

Sept. 7, 1943.

K. S. DUNLAP

2,329,111

ALTERNATING CURRENT GENERATOR

Filed May 14, 1941

3 Sheets-Sheet 1

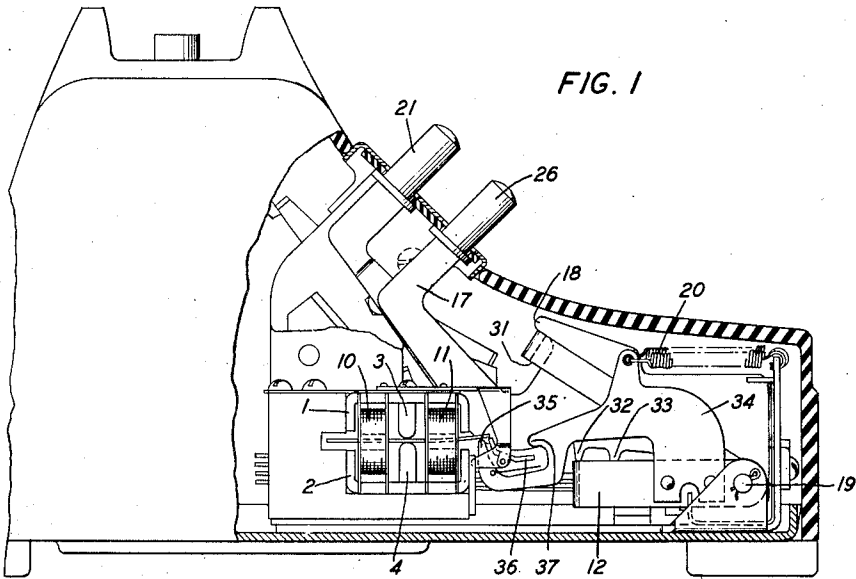
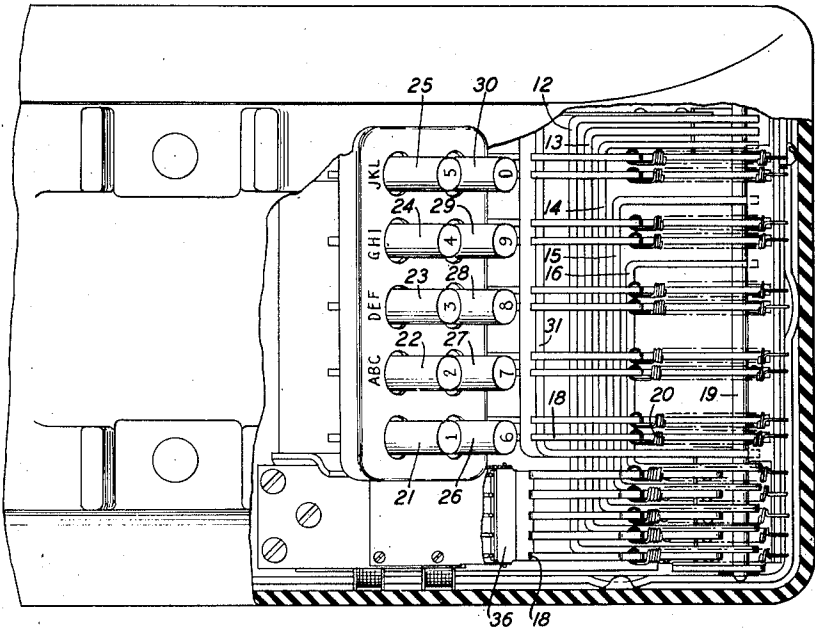


FIG. 2



INVENTOR
K. S. DUNLAP
BY *[Signature]*
ATTORNEY

Sept. 7, 1943.

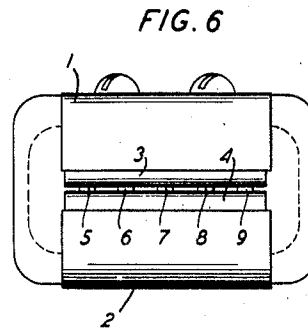
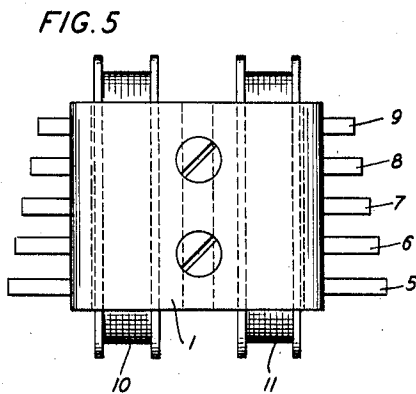
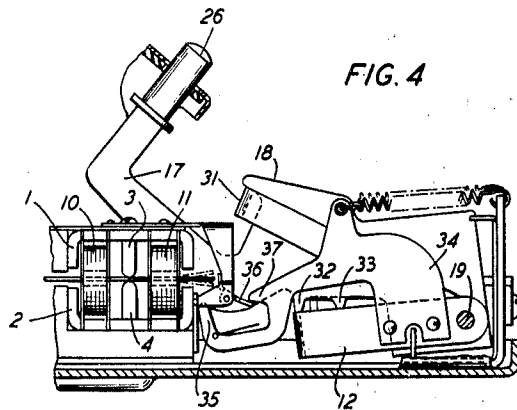
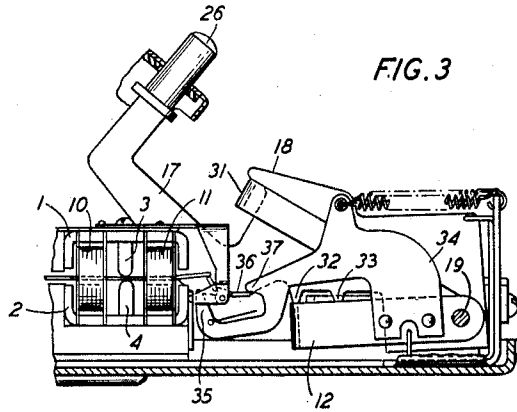
K. S. DUNLAP

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ALTERNATING CURRENT GENERATOR

Filed May 14, 1941

3 Sheets-Sheet 2



INVENTOR
K.S. DUNLAP

BY *John A. Hall*
ATTORNEY

Sept. 7, 1943.

K. S. DUNLAP

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ALTERNATING CURRENT GENERATOR

Filed May 14, 1941

3 Sheets-Sheet 3

FIG. 7

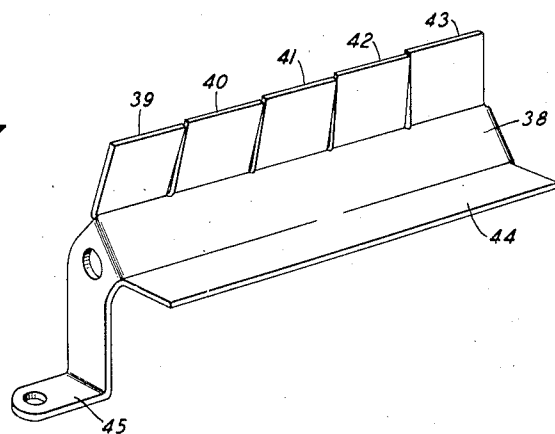


FIG. 8

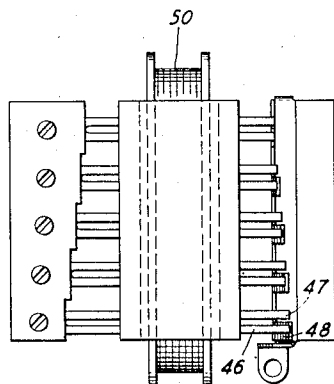
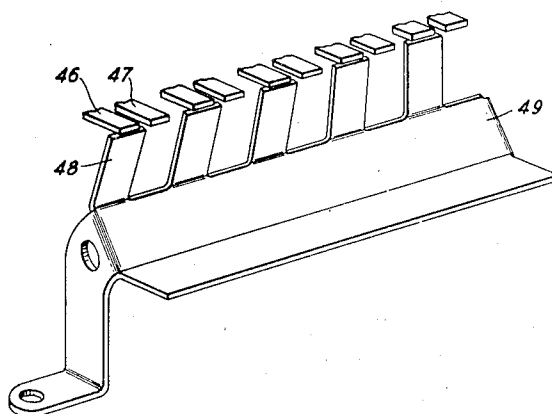


FIG. 9



INVENTOR
K. S. DUNLAP
BY *Samuel Hall*
ATTORNEY

UNITED STATES PATENT OFFICE

2,329,111

ALTERNATING CURRENT GENERATOR

Kermit S. Dunlap, Richmond Hill, N. Y., assignor
to Bell Telephone Laboratories, Incorporated,
New York, N. Y., a corporation of New York

Application May 14, 1941, Serial No. 393,399

4 Claims. (Cl. 179-90)

This invention relates to signaling means and particularly to alternating current generators of the type used in telephones for generating alternating current dialing signals representing telephone station designations.

The object of the invention is to provide a device which will generate a signal of substantially constant amplitude over a period sufficiently long for the purpose intended. The invention belongs in the class of reed generators in which a reed designed to have a particular natural period of vibration corresponding to the frequency of the alternating current needed for signal purposes is included in a magnetic circuit interlinked with a pick-up coil whereby when the reed is set into vibration by being plucked will, through such vibration, alter the conditions in such magnetic circuit and cause an alternating current to be induced in said pick-up coil. In such generators it is usual to employ a plurality of such reeds each of a different dimension whereby a plurality of alternating currents of different frequencies may be generated and which may be transmitted either singly or in combination and in permutation codes representing different telephone designations. In general, when such reeds are plucked the energy stored therein is dissipated at a high rate at first, followed by a gradual diminution so that the signal produced is at first strong but rapidly loses its strength. The object of the present invention is to produce a new technical effect whereby the reed upon being plucked will generate a voltage of a substantially constant volume over a period long enough to become an effective signal.

According to the present invention, a reed clamped in the middle and having two free ends is employed. Clamping is rigid but takes place on a narrow line such as knife-edge or cylindrical surfaces and allows energy to be fed from one end to the other. Each end threads a coil, and these two coils may be variously interconnected so that the voltages generated in the coils are additive. When one end of the reed element is plucked, its vibration starts suddenly and generates a voltage in the coil threaded by it. At the same time energy is fed through the clamp to the other reed which slowly builds up in amplitude and generates a corresponding slowly rising voltage in the coil threaded by it. The transfer of energy continues until practically all the energy remaining in the system has been transferred to the other end of the reed, at which time the process reverses.

By variously interconnecting the two coils it is

possible to produce a signal in the form of a damped sinusoidal voltage which starts suddenly, a signal with a gradual build-up and a gradual delay, a signal with a sudden start and very nearly constant amplitude with time for a given period of time followed by rapid decay or a signal whose amplitude rises and falls periodically.

A feature of the invention is a reed generator comprising a double-ended reed clamped in the middle with both ends free to vibrate and with each end threading a separate pick-up coil.

Another feature of the invention is a reed generator comprising a multiple magnetic circuit having a reed threading a pick-up coil in each part thereof with provision for communication of energy from one reed to another.

Still another feature of the invention is a reed generator comprising a pair of reeds both having the same natural period of vibration and so disposed that energy stored in one will be transferred to the other with means for translating the combined vibrations of the two reeds into a single signal in the form of an alternating current voltage of the same frequency as the natural period of vibration of said reeds.

Other features will appear in the following description.

The drawings consist of three sheets having nine figures as follows:

Fig. 1 is a left side elevation partly in section showing the key mechanism and the manner in which the generator of the present invention is operated;

Fig. 2 is a top view partly in section of the same and showing in more detail the operative combinations of code bars and key members;

Fig. 3 is a fragmentary view showing one of the keys partly operated;

Fig. 4 is a view similar to Fig. 3 showing one of the keys and a pawl member in the operated position, a reed being portrayed as freely vibrating;

Fig. 5 is a plan of one form of the invention in which the reeds are damped at their middle points;

Fig. 6 is a front view of the device shown in Fig. 5;

Fig. 7 is a perspective of the common pawl member for setting the reeds of Fig. 5 in vibration;

Fig. 8 is a plan of an alternative form of the invention in which each reed consists of a pair of like reeds somewhat in the nature of the prongs of a tuning fork; and

Fig. 9 is a perspective of the common pawl

member for setting the reeds of Fig. 8 into vibration.

The alternating current generator of the present invention consists essentially of a magnetic circuit including in one form two permanent magnets 1 and 2 and a pair of clamping members 3 and 4 of magnetic material for securing a plurality of reeds 5, 6, 7, 8 and 9. A pair of coils 10 and 11 is interlinked with the magnetic circuit since they are wound about the reeds 5 to 9, the coil 10 being wound about one end of the reeds and the coil 11 being wound about the other end of the same reeds. When the reed 5, for instance, is plucked so that its right-hand end is mechanically set into vibration the result of its movement is translated into an alternating current in the coil 11. As this reed vibrates energy is transmitted past the clamping point and the left-hand end begins to vibrate. As the two ends are alike in dimensions the left-hand end will vibrate at the natural period of vibration of both ends which are the same and the result of its movement is translated into an alternating current in the coil 10. In accordance with well-known principles, as the vibration in the right-hand end of the reed dies down, that in the left-hand end builds up and so if the two coils are interconnected, the algebraic sum of the two separately generated currents which may be delivered to an output circuit will be a current which suddenly starts at a high value and remains at an approximately even value over an appreciable period although the value of the separately generated currents may vary periodically.

The manner in which the reeds of this generator are plucked may be seen from Figs. 1 to 4. Here the generator of the present invention is shown as it would be incorporated in a telephone handset cradle. A group of ten-digit push buttons 21 to 33 is provided for the use of the subscriber for calling purposes. Each button operates a lever such as 17 on which the button 26 is mounted. These levers are all pivoted on the shaft 19 and each has an arm such as 18 for rotating a commonly actuated U-shaped bar 31. Each lever is held in its normal position by an individual spring such as 20 as well as by the pressure of the common bar 31 which has a similar spring.

There are five U-shaped bars 12 to 16, inclusive, also pivoted on the shaft 19. The lever 17 is provided with two lugs 32 and 33 which bear on the bars 12 and 14, respectively, so that when the key 25 is depressed the two bars 12 and 14 will be moved. Each lever has two such lugs but each will operate a different combination of the bars 12 to 16 so that these bars are operated in a permutation code by the push buttons 21 to 30.

To each of the code bars there is secured a lever such as the lever 34 shown as riveted to the bar 12. The lever 34 terminates in a finger 35 which normally rests against the reed 5 and stresses it upwardly as shown in Fig. 1. When the lever 34 is rotated in a counter-clockwise direction the finger 35 moves downwardly and allows the reed to come in contact with the upper edge of the pawl member 36. As the lever 34 continues its movement another finger 37 engages the pawl member 36 as shown in Fig. 3 and rotates it in a clockwise direction as shown. Thus the reed is set in vibration.

When the button 26 is released the pawl member 36 rotates in a counter-clockwise direction under spring control and after the finger 35 has lifted the reed to nearly its extreme position the

pawl member 36 slips in under the end of the reed.

In Fig. 7 a pawl member 38 is shown which may be used with the unequal length reeds 5 to 9, inclusive, the fingers 39 to 43, inclusive, being constructed and arranged to cooperate with the reeds 5 to 9, inclusive, respectively. The lip 44 cooperates with the fingers such as the finger 37 of the lever 34. A tab 45 is provided for the attachment of a spring to oppose the movement imparted to the pawl member 38 by the fingers such as 37.

In Fig. 8 a variation of the invention is shown. Here each reed consists of a twin pair only one of which is plucked. Thus, the first reed consists of two like reeds 46 and 47. The portion 46 cooperates with the finger 48 of the pawl member 49. When the reed 46 is plucked, energy is mechanically transmitted into the reed 47 and the algebraic sum of the effects of the two reeds is manifested in the single coil 50 through which all the reeds are threaded.

It might be pointed out that the arrangement of Figs. 8 and 9 may be modified by having all reeds terminate in a line parallel to the axis about which the pawl member 49 rotates so that the various fingers such as 48 may be in the same plane.

It is intended that this specification will cover other modifications of this device which come within the spirit of this invention and the scope of the following claims.

What is claimed is:

1. An alternating current generator comprising interlinked electrical and magnetic circuits, mechanically movable magnetic elements in said magnetic circuit comprising a plurality of pairs of reeds, each pair having a secured and a free end so disposed that energy may be transferred from one to the other of said pairs of reeds through their respective secured ends, said electrical circuit being arranged to respond to the combined movement of said reeds when one is set in vibration, and mechanical means for plucking the free end of one of said reeds of said pair.

2. An alternating current generator comprising interlinked electrical and magnetic circuits, mechanically movable magnetic elements in said magnetic circuits each comprising a reed secured at its mid-point and having a free end extending into a different branch of said magnetic circuit, means for securing said reed at its said mid-point in such manner that energy may be transferred from one portion of said reed to another portion beyond said mid-point, said electrical circuit being arranged to respond to the combined movement of said portions of said reed when one portion thereof is set in motion by external means, whereby the time of generation of a constant voltage is increased by said energy transfer.

3. An alternating current generator comprising interlinked electrical and magnetic circuits, mechanically movable magnetic elements in said magnetic circuits each comprising a reed secured at its mid-point and having a free end extending into a different branch of said magnetic circuit, means for securing said reed at its said mid-point in such manner that energy may be successively transferred from a portion of said reed to another portion of said reed beyond said mid-point, and said electrical circuit comprising a coil wound about each end of said reed whereby said coils are each interlinked with a different branch of said magnetic circuit, said coils being

connected to produce a resultant voltage proportional to the algebraic sum of the movement of both ends of said reed.

4. An alternating current generator comprising interlinked electrical and magnetic circuits, said magnetic circuits comprising a pair of permanent magnets magnetically joined at their mid-points to form a pair of simple magnetic circuits each having an air-gap between the free ends of said magnets, mechanically movable
10 magnetic elements in said magnetic circuits each

comprising a reed clamped at the mid-points of said magnets and having two free ends each protruding through one of said air-gaps, pick-up coils wound about said reeds and mechanical
5 means for selectively plucking one free end of each of said reeds, whereby the vibration of said plucked end is transmitted through said clamp to set up a similar vibration on the other end thereof.

KERMIT S. DUNLAP.