March 12, 1957 F. L. WHITE 2,785,248

REED DAMPED VIBRATOR ARM MECHANISM

Filed Dec. 22, 1953

Fig. 1

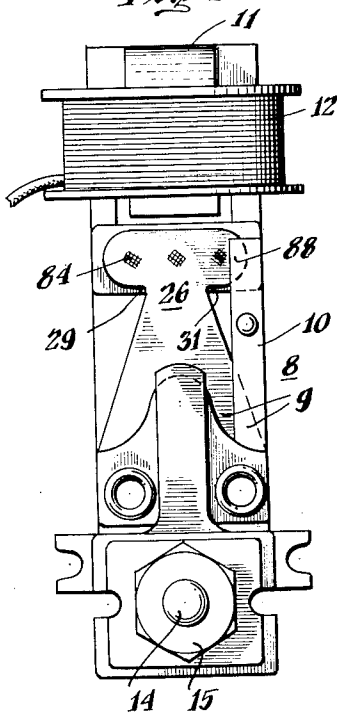


Fig. 2

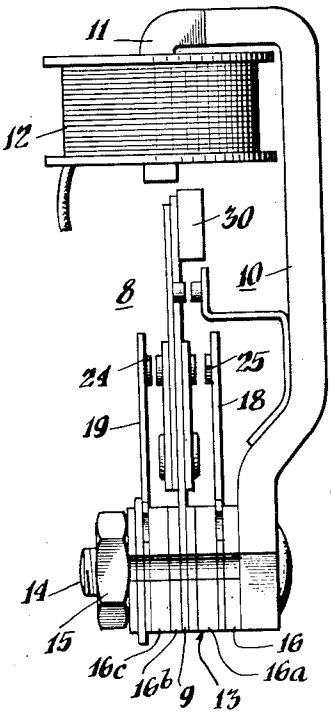


Fig. 3

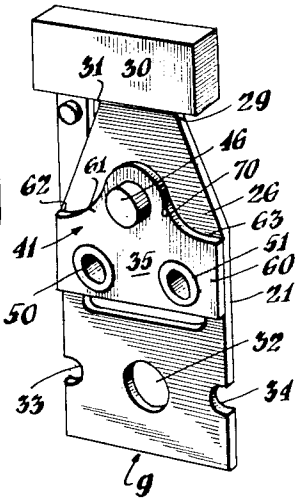


Fig. 4A

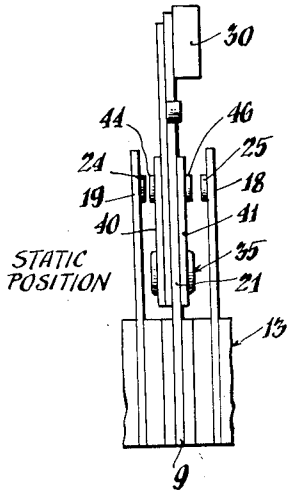


Fig. 4B

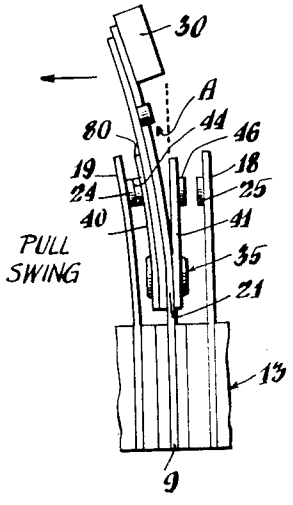
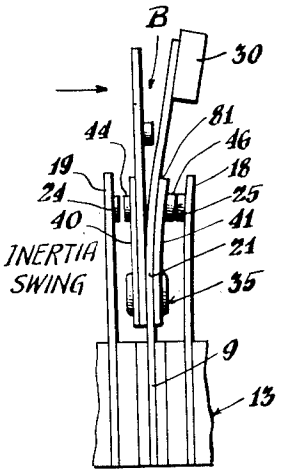


Fig. 4C



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REED DAMPED VIBRATOR ARM MECHANISM

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5 Claims. (Cl. 200—90)

This invention relates generally to electrical translating apparatus and has particular reference to such means and methods including translating apparatus for transferring energy between direct and alternating current circuits.

Interrupter devices, more generally known as vibrators, have been extensively used for converting direct current energy into alternating current energy or into direct current energy of a different voltage. In the usual form of these vibrators a reed contact bearing arm usually makes contact with a substantially fixed side contact member at a frequency depending upon the operation of the reed member.

Normally because of the natural resilience of one of these members an oscillatory condition known as vibrator "chatter" occurs which acts to decrease the efficiency of the vibrator. Further, because of the unrestrained impact, the abutting contact members become eroded quickly so that after a relatively short time these contacts must be replaced. It is apparent that as the frequency of the vibrator increases these conditions become more pronounced and create a definite operating problem.

Moreover, as data on the continual use of vibrators has been collated it has been found that numerous difficulties arise therein when a compliant reed structure is used. One of these difficulties resides in the fact that there is a natural tendency for harmonic motion to exist between the point of reed attachment and the reed weight. This tendency causes undesired reed arm motions being transferred to the reed arm contacts which results in contact pressure variations and tuning difficulties unless these motions are accurately tuned so as to be accurately controlled.

Another method to eliminate these effects has been by making the reed essentially non-compliant and putting substantially all of the system's compliance in the reed arms or in the side springs of the vibrator or to distribute it between the reed arms and the side springs. It is also possible to eliminate these effects by using a damping means on the reed arms so as to eliminate oscillations of the reed arms, as described in U. S. Patent 2,606,259, issued to Clarence Huetten and assigned to applicant's assignee.

In the present vibrator invention, however, this problem has been faced and the difficulties resulting therefrom have been substantially overcome with simplified means being provided so as to eliminate several parts from the reed assembly. Thus, in the present invention the reed, itself, is effectively used as a damping means without the necessity of having a damper spring used either on the outside of the reed arms or between the reed arm and the reed. In the latter cases a member near the reed is formed to space the reed arm contact out away from the reed and so to develop a bias between the reed arms and the damper spring.

In the subject invention, moreover, in contradistinction to the structure heretofore, the reed arms are stamped

out in an essentially flat manner and lie flat against the reed, itself. Moreover, the reed arms are constructed to be more compliant than the reed. It is apparent, therefore, that several parts necessitated by the former construction and used in the prior reed assembly are eliminated. In the present invention, to provide good reed amplitude the reed arms of the invention which are more compliant than the reed are made of substantially thin material and have relatively compliant fixed side springs used therewith. It has been found after considerable experimentation that this construction has given excellent efficiency and has shown good results. Thus, the improved reed construction of the present invention has provided a vibrator operating with a minimum of parts and which is adapted to overcome the disadvantage set up by harmonic motion established usually between a point of reed arm attachment and the reed weight or armature. It is therefore an object of the present invention to provide a vibrator using a novel reed construction which is adapted to prevent undesired reed arm harmonic motion from being transferred to the reed arm contacts, thus to avoid variations in contact pressure and inaccurate tuning difficulties.

Still another object of the present invention is to provide a novel interrupter mechanism having means associated with the reed for eliminating unwanted harmonic motions between a point of reed arm attachment and the reed armature and to provide maximum efficiency therefor.

Still another object of the present invention is to provide an interrupter mechanism having a novel reed construction obviating the necessity for side arm damper means and whereby the tendency for harmonic motions existing in said reed arm is eliminated with consequent improvement in the operation of the interrupter.

Still another object of the present invention is to provide a novel interrupter mechanism having damped arm characteristics but wherein said characteristics are obtained in the construction of the reed thereof without the necessity of utilizing auxiliary means and components, thus providing a relatively inexpensive construction for the vibrator as adapted to operate at a maximum efficiency in a manner similar to such damped arm interrupter.

The invention in another of its aspects relates to novel features of the instrumentalities described herein for teaching the principal object of the invention and to the novel principles employed in the instrumentalities whether or not these features and principles may be used in the said object and/or in the said field.

Other objects of the invention and the nature thereof become apparent from the following description considered in connection with the accompanying figures of the drawing wherein like reference characters describe elements of similar function therein and wherein the scope of the invention is determined rather from the dependent claims.

Referring now to the figures of the drawing:

Figure 1 is a front elevational view of the embodiment of the invention showing the constructional arrangement of the separate parts thereof;

Figure 2 is a side elevational view of the vibrator invention shown in Figure 1 as adapted to show the novel arrangement of the components which provide means for avoiding harmful harmonic frequencies in the reed construction therein;

Figure 3 is a profile view of the reed assembly used in the present invention and as adapted to illustrate the positional arrangement of the arms of the reed as lying flat against the reed; and

Figures 4A, 4B and 4C are positional illustrations of the reed arm assembly as opposed to the associated fixed

contacts as adapted to exemplify the operational relationships therebetween and to define the method of obtaining dampening of the reed arms therein.

Generally speaking, the present invention describes novel vibrator means for obviating "chatter" or "fluttering contact" make as developed in the relationship between the vibrator reed arm contacts and their associated fixed contacts and which is due to the harmonic frequencies usually set up within the reed, itself. Instead of using auxiliary vibrator equipment, for example damping springs or stops, or using a construction of angulating the reed arm while using a damping spring or stop to give the necessary contact bias, the present invention places and assembles the reed arm to the reed in a manner such that the reed, itself damps out the oscillations of the more compliant reed arms.

In the vibrator as now constructed, the reed arms are unformed and lie flat against the reed for a substantial distance therealong. Thus, as the reed swings away from the particular arm the said arm will not completely follow the reed. It therefore follows that at the extreme deflection of the reed, this arm may be lifted away from the reed to an extent that it will be free to oscillate. However, on the return swing of the reed, contact will be made between the outer end of the arm and the reed with the result that the oscillations are damped out before make of the contacts on the reed arm with their fixed side contacts.

In the present novel construction, moreover, there are several advantages that accrue from the mechanism here developed. For example, since there are no forms in the reed arms and no angulations in either the reed arms or side springs, there are fewer tolerances which will have an effect on the contact spacing prior to adjustment. Thus, the unit requires a minimum of adjustment. In addition, the unit shows a rising frequency characteristic with an increase in input voltage which helps to prevent the saturation of the transformer at high input voltage and helps to maintain the balance of the vibrator during dwell times.

Referring now to the figures of the drawing, there is shown in an embodiment of the present invention a vibrator generally designated by reference numeral **8**. Vibrator **8** has a hook shaped ferro-magnetic frame denoted by reference character **10** and has a dependent narrowed hook portion **11** around which there is provided a centrally circumscribing wire wound driver coil **12** adapted to be current excited from a suitable supply source. The end of the hook portion is constructed as a magnetic pole piece, with the pole piece and dependent hook portion having equal end widths less than the width of the frame from which the latter depends.

A stack generally denoted by reference character **13** is secured to the lower extremity of ferro-magnetic frame **10** as by means of a single stack screw **14** and nut **15** at a substantial distance away from said dependent hook portion. The stack comprises a plurality of spacers **16**, **16***a*, **16***b*, **16***c* which may be fabricated of an electrically insulative material. Between spacers **16** and **16***a* and **16***b* and **16***c* there are included side contact arms **18** and **19** substantially fixedly maintained therebetween as by means of the tight locking afforded by means of stack screw **14** and nut **15**. Clamped between spacers **16***a* and **16***b*, at its lower extremity, is a main reed **9** and an armature **30** connected to a flat elliptical shaped top end of the reed **88** as by weld means **89** but which may be integrally formed and connected thereto at its upper end. All of the spacers of the stack are provided with an alignment hole through which the stack screw may extend. Side contacts **18** and **19** carry relatively fixed contacts **24** and **25** respectively at the ends thereof and cooperate with the vibrator contacts **44** and **46** of the reed arms **40** and **41**, as will appear presently.

The structure of the vibratory system will be generally understood from Figures 1 and 2. It will be noted that the system is built around reed **9** having a main body section **21**, a neck portion **26** integrally formed therewith and shoulders **29** and **31** connecting the latter with armature **30**. Reed **9** is maintained within stack **13** and is less compliant than its associated reed arms.

As noted and as shown in Figure 3, reed **9** has an alignment aperture **32** penetrating its thickness, and also contains cut-out U-shaped apertures **33** and **34**.

On reed **9**, at a determined distance above stack **18**, near the junction of neck **26** and main body section **21**, a second stack **35** is provided. Stack **35** clamps vibrator reed arms **40** and **41** to the main body section **21** of reed **9** as by means of rivets such as **50** and **51**. Each of the vibrator reed arms lies flat against the reed of the vibrator and is punched out flat, having a compliant characteristic greater than that of the reed and being fabricated of a thin material.

Further, side springs **18** and **19** having contacts **25** and **24** are also constructed of a material having a relatively compliant characteristic. Thus, the cooperative operation between the reed arms and the side springs, as described below, will provide the damped arm vibrator characteristic in which the reed itself becomes the damping means, without the use of damper springs or other such structure.

Each of the reed arms **40** and **41** having contacts **44** and **46** has a rectangular main section **60** and a tapered head section **61** integrally joined thereto by means of shoulders **62** and **63**. The lower face of each reed arm, in the static position, snugly lies against a surface of the main reed section **21** of reed **9**, while the upper surface **70** of the reed arm **41** has a contact such as **46** welded thereto and which on the operation of the vibrator reed is cooperatively adapted to mate with its corresponding fixed arm contact such as **25**.

The operation of the vibrator is illustrated in Figs. 4A, 4B and 4C. As disclosed, in Fig. 4A, in the static position the reed arms are unformed and lie flat against the reed for a substantial distance therealong dependent upon the compliance characteristics of the reed arms as opposed to essentially non-compliant characteristics of the reed. Upon operation of the vibrator by excitation of the driver coil and as shown in Figs. 4B and 4C, the reed is seen to swing away from arm **41** so that the said arm will not completely follow the reed. It therefore follows that at the extreme deflection of the reed, the arms may be lifted away from the reed by an angle A, or B having such a magnitude that the arm will be free to oscillate. However, on the individual return swings of the reed, contact will be made between the outer end **80** of the arm **40**, or end **81** of arm **41**, and the reed, with the result that the oscillations are damped out before make of the contacts on the reed arm with their associated fixed side contacts. In this manner a damped arm vibrator mechanism is obtained which uses the reed as a damping means and eliminates the need for auxiliary dampening or stop structure heretofore used to obtain the above results.

The novel damped arm vibrator mechanism using the reed as a damping means as described above is intended to be merely illustrative and not exhaustive and the invention is not intended to be restricted thereby but rather the scope is to be determined by the nature of the claims here appended.

What is claimed is:

1. A vibrator comprising in combination, a vibratory reed swingable toward contact engaging positions and having a free end, means for supporting the other end of said reed, a driver coil, a frame for holding said coil having one end connected to and supported by said reed supporting means, said frame further being bent to have a hook-like configuration including a dependent portion, said dependent portion penetrating said coil substantially at the center thereof, said portion having its end constructed as a magnetic pole piece, said support means for said reed and said frame being positioned substantial-

ly below said pole piece, a pair of fixed side arms held in said support means, an armature connected to said reed and cooperating with said pole piece to activate said reed upon excitation of said coil, and vibrator reed arms more compliant than said reed and separate from said vibratory reed included by second support means held flat against said reed for a substantial extent therealong on said second support means in the rest condition and adapted to move therewith, each of said flat lying reed arms acting with said reed and lying thereagainst for at least the greatest swing of said reed toward a contact engaging position.

2. A vibrator having damped arm characteristics comprising in combination a vibratory reed swingable toward contact engaging positions and having a free end, stack means for supporting the other end of said reed, a driver coil, a frame for holding said coil having one end connected to and supported by said reed supporting means, said frame further being bent to have a hook-like configuration including a dependent portion, said dependent portion penetrating said coil substantially at the center thereof, said portion having its end constructed as a magnetic pole piece, said support means for said reed and said frame being positioned substantially below said pole piece, and armature connected to the free end of said reed and cooperating with said pole piece to activate said reed upon excitation of said coil, unformed vibrator reed arms placed on opposite sides of said vibratory reed included by second support means held on said reed and adapted to move therewith, each of said arms being more compliant in characteristic than said reed and lying flat thereagainst for a considerable extent in the static condition of said vibrator, each of said flat lying arms acting with said reed and lying thereagainst for at least the greatest swing of said reed toward a contact engaging position.

3. A vibrator comprising in combination, a vibratory reed swingable toward contact engaging positions and having a free end, means for supporting the other end of said vibratory reed, a driver coil, a frame for holding said coil having one end connected to and supported by said reed supporting means, said frame further being bent to have a hook-like configuration including a dependent portion, said dependent portion penetrating said coil substantially at the center thereof, said portion having its end constructed as a magnetic pole piece, said support means for said reed and said frame being positioned substantially below said pole piece, an armature connected to the free end of said reed and cooperating with said pole piece to activate said reed upon excitation of said coil, vibrator reed arms separate from said vibratory reed included by second support means held on said reed and adapted to move therewith, said reed arms lying flat against said reed for a considerable extent therealong at rest, each of said arms lagging in swing behind said reed on one portion of the vibratory reed cycle while at another portion of the cycle going toward a contact engaging position, each arm lies flat against said reed and acting thereagainst for at least the greatest swing thereof.

4. A vibrator comprising in combination, a vibratory reed swingable toward contact engaging positions and having a free end, means for supporting the other end of said vibratory reed, a driver coil, a frame for holding said coil having one end connected to and supported by said reed supporting means, said frame further being bent to have a hook-like configuration including a dependent portion, said dependent portion penetrating said coil substantially at the center thereof, said portion having its end constructed as a magnetic pole piece, said support means for said reed and said frame being positioned substantially below said pole piece, an armature connected to the free end of said reed and cooperating with said pole piece to activate said reed upon excitation of said coil, vibrator reed arms being more compliant than said reed and separate from said vibratory reed included by second support means held on said reed and adapted to move therewith, said reed arms being unformed and lying flat against said reed for a considerable extent therealong at rest, each of said arms lagging in swing behind said reed on one portion of the vibratory reed cycle so that at the extreme deflection thereof away from a contact engaging position the reed arm is lifted away from the reed so that it will be free to oscillate and at the other portion of the cycle going toward a contact engaging position each arm lies flat against said reed and acts therewith for at least the greatest swing thereof.

5. A vibrator comprising in combination, a vibratory reed swingable toward contact engaging positions and having a free end, means for supporting the other end of said vibratory reed, a driver coil, a frame for holding said coil having one end connected to and supported by said reed supporting means, said frame further being bent to have a hooklike configuration including a dependent portion, said dependent portion penetrating said coil substantially at the center thereof, said portion having its end constructed as a magnetic pole piece, said support means for said reed and said frame being positioned substantially below said pole piece, fixed side arms also included thereby, an armature integral with the free end of said reed and cooperating with said pole piece to activate said reed upon excitation of said coil, vibrator reed arms separate from said vibratory reed included by second support means held on said reed and adapted to move therewith, said reed arms being unformed and lying flat against said reed for a considerable extent therealong, said arms being more compliant than said reed and lagging in swing behind said reed on one portion of the vibratory reed cycle going away from a contact engaging position so that the extreme deflection thereof the reed arm is lifted away from the reed by a determined angle dependent on the relation of the compliance characteristics of said arm and said reed so that it will be free to oscillate while at the other portion of the cycle going toward a contact engaging position each arm lies flat against said reed and acts therewith for at least the greatest swing thereof.

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