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R. F. MALLINA

2,323,719

ALTERNATING CURRENT GENERATOR

Filed May 21, 1941

FIG. 1

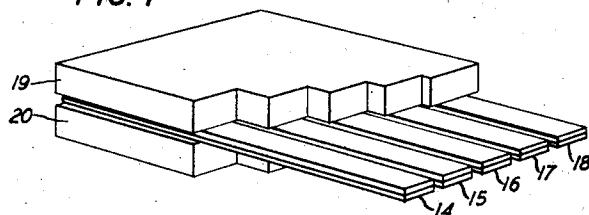


FIG. 2

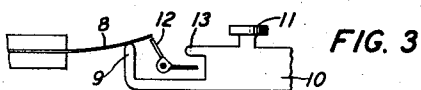
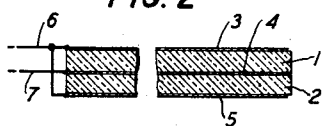


FIG. 4

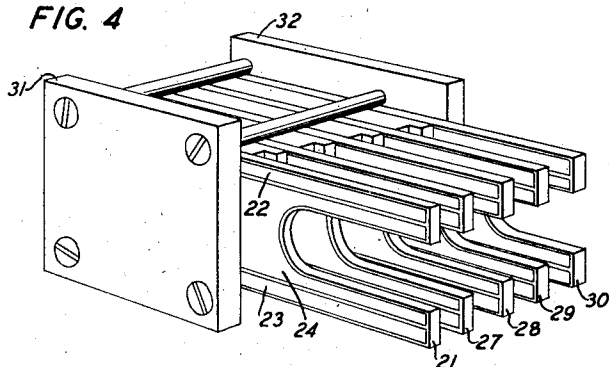
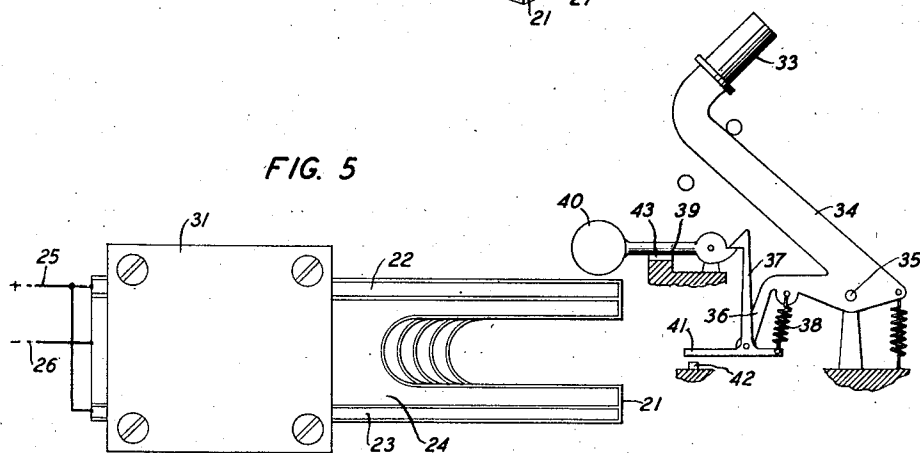


FIG. 5



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2,323,719

ALTERNATING CURRENT GENERATOR

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Application May 21, 1941, Serial No. 394,465

1 Claim. (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 simple and efficient alternating current generator of small dimensions which will respond to push button manipulation. The device belongs in that class of generators used in communication systems for signaling by voice frequency alternating currents. Generally speaking, these generators comprise interlinked magnetic and electric circuits operated by a plucked reed designed to have a particular natural period of vibration corresponding to the frequency of the alternating current needed for signal purposes. When the reed is plucked it will vibrate at a sufficient amplitude over a period sufficient to produce an effective signal. 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.

It is the object of the present invention to employ piezoelectric means rather than electromagnetic means to translate the mechanical movement resulting from the operation of the signal devices into alternating current signals. Accordingly an electrical circuit including a piezoelectric crystal is provided for the electric circuit of the alternating current generator. In the present device the crystal is proportioned to have the natural period of vibration corresponding to the frequency desired and the signaling device which may consist of a plurality of keys or push buttons operated to set the crystal into mechanical vibration.

In one form of the invention the crystal may constitute a reed and the push buttons may act to pluck this reed. In another form the crystal may be in the form of a tuning fork and the push buttons may operate a hammer to strike such fork.

A feature of the invention is an alternating current generator operating through the mechanical vibration of a piezoelectric crystal in which the crystal performs the dual role of electrical circuit modulator and mechanical vibrator.

Another feature is an alternating current generator in which a piezoelectric crystal cut in the form of a reed and proportioned to vibrate at a

given natural period of vibration acts as a circuit modulator when mechanically plucked.

Still another feature is an alternating current generator in which a piezoelectric crystal cut in the form of a tuning fork and proportioned to vibrate at a given natural period of vibration acts as a circuit modulator when mechanically set into vibration.

Other features will appear in the following description.

The drawing consists of a single sheet having five figures, as follows:

Fig. 1 is a perspective view of five crystal reeds mounted in the conventional manner employed in reed generators;

Fig. 2 is a cross-sectional view of a reed showing how connections to the crystals are made to take advantage of the piezoelectric effects of the crystal;

Fig. 3 is a schematic diagram of a reed plucking mechanism;

Fig. 4 is a perspective view of five crystals of tuning fork form mounted in the conventional manner employed in reed generators; and

Fig. 5 is a side view of the device of Fig. 4 used to illustrate the electrical connections to the crystals employed to take advantage of the piezoelectric effects of the crystal, and also showing in schematic form a striking mechanism for setting the crystal tuning forks into vibration.

Alternating current generators of this type are intended for use primarily in telephone substation sets for sending switch setting impulses. Such generators usually consist of five reeds each tuned to a different natural period of vibration and the reeds are plucked in different combinations so that through a permutation code definite signals each representing a different digit of a telephone number may be transmitted from the substation to the central office at the distant end of the telephone line to set up connections to other wanted lines. The general appearance and operation of these generators may be found in Patent No. 2,147,710, granted February 21, 1939, to R. F. Mallina.

The generator of the present invention utilizes the piezoelectric effect of certain crystals. When two such crystals as 1 and 2 are secured at one end, such as the left end in Fig. 2, and are faced with conducting material such as the sheets 3, 4 and 5 and connected to the conductors 6 and 7 in the manner shown in Fig. 2, then a potential applied across the terminals 6 and 7 will cause a mechanical movement of the free end of the

crystal structure. If the potential applied is alternating then the free end of the crystal structure will vibrate accordingly. Conversely if the free end is set in vibration an alternating potential will be set up at the terminals 6 and 7. If the crystal structure is plucked and allowed to vibrate freely then the alternating potential set up at the terminals 6 and 7 will have the same frequency as the natural period of vibration of the crystal structure.

In Fig. 3 a reed plucking mechanism is shown in schematic form. The reed 8 is normally stressed upwardly by the finger 9 of the key bar 10 by a spring, not shown. When the button 11 is depressed the finger 9 frees the reed 8, but this reed is temporarily held by the pawl member 12. When the key bar 10 is further depressed the finger 13 engages the pawl member 12 and rotates it in a clockwise direction until it snaps away from the reed 8 which thereupon begins to vibrate freely. A structure fundamentally of this nature may be used to pluck the crystal reeds of the present invention.

In Fig. 1 a unit of five reeds 14, 15, 16, 17 and 18 is shown, each of a different length and each having a different natural period of vibration. These reeds are secured by the anchor plates 19 and 20 which together may form one output terminal for the generator. The other terminal may be a multiple connection to the center conducting sheets of the five reeds such as the terminal 7 connected to the center conducting sheet 4 as shown in Fig. 2.

In Figs. 4 and 5 an alternative arrangement is shown. Here each reed is shaped like a tuning fork. The crystal fork 21 is coated with three areas of conducting material 22, 23 and 24 of any well-known and appropriate nature, such for instance as that known as aquadag. These conducting areas when connected to the terminals 25 and 26 as indicated in Fig. 5 will act as terminals of the generator in the same manner as the terminals 6 and 7 of Fig. 2. The five forks 21, 27, 28, 29 and 30 are each of a different length and when set in vibration will each vibrate

in accordance with a different natural period. The five forks may be secured at their bases by anchor plates 31 and 32 which may form a convenient means for mounting in a structure generally such as that shown in the above-noted Mallina patent.

In Fig. 5 there is also shown in schematic form a means for setting a fork into vibration. A key or push button 33 on an arm 34 is pivoted at 35 to a frame member. A finger 36 of the arm 34 has a latch member 37 pivoted to its extremity and stressed normally in a counter-clockwise direction by a spring 38. The end of the latch 37 engages one end of a lever 39 to the other end of which a suitable weight or hammer member 40 is secured. When the push button 33 is depressed the weight 40 will be lifted. As the movement continues an arm 41 of the latch member 37 will engage a stop 42 whereupon the latch 37 will be rotated in a clockwise direction so that the engagement between the latch 37 and the lever 39 is broken. Thereupon the weight 40 will return by gravity to the position shown. By providing a resilient cushion the overthrow of the weight 40 will result in a striking of the fork 21 by the weight 40 whereupon the crystal 21 will be set into vibration.

It will be realized that there will be a striker for each crystal and that these strikers may be operated by means common to the push buttons as in the above-noted Mallina patent.

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 claim.

What is claimed is:

An alternating current generator comprising an electrical circuit, a piezoelectric crystal for modulating said circuit, said piezoelectric crystal being constructed in the form of a vibrator clamped at its middle, said crystal being further proportioned and arranged to have a given natural period of vibration, and mechanical means for striking said crystal into free vibration.

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