Jan. 23, 1940. M. E. NULSEN ET AL 2,187,950

MAGNETIC INTERRUPTER

Filed March 14, 1934 2 Sheets-Sheet 2

Fig. 4

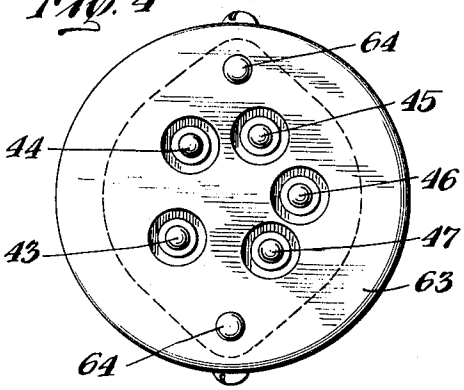


Fig. 7

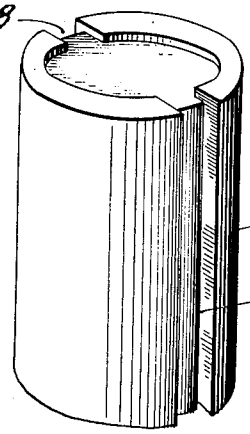


Fig. 5

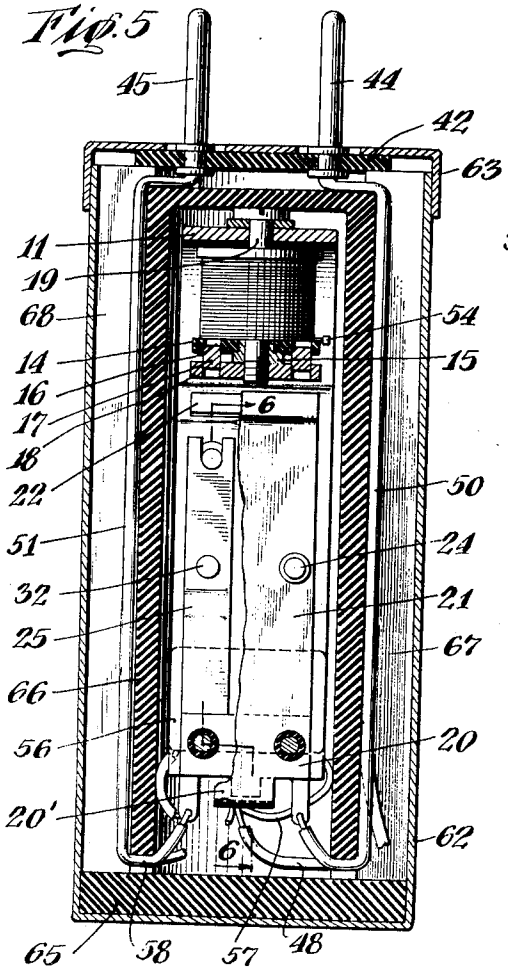
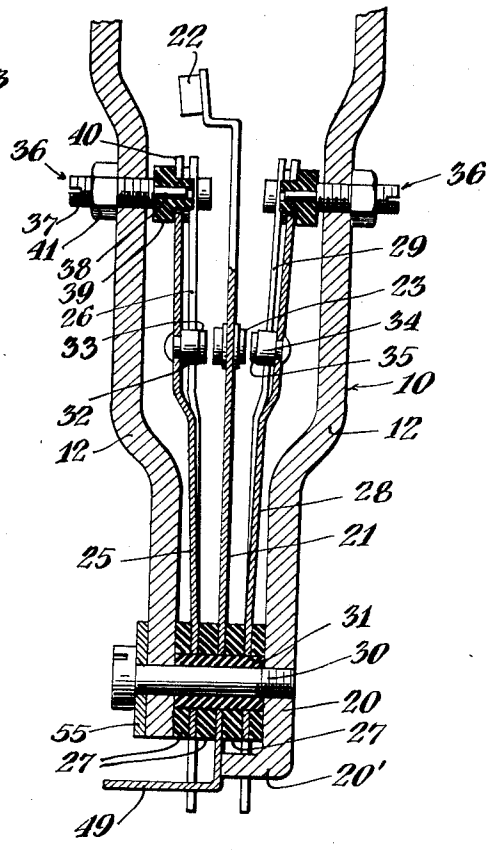


Fig. 6



INVENTORS
Marvin E. Nulsen, Raymond S. Yoder,
BY William P. Ledr,
Watson, Bristol, Johnson & Leavenworth
ATTORNEYS

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MAGNETIC INTERRUPTER

Marvin E. Nulsen, Indianapolis, Ind., Raymond S. Yoder, Chicago, Ill., and William P. Lear, New York, N. Y., assignors to P. R. Mallory & Co., Inc., Indianapolis, Ind., a corporation of Delaware

Application March 14, 1934, Serial No. 715,478

23 Claims. (Cl. 200—90)

This invention relates to mechanical interrupter units for electrical circuits and, more particularly, to such devices of the magnetic type adapted rapidly to make and break electrical circuits of potential changers such as the so-called "B" eliminators for radio receivers and constitutes an improvement upon United States Letters Patent of William P. Lear and Marvin E. Nulsen, No. 1,943,240, issued January 9, 1934.

A general object of the present invention is the provision of such a device which is efficient in operation, can be readily duplicated in commercial production, is readily removable as a unit from a circuit, provides for proper and substantially simultaneous interruption of direct current in a transformer primary circuit and rectification of the alternating current in the transformer secondary circuit, and is characterized by various constructional features making for efficient operation thereof.

More specific objects of the invention are the provision of such removable units wherein a flux path of high magnetic permeability is completed about the magnetic coil through a coil core, a base of magnetic permeable material and a vibratory reed mounted on the latter whereby the reed constitutes one pole of the magnetic coil; the provision of a U-shaped base to provide simple arrangement of the coil between the arms of the base with one end of the core facing toward the ends of the arms and support for the reed between the ends of the arms to extend toward the core; the provision of spring members adjustably supported on the arms of the base to carry interrupter contacts and rectifier contacts for cooperation with contacts on the vibratory reed for half- or full-wave rectification as desired in a manner so that ready adjustment can be made to insure proper and efficient interruption and rectification; and the provision of other constructional features insuring simplicity in and ready assembly, and cheapness in manufacture.

Other objects of the invention will in part be obvious and will in part appear hereinafter.

The invention accordingly comprises the features of construction, combination of elements, and arrangement of parts, which will be exemplified in the construction hereinafter set forth and the scope of the invention will be indicated in the claims.

For a fuller understanding of the nature and objects of the invention reference should be had to the following detailed description taken in connection with the accompanying drawings, in which:

Fig. 1 is a longitudinal sectional view with parts broken away of a device embodying the present invention;

Fig. 2 is a lateral sectional view of the device depicted in Fig. 1, taken on line 2—2 thereof;

Fig. 3 is an enlarged exploded perspective view of the device depicted in Fig. 1 with parts broken away and the case and coil omitted;

Fig. 4 is a base end view of the device;

Fig. 5 is a longitudinal sectional view of the device depicted in Fig. 1, taken on line 5—5 thereof;

Fig. 6 is an enlarged detail sectional view with parts broken away taken on line 6—6 of Fig. 5; and

Fig. 7 is a perspective view with parts broken away of the sound isolating casing.

Potential changers have become of great service as devices for supplying high voltage direct current for the "B" supply or plate circuit of radio receivers, particularly where as in automobiles it is desirable to use a low voltage source such as the automobile storage battery. However, since the battery is used for the ignition and lighting circuits of the automobile as well as for the "A" supply of the radio receiver, many problems peculiar to such service are involved.

The present invention eliminates many of these problems while increasing the efficiency of potential changers used for such service wherein a mechanical interrupter is used in the primary circuit thereof to make and break periodically the flow of direct current through the primary of a transformer so that an alternating E. M. F. of desired potential will be set up in the secondary of the transformer and thereafter rectified and filtered to supply direct current of desirably higher voltage than that of the direct current source of the primary circuit.

Referring to the drawings, like numerals refer to like parts throughout. The mechanical interrupter unit consists of a U-shaped base 10 of magnetic permeable material having electrical conductivity. The base 10 is provided with a transversely extending midportion 11 from which project two substantially parallel arms 12, 12. A magnetic coil 13 is provided with end plates 14, 14 of any suitable insulating material and a core 15 of magnetic permeable material, preferably in the form of a collar adapted to hold the end plates 14, 14 in position to form a unitary structure.

As is more clearly shown in Fig. 5, one end plate 14 is provided with a pair of indentations 16, 16 adapted to receive projections 17, 17 on a

complete a well known circuit as exemplified in Reissue Patent 18,971 to R. J. Rockwell of October 24, 1933. As is indicated in the present drawings, the pairs of contacts are normally open, thus the magnetic coil 13 is in series with half of the primary and with the battery so that it will become energized to cause the reed pole piece 22 on the vibratory reed 21 to more nearly align with the pole piece 18 thereby closing the pairs of contacts 23, 34 and 24, 35. The closure of the contacts 24, 35 shorts out the magnetic coil 13 thereby allowing the vibratory reed 21 to spring back and close the pairs of contacts 23, 32 and 24, 33, thereby opening contacts 24, 35 allowing the magnetic coil 13 to be again energized whereby the action is repeated. There is thus substantially simultaneous operation of the pairs of interrupter contacts 24, 35 and 24, 33 with the pairs of rectifier contacts 23, 34 and 23, 32. In practise spring members 25 and 28 carrying rectifier contacts 32 and 34 respectively are sometimes set at a greater distance from the vibratory reed 21 to provide larger spaces between the pairs of rectifier contacts 23, 34 and 23, 32 than are provided betwen the pairs of interrupter contacts 24, 35 and 24, 33. While, obviously different relations between the interrupter contacts and the rectifier contacts may be obtained through the proper settings of the adjustable supports 36—36, the above relationship is usually preferred for the reason that more nearly sparkless operation is obtained over a wide range of battery voltages. Since the desired relationship is obtained by virtue of structure forming a part of the mechanical interrupter unit, it is inherently a part of the present invention.

It will thus be seen that the objects of the present invention are efficiently attained by a simplified, readily manufactured and easily adjusted mechanical interrupter structure described above.

Since certain changes may be made in the above construction and different embodiments of the invention could be made without departing from the scope thereof, for example, rectifier contacts and cooperating spring arms can be omitted, the device being used solely for interruption of the primary circuit, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the following claims are intended to cover all of the generic and specific features of the invention herein described, and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

Having described our invention, what we claim as new and desire to secure by Letters Patent is:

1. In a potential changer adapted for use with a direct current source as a power supply such as the "B" supply of an automobile radio, an article of manufacture consisting of a mechanical interrupter unit comprising a base of magnetic permeable material, a magnetic coil mounted on one end thereof, a core for said coil having one end thereof disposed adjacent to a portion of said base and the other end thereof facing toward the other end of said base, a vibratory reed of magnetic permeable material mounted on and magnetically connected to the last-mentioned end of said base and having the free end thereof extending toward the last-mentioned end of said core with the major portion of the body thereof disposed substantialy parallel to the axis of said core, the free end of said vibratory reed thereby constituting one pole of said magnetic coil.

2. In a potential changer adapted for use with a direct current source as a power supply such as the "B" supply of an automobile radio, an article of manufacture consisting of a mechanical interrupter unit comprising a U-shaped base of magnetic permeable material, a magnetic coil positioned between the arms of said base, a core for said coil having one end thereof secured to said base and the other end thereof facing toward the ends of the arms of said base, a vibratory reed of magnetic permeable material mounted betwen the arms of said base and magnetically connected thereto and having the free end thereof extending toward the last-mentioned end of said core with the major portion of the body thereof disposed substantially parallel to the axis of said core, the free end of said vibratory reed thereby constituting one pole of said magnetic coil.

3. In a potential changer adapted for use with a direct current source as a power supply such as the "B" supply of an automobile radio, an article of manufacture consisting of a mechanical interrupter unit comprising a base of magnetic permeable material having a transversely extending mid-portion and a pair of spaced apart arms extending therefrom substantially parallel to each other, a magnetic coil positioned between said arms, a core for said coil having one end thereof secured to said transversely extending mid-portion with the other end thereof facing toward the ends of said arms, a vibratory reed of magnetic permeable material positioned between said arms having one end thereof secured between the ends of said arms and the other end thereof extending toward the last-mentioned end of said core for free vibratory action, the free end of said vibratory reed thereby constituting one pole of said magnetic coil.

4. In a potential changer adapted for use with a direct current source as a power supply such as the "B" supply of an automobile radio, an article of manufacture consisting of a mechanical interrupter unit comprising a base of magnetic permeable material having a transversely extending mid-portion and a pair of spaced apart arms extending therefrom substantially parallel to each other, a magnetic coil positioned between said arms, a core for said coil having one end thereof secured to said transversely extending mid-portion with the other end thereof facing toward the ends of said arms, a vibratory reed of magnetic permeable material positioned between said arms having one end thereof secured between the ends of said arms and the other end thereof extending toward the last-mentioned end of said core for free vibratory action, at least one circuit contact mounted on said vibratory reed, a spring member positioned between one of said arms and said vibratory reed having one end thereof fixedly mounted between the end of one of said arms and the end of said vibratory reed and the other end thereof adjustably supported upon said last-mentioned arm, and another circuit contact mounted on said spring member for cooperation with the circuit contact on said vibratory reed.

5. In a potential changer adapted for use with a direct current source as a power supply such as the "B" supply of an automobile radio, an article of manufacture consisting of a mechanical interrupter unit comprising a base of mag-

netic permeable material having a transversely extending mid-portion and a pair of spaced apart arms extending therefrom substantially parallel to each other, a magnetic coil positioned between said arms, a core for said coil having one end thereof secured to said transversely extending mid-portion with the other end thereof facing toward the ends of said arms, a vibratory reed of magnetic permeable material positioned between said arms having one end thereof secured between the ends of said arms and the other end thereof extending toward the last-mentioned end of said core for free vibratory action, at least one double-faced circuit contact mounted on said vibratory reed, a spring member positioned between one of said arms and said vibratory reed having one end thereof fixedly mounted between the end of said arm and the end of said vibratory reed and the other end thereof adjustably supported upon said arm, a circuit contact mounted on said spring member for cooperation with one face of said double-faced circuit contact, another spring member positioned between said vibratory reed and the other arm of said base in like manner, and a circuit contact mounted on said last-mentioned spring member for cooperation with the other face of said double-faced contact.

6. In the mechanical interrupter unit defined in claim 3 the combination comprising a pair of double-faced contacts mounted on said vibratory reed, two spring members positioned between one of the arms of the base and the vibratory reed, two spring members positioned between the other arm of said base and said vibratory reed, each of said spring members having one end thereof fixedly mounted between the end of one of said arms and the end of said vibratory reed and the other end thereof adjustably supported upon the adjacent arm of said base, and a circuit contact mounted on each of said spring members for cooperation with one face of one of said double-faced circuit contacts, one opposed pair of spring member supported contacts and the cooperating double-faced contact constituting interrupter contacts for the primary circuit of the potential changer, and the other opposed pair of said spring member supported contacts and the cooperating double-faced contact constituting mechanical rectifier contacts for the secondary circuit of the potential changer.

7. In a potential changer adapted for use with a direct current source as a power supply such as the "B" supply of an automobile radio, an article of manufacture consisting of a mechanical interrupter-rectifier unit comprising a vibratory reed, means to vibrate said reed, a pair of double-faced contacts on said reed, a pair of contact supports on each side of said reed, and a contact on each support adapted to cooperate with one face of said double-faced circuit contacts, one opposed pair of contacts and the cooperating double-faced contact constituting interrupter contacts for the primary circuit of the potential changer, and the other opposed pair of said contacts and the cooperating double-faced contact constituting rectifier contacts for the secondary circuit of the potential changer, said interrupter contacts being positioned nearer the cooperating double-faced contact than are the rectifier contacts with respect to their cooperating double-faced contact so that said rectifier contacts will make later and break sooner than the interrupter contacts.

8. In a potential changer adapted for use with a direct current source as a power supply such as the "B" supply of an automobile radio, an article of manufacture consisting of a mechanical interrupter unit comprising a magnetic coil, a core for said coil, a transversely extending core pole piece mounted on the end of said core, a vibratory reed of magnetic permeable material having its fixed end connected by an iron path to one end of said core, and a reed pole piece mounted on the end of said vibratory reed disposed in offset relationship to said core pole piece, the longitudinal axes of said core pole piece and of said reed pole piece being substantially parallel and said reed pole piece constituting the other pole of said magnetic coil.

9. In a potential changer adapted for use with a direct current source as a power supply such as the "B" supply of an automobile radio, an article of manufacture consisting of a mechanical interrupter unit comprising a magnetic coil having an end plate, a hollow core for said coil having one end thereof extending through said end plate, a transversely extending core pole piece mounted on the extending end of said core by means of a screw, means between said core pole piece and said end plate to prevent relative rotation therebetween, a vibratory reed of magnetic permeable material, magnetic permeable material between the fixed end of said reed and the other end of said core, a transversely extending reed pole piece mounted on the free end of said reed disposed in offset relationship to said core pole piece with the longitudinal axis thereof substantially parallel to the longitudinal axis of said core pole piece, said reed pole piece thereby constituting the other pole of said coil.

10. In a potential changer adapted for use with a direct current source as a power supply such as the "B" supply of an automobile radio, an article of manufacture comprising a mechanical interrupter unit comprising a base of magnetic permeable material having a transversely extending mid-portion and a pair of spaced apart arms extending therefrom substantially parallel to each other, a magnetic coil positioned between said arms, a core for said coil having one end thereof secured to said transversely extending mid-portion, a transversely extending core pole piece secured to the other end of said core and facing toward the ends of said arms, a vibratory reed of magnetic permeable material positioned between said arms having one end thereof fixed between the ends of said arms and in contact with at least one of said arms, said vibratory reed having the free end thereof extending toward said core pole piece, a reed pole piece mounted on the free end of said vibratory reed disposed in offset relationship to said core pole piece with the longitudinal axis thereof substantially parallel to the longitudinal axis of said core pole piece, two spring members positioned between one of said arms and said vibratory reed, two spring members positioned between the other arm and said vibratory reed, each of said spring members having one end provided with a slot and the other end fixedly mounted between the end of one of said arms and the end of said vibratory reed and insulated from both, a collar of insulating material disposed in the slot in the end of each of said spring members, and screws mounted through said arms the end of each of which is adapted to engage one of said collars, said screws and collars cooperating adjustably to position the ends of said spring members with respect to said arms, a pair of double-faced contacts mounted on said vibratory reed and a cir-

cuit contact mounted on each of said spring members for cooperation with one face of one of said double-faced circuit contacts.

11. In a potential changer adapted for use with a direct current source as a power supply such as the "B" supply of a radio receiver, an article of manufacture consisting of a mechanical interrupter unit comprising a base of magnetic permeable material, a magnetic coil mounted on one end thereof, a core for said coil having one end thereof disposed adjacent to a portion of said base and the other end thereof facing toward the other end of said base, a vibratory reed of magnetic permeable material mounted on the last-mentioned end of said base, said vibratory reed having the major portion of its body disposed substantially parallel to the axis of said core with its free end extending toward the last-mentioned end of said core to constitute one pole of said magnetic coil.

12. As an article of manufacture, a mechanical interrupter comprising an elongated base of magnetic permeable material, a magnetic coil having a core with one end mounted on one end of said base and the other end facing toward the other end of said base, an elongated vibratory reed mounted on the last-mentioned end of said base with the major portion of the body thereof disposed substantially parallel to the axis of said core and the free end thereof disposed adjacent to and offset from the last-mentioned end of said core to constitute one pole of said magnetic coil.

13. In a potential changer adapted for use with a direct current source as a power supply such as the "B" supply of a radio receiver, an article of manufacture consisting of a mechanical interrupter unit comprising an elongated base of magnetic permeable material, a magnetic coil having a core, means to mount one end of said core on one end of said base with the other end of said core facing toward the other end of said base, an elongated vibratory reed, means to mount one end of said reed on the last-mentioned end of said base with the major portion of the body of said reed disposed substantially parallel to the axis of said core and the free end thereof disposed adjacent to and offset from the last-mentioned end of said core for movement substantially transversely of the axis of said core.

14. In a potential changer adapted for use with a direct current source as a power supply such as the "B" supply of an automobile radio, an article of manufacture consisting of a mechanical interrupter unit comprising a base of magnetic permeable material having a transversely extending mid-portion and a pair of arms extending therefrom in substantially parallel relationship, a magnetic coil positioned between said arms adjacent said transversely extending mid-portion, a core for said coil secured to said base, at least one pole piece associated with said core, a vibratory reed of magnetic permeable material positioned between said arms having one end thereof secured between the ends of said arms with means whereby a path of magnetic permeability is provided between said reed and at least one of said arms, the free end of said reed extending toward said pole piece in offset relationship thereto for free vibratory action, at least one pair of contacts located between said reed and one of said arms with one of said contacts supported on said reed and the other mounted on means supported by said base structure.

15. In a potential changer adapted for use with a direct current source as a power supply such as the "B" supply of an automobile radio, an article of manufacture consisting of a mechanical interrupter unit comprising a base of magnetic permeable material having a transversely extending mid-portion and a pair of spaced apart arms extending therefrom substantially parallel to each other, a magnetic coil positioned between said arms, a core for said coil having one end thereof secured to said transversely extending mid-portion with the other end thereof facing toward the ends of said arms, a vibratory reed of magnetic permeable material positioned between said arms having one end thereof secured between the ends of said arms and the other end thereof extending toward the last-mentioned end of said core for free vibratory action, the free end of said vibratory reed thereby constituting one pole of said magnetic coil, a metallic case inclosing said structure and having a prong base, a layer of sound isolating material between said case and said structure, and resilient means supporting said structure in said case.

16. In a potential changer adapted for use with a direct current source as a power supply such as the "B" supply of an automobile radio, an article of manufacture consisting of a mechanical interrupter unit comprising a base of magnetic permeable material having a transversely extending mid-portion and a pair of arms extending therefrom in substantially parallel relationship, a magnetic coil positioned between said arms adjacent said transversely extending mid-portion, a core for said coil secured to said base, at least one pole piece associated with said core, a vibratory reed of magnetic permeable material positioned between said arms having one end thereof secured between the ends of said arms with means whereby a path of magnetic permeability is provided between said reed and at least one of said arms, the free end of said reed extending toward said pole piece in offset relationship thereto for free vibratory action, at least one pair of contacts located between said reed and one of said arms with one of said contacts supported on said reed and the other mounted on means supported by said base structure, a metallic case inclosing said structure and having a prong base, a layer of sound isolating material between said case and said structure, and resilient means supporting said structure in said case.

17. In a potential changer adapted for use with a direct current source as a power supply such as the "B" supply of an automobile radio, an article of manufacture consisting of a mechanical interrupter unit comprising a base of magnetic permeable material having a transversely extending mid-portion and a pair of arms extending therefrom in substantially parallel relationship, a magnetic coil positioned between said arms, a core for said coil having one end thereof secured to said transversely extending mid-portion with the other end thereof facing toward the ends of said arms, a transversely extending core pole piece mounted on the last mentioned end of said core, a vibratory reed of magnetic permeable material positioned between said arms with one end thereof secured between the ends of said arms and in contact with a portion of at least one of said arms and the free end extending toward said pole piece, a reed pole piece mounted on the free end of said vibratory reed disposed in offset relationship to said core pole piece, at least one pair of contacts located be-

tween said reed and one of said arms with one of said contacts supported on said reed and the other mounted on means supported by said base structure, a metallic case inclosing said structure and having a prong base with at least one prong grounded to said case, a layer of sound isolating material between said case and said structure, and resilient means supporting said structure in said case.

18. In a potential changer adapted for use with a direct current source as a power supply such as the "B" supply of an automobile radio, an article of manufacture consisting of a mechanical interrupter unit comprising an elongated base having a pair of spaced apart arms extending from one end thereof in substantially parallel relationship, a magnetic coil positioned on the end of said base between said arms, a core for said coil secured to said base, at least one pole piece mounted on said core, a vibratory reed positioned between said arms having one end thereof secured between the ends of said arms and the other end thereof extending toward and offset from said pole piece for free vibratory action, at least one circuit contact supported on said vibratory reed, a spring member positioned between one of said arms and said vibratory reed having one end thereof fixedly mounted between the end of one of said arms and the end of said vibratory reed and the other end thereof adjustably supported on said last-mentioned arm, and a cooperating circuit contact mounted on said spring member.

19. In a vibratory motor, the combination of a frame formed of a continuous piece of magnetically permeable material bent into an elongated rectangular frame and having the opposite ends thereof turned to provide opposed faces, an electromagnet mounted at the closed end of the frame, and a vibratory reed secured between said faces and extending to a position for co-operation with said electromagnet, said frame forming part of the magnetic path of said vibratory motor.

20. In a vibratory motor, the combination of a U-shaped frame formed of a continuous piece of magnetic permeable material having the opposite ends thereof positioned to provide opposed faces, a vibratory reed secured between said faces and a magnetic coil having a core mounted in co-operative relation with said reed and said frame with the axis of said core disposed substantially parallel to the major portion of the body of said reed.

21. In a vibratory motor, the combination of a frame formed of a continuous piece of magnetically permeable material bent into an elongated U-shaped frame and having the opposite ends thereof turned to provide opposed faces, an electromagnet mounted at the closed end of the frame, and a vibratory reed secured between said faces and extending to a position for co-operation with said electromagnet, said vibratory reed having the major portion of its body disposed substantially parallel to the axis of said electromagnet, said frame forming a part of the magnetic path of said vibratory motor.

22. A mechanical vibratory interrupter unit for use in power supply systems, said unit comprising an elongated base of magnetically permeable material, an elongate electromagnet core secured by one of its ends to one end of said base and having its other end projecting toward the other end of said base, an electromagnet coil around said core, a vibratory reed mounted by one end on the last-mentioned end of said base, said reed having an armature of magnetically permeable material on the free end thereof, said reed having the major portion of its body disposed substantially parallel to the axis of said core with its armature end extending toward the projecting end of said core and said armature disposed adjacent to the projecting end of said core in a position to swing past said core end upon vibration of said reed, said armature being offset with respect to said core end in the normal rest position of said reed, at least one electric contact supported from said reed, and a co-operating relatively stationary contact supported from said base, said co-operating contacts being opened and closed by the normal vibration of said reed.

23. A mechanical interrupter unit for use in power supply systems, said unit comprising an elongated base of magnetically permeable material, an electromagnet core having one of its ends disposed adjacent to one end of said base and the other end projecting toward the other end of said base, an electromagnet coil around said core, a vibratory reed mounted by one end on the last-mentioned end of said base, said reed having an armature of magentically permeable material on the free end thereof, said reed having the major portion of its body disposed substantially parallel to the axis of said core with its armature end extending toward the projecting end of said core and said armature disposed adjacent to the projecting end of said core in a position to swing past said core end upon vibration of said reed, and electric contacts controlled by said reed during vibration thereof.

MARVIN E. NULSEN.
RAYMOND S. YODER.
WILLIAM P. LEAR.

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PHOTOGRAPHIC CAMERA

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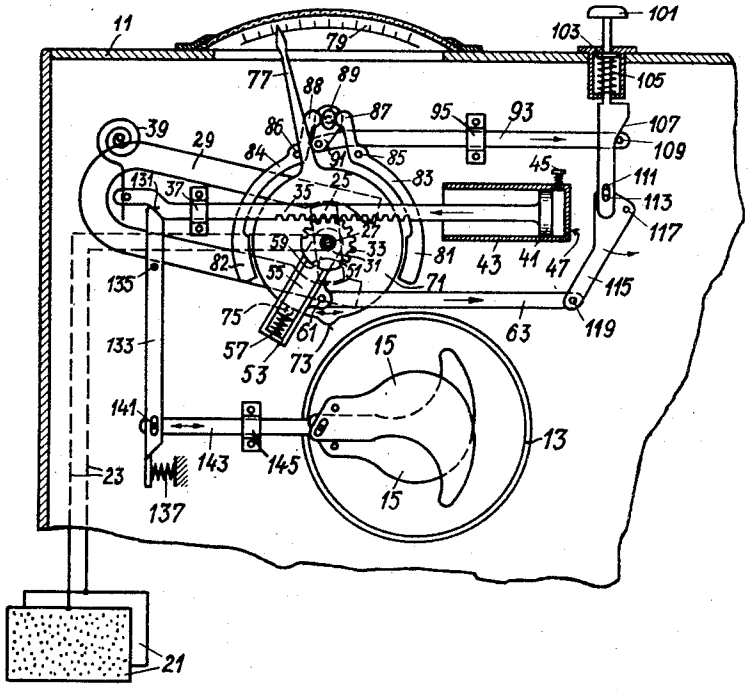

Inventor:
Walter Schmidt,
by
Cumpston & Shepard
his attorneys.