjacent the armature for actuating the reed.

7. In an electrical device, a vibrating resilient reed having one end anchored and the other end free to vibrate, said resiilent reed having an aperture therethrough intermediate the anchored and free ends thereof, and a layer of fibrous material secured to the reed and covering said aperture.

8. In an electrical device, a plurality of coaxially extending reeds each anchored at one end and having their other ends free to vibrate, said reeds being normally in substantially the same plane, a common armature secured to the free ends of the reeds to provide a substantially rigid connection between said free ends, said armature being electrically insulated from the reeds by insulating members, an electromagnet for actuating the reeds spaced axially from the ends of the reeds and having pole pieces associated with the armature, stationary contacts, and cooperating movable contacts on each of the reeds for controlling separate circuits.

9. In an electrical device, a pair of separated reeds for controlling separate electrical circuits, said reeds being supported at one end and having their other ends free to vibrate, means electrically insulating the reeds from each other at their supported ends, a common armature secured to the free ends of each of the reeds, means electrically insulating the armature from at least one of the reeds, and an actuating magnet having a pole piece adjacent and eccentric to the armature, said pole piece being spaced from the armature axially of the reeds.

10. In an electrical device, a plurality of separated vibrating reeds anchored at one end and extending substantially parallel to each other in substantially the same plane, means electrically insulating the reeds at their anchored ends, an armature secured to each of the reeds and providing a substantially rigid tie between the free ends of the reeds, means electrically insulating the armature from one of the reeds, and an electromagnet having a pole piece magnetically associated with the armature for actuating the reeds.

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