

Dec. 19, 1933.

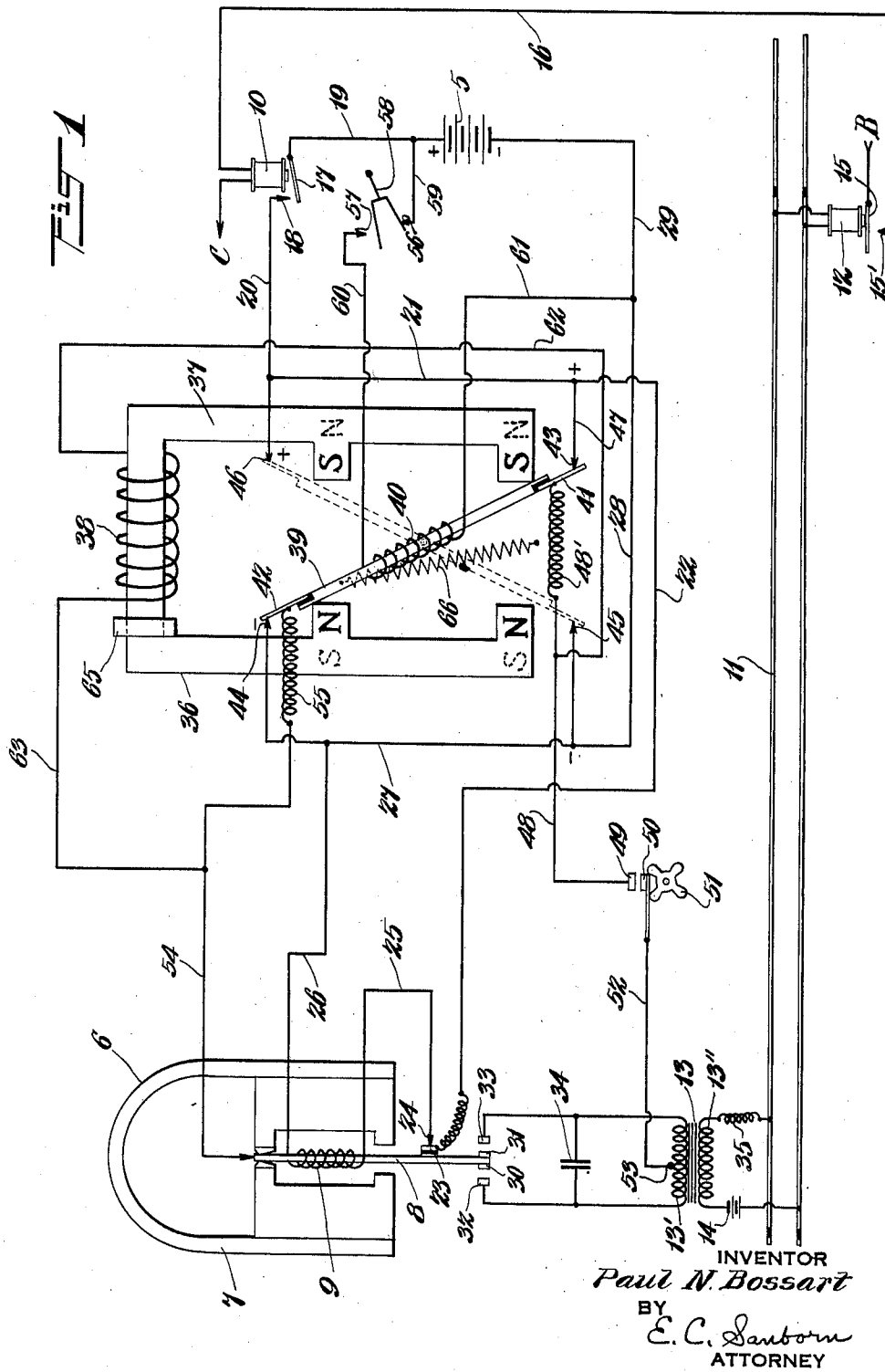
P. N. BOSSART

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APPARATUS FOR THE CONTROL OF VIBRATING GENERATORS

Filed Nov. 1, 1930

2 Sheets-Sheet 1



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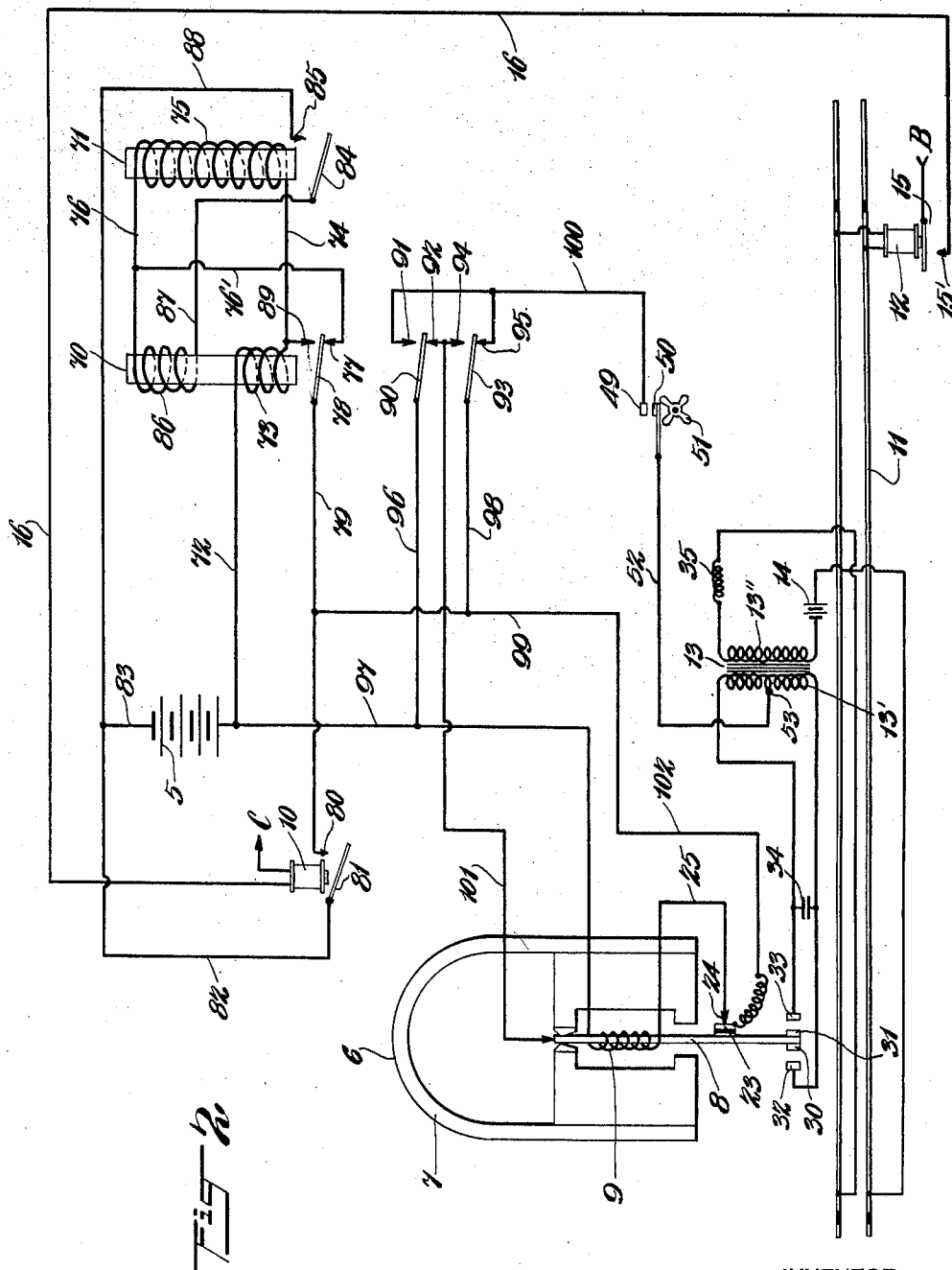
P. N. BOSSART

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2 Sheets-Sheet 2



INVENTOR
Paul N. Bossart
BY
E. C. Sanborn
ATTORNEY

UNITED STATES PATENT OFFICE

1,940,386

APPARATUS FOR THE CONTROL OF
VIBRATING GENERATORS

Paul N. Bossart, Swissvale, Pa., assignor to The
Union Switch & Signal Company, Swissvale,
Pa., a corporation of Pennsylvania

Application November 1, 1930. Serial No. 492,685

7 Claims. (Cl. 175—365)

This invention relates to apparatus for the control of vibrating alternating current generators operated by direct current. An object of the invention is to prevent objectionable pitting of the generator contacts, and thus to enable vibration generators to be used in connection with large power values without shortening of the life of the contacts. It has been found that where such generators are used with large powers (of the order of 100 VA, for example) the life of the contacts is comparatively short, since the contacts pit deeply on one polarity and build up on the other with resultant rapid destruction of contact clearances and thickness. My invention provides for the automatic reversal of the polarity of the generator contacts at certain times and thus avoids the difficulties above noted. A specific object of the invention is the provision of simple and effective means, governed by means for controlling the bringing into action of the generator, for reversing the polarity of the generator contacts. I have illustrated my invention in connection with a system of railway traffic control wherein current impulses are supplied by the vibrating generator to a section of railway track in response to the entry of a train into said section; but it will be apparent that the invention is not limited to this use and that instead the invention is useful wherever automatic reversal of the polarity of vibrating generator contacts is desired. I shall describe herein certain forms of apparatus embodying my invention and shall then point out the novel features thereof in claims.

In the accompanying drawings Figure 1 is a diagrammatic view illustrating one form of apparatus embodying my invention, and

Figure 2 is a diagrammatic view of another form of apparatus embodying my invention.

Referring to the drawings, the numeral 5 indicates a source of direct current such as a battery, for supplying energy to a vibrating generator 6. The latter is of a standard type, comprising a permanent magnet 7 providing a polarizing field for an armature 8 which carries a coil 9. The supplying of direct current for operating said generator is controlled by a relay 10, which in the example shown is an approach relay, brought into action by the entry of a train into a track section 11. Connected to the rails adjacent one end of said section is a track relay 12. A transformer 13, the primary 13' of which is supplied with current impulses by the vibrating generator 6, has its secondary 13'' connected to the rails of the track section at the end opposite that to which track relay 12 is connected, said secondary sup-

plying impulses of train control current to said section. A battery 14 may be inserted in the secondary leads of said transformer, as shown, to supply the normal track circuit current for energizing the track relay 12. Upon the entry of a train into the track section 11, the track relay 12 is deenergized, and its armature 15 thereupon engages back contact 15', thus establishing a circuit thru approach relay 10 as follows: from terminal B of a source of electromotive force, thru armature 15, back contact 15', wire 16 and relay 10 to terminal C of said source.

Energization of approach relay 10 results in engagement of armature 17 with front contact 18 and in operation of the vibrating generator by way of the following circuit: from the positive terminal of battery 5, through wire 19, armature 17, front contact 18, wires 20, 21, 22, insulated contact 23 carried by armature 8 of the vibrating generator, contact 24, wire 25, coil 9, wire 26, and wires 27, 28 and 29 to the negative terminal of battery 5. The armature 8 of the generator 6 carries a pair of contacts, 30, 31, and, upon the establishing of a circuit thru the coil 9 as aforesaid said armature vibrates at a given frequency to alternately engage contact 30 with fixed contact 32 and contact 31 with fixed contact 33. The generator 6 being of standard type and its action well-known, further description thereof is unnecessary for purposes of the present invention.

The fixed contacts 32 and 33 are connected to the primary winding 13' of transformer 13, whereby the vibrating armature 8, thru said contacts, may control the supplying of current impulses to said transformer, and thus to the track rails. A condenser 34 is shown connected in parallel with the primary winding 13', and a reactance 35 in series with secondary 13'', as is well understood in the art.

From the foregoing description, it will be seen that energization of approach relay 10 causes current to be supplied from battery 5, thru contacts 30, 32, and 31, 33, to transformer 13. In the form of invention shown in Fig. 1 I provide a reversing relay 36 between the battery 5 and generator 6, and controlled by the approach relay 10, for automatically reversing the direction of flow of current thru the generator contacts, or in other words reversing the polarity of said contacts, at given times. Said reversing relay comprises an electromagnet 37 having a winding 38 and an armature 39 having a winding 40. Contacts 41, 42 carried by and insulated from said armature 39 are engaged respectively by

fixed contacts 43 and 44 when said armature is in the full line position in Figure 1, and with contacts 45 and 46 when said armature is in the reverse or dotted line position. When armature 39 is in the full line position shown in Figure 1 and relay 10 is energized, current is supplied to transformer 13 as follows: from the positive terminal of battery 5, thru wire 19, armature 17, front contact 18, wires 20, 21, and 47, contacts 43' and 41, wires 48' and 48, fixed contact 49, movable contact 50 operated by coder 51, wire 52, tap 53, one portion or the other of primary 13' to contact 32 or 33, the corresponding contact 30 or 31, armature 8, wires 54 and 55, contacts 42 and 44, and wires 27, 28 and 29 to the negative terminal of battery 5. It will be noted that in the circuit above outlined the armature 8 and its contacts 30 and 31 are of negative polarity with respect to fixed contacts 32 and 33, the latter being positive with respect to contacts 30 and 31. The coder 51, thru its action upon contacts 49 and 50, interrupts the flow of current to the transformer primary 13' at a given code frequency. Said coder and its action are well known in the art and need not be here described. For purposes of the present invention it suffices to note that the vibrating armature 8 causes current from battery 5 to be impressed in the form of impulses upon transformer primary 13' and that these impulses may be interrupted at a code frequency by coder 51, operated by any suitable means. Of course, if uninterrupted current is desired in the output circuit of transformer 13, the coder 51 may be omitted, and this coder is in no way essential to my invention.

The approach relay 10 controls the reversal of armature 39 of relay 36, and thus of the polarity of contacts 30 and 31 with respect to contacts 32 and 33. This control comprises a pair of contacts 56 and 57 with which cooperates a bridging armature 58 operated by said relay 10. When said relay 10 becomes energized, armature 58 momentarily bridges contacts 56 and 57 and a pulse of current from battery 5 goes thru coil 40 by way of the positive terminal of said battery, wire 59, contact 56, bridging contact 58, contact 57, wire 60, coil 40, wire 61, and wire 29 to the negative terminal of said battery. The polarizing coil 38 of the reversing relay is connected to the battery 5 under control of relay 10, as hereinafter more particularly specified, but no current flows thru coil 38 at the time that armature 58 bridges contacts 56, 57 since the parts are so designed that armature 17 does not engage contact 18 until after bridging armature 58 has become disengaged from contact 56. When armature 17 engages contact 18 a current thru coil 38 is established as follows: from the positive terminal of battery 5 thru wire 19, armature 17, contact 18, wires 20, 21 and 47, contacts 43 and 41, wire 48', wire 62, coil 38, wire 63, wire 55, contacts 42 and 44, and wires 27, 28, and 29, to the negative terminal of battery 5. To guard against the building up of sufficient flux in the electromagnet 37 to cause reversal of armature 39 in case armature 17 should engage contact 18 before armature 58 is disengaged from contact 56, a short circuited copper ring 65 is provided around said electromagnet 37. A pulse of current flowing thru winding 40 when armature 58 bridges contacts 56 and 57 thus does not disturb armature 39 of the reversing relay and said armature remains in its full line position.

When the train which entered the track sec-

tion 11 departs from said section, track relay 12 is energized and approach relay 10 deenergized. During the dropping of armature 58 the latter bridges contacts 56 and 57 and allows a pulse of current to flow thru coil 40 as previously traced. At this time the magnet 37 of relay 36 is strongly polarized in such direction as to reverse armature 39 and the latter accordingly shifts into reverse position wherein its contacts 41, 42 engage respectively with contacts 45 and 46. Even if armature 17 is disengaged from contact 18 at the time armature 58 bridges contacts 56 and 57, the eddy currents flowing in the short circuited collar 65 according to Lenz's law will maintain a strong field for an appreciable time and thus cause reversal of armature 39.

When the next train approaches and relay 10 is again energized, the pulse of current thru coil 40 does not move armature 39 since the magnet 37 is not then polarized. The armature 39 thus remains in the position to which it was shifted in response to the preceding deenergization of relay 10. It will be seen that with armature 39 in this position (i. e. with contacts 41, 42, engaging respectively contacts 45 and 46) the polarity of contacts 30 and 31 with respect to contacts 32, 33 has been reversed from that corresponding to the full line position of armature 39, and that contacts 30, 31 are now positive with respect to contacts 32, 33. Current from battery 5 will thus now flow thru contacts 30, 31, and 32, 33 in the reverse direction from that in which it flows when armature 39 is in its full line position. Also it should be noted that the polarity of coil 38 has been reversed, interchanging the N and S poles of the field structure of relay 36, as the result of shifting of armature 39 from its full to its dotted line position. Thus, when relay 10 is now deenergized upon the departure of the train from track section 11, the pulse of current thru coil 40 incident to bridging of contacts 56 and 57 by armature 58 will again reverse the armature 39 and restore the latter to its original or full line position.

It will thus be seen that I have provided for reversal of the polarity of the contacts of the vibrating generator during each cycle of energization and deenergization of relay 10, or in other words, said polarity is reversed as many times as the generator is called into action.

To insure that the armature 39 will be held in its set position against the pressure of contacts 42, 43 or contacts 44, 45, when coil 38 is deenergized, a toggle spring 66 may be connected to said armature as shown. This spring operates to hold the armature in either its full line or its dotted line position as will be apparent.

In the form of invention shown in Fig. 2 the reversing relay 36 of Fig. 1 is replaced by a pair of relays 70, 71. The same parts in Figs. 1 and 2 are designated by the same reference numerals. Relays 70, 71 are controlled by approach relay 10 in the same manner that relays 6 and 7 in my Patent No. 1,753,982, are controlled by relay C of that patent. In other words, relay 70 is energized and deenergized once in each two cycles of energization and deenergization of relay 10. Thus, assuming relays 10, 70, and 71 to be deenergized, the subsequent energization of relay 10 establishes a flow of current from one terminal of battery 5 thru wire 72, winding 73 of relay 70, wire 74, winding 75 of relay 71, wire 76, wire 76', back contact 77 and armature 78 of relay 70, wire 79, front contact 80 and armature 81 of relay 10, wire 82, and wire 83 to

the opposite terminal of said battery. Windings 73 and 75 are in series, and the current flowing thru winding 73 is insufficient to operate relay 70; but the current in winding 75 is sufficient to operate relay 71, and the armature 84 of the latter is thus engaged with front contact 85. Now, when relay 10 is deenergized, current flows from one terminal of battery 5 thru wire 72, winding 73 of relay 70, wire 74, winding 75 of relay 71, wire 76, winding 86 of relay 70, wire 87, armature 84 and front contact 85 of relay 71, wire 88, and wire 83 to the opposite terminal of the battery. Due to the fact that both windings 73 and 86 of relay 70 are now energized, said relay is operated, and its armature 78 engages front contact 89 of said relay. When relay 10 is next energized, winding 75 of relay 71 and winding 86 of relay 70 are short circuited, and current flows from one terminal of battery 5 thru wire 72, winding 73, front contact 89 and armature 78 of relay 70, wire 79, front contact 80 and armature 81 of relay 10, and wires 82 and 83 to the opposite terminal of the battery. Winding 75 is not at this time in circuit with winding 73 and the current flowing thru the latter is sufficient to maintain armature 78 engaged with front contact 89. Now when relay 10 is deenergized, the circuit thru winding 73 is broken and armature 78 drops into engagement with back contact 77. The relays 10, 70 and 71 are now again all deenergized.

Relay 70 is provided with an armature 90, cooperating with front and back contacts 91, 92, and also with an armature 93 cooperating with front and back contacts 94, 95. Armature 90 is connected by wires 96 and 97 with one terminal of battery 5; while armature 93 is connected by wires 98, and 99 with wire 79, and thus with the opposite terminal of battery 5 thru armature 81 of relay 10. Contacts 91 and 95 are connected by wire 100 to contact 49, while contacts 92 and 94 are connected by wire 101 with armature 8 of the vibrating generator 6.

Now assuming the approach relay 10 and the relays 70 and 71 to be deenergized and a train to enter the track section 11 the approach relay 10 will be operated, engaging armature 81 with front contact 80. Relay 70 is not operated at this time and its armatures 78, 90 and 93 engage the respective back contacts 77, 92 and 95. The engagement of armature 81 with front contact 80, however, closes a circuit through coil 9 of the vibrating generator 6 as follows: from one terminal of battery 5 through wire 97, coil 9, wire 25, fixed contact 24, contact 23, carried by and insulated from armature 8, wire 102, wire 99, wire 79, front contact 80 and armature 81 of relay 10, and wires 82 and 83 to the other terminal of battery 5. The vibrating generator is thus set in action alternately engaging its contacts 30, 31 with the respective contacts 32 and 33. At the same time, current flows from wire 97 through wire 96, armature 90 and back contact 92 of relay 70, wire 101, armature 8 of the vibrating generator, contacts 30, 32 or 31—33 through one-half or the other of the primary 13' of transformer 13, tap 53, wire 52, contacts 50, 49, wire 100, back contact 95, and armature 93 of relay 70, wires 98, 99 and 79, and thence through front contact 80 and armature 81 of relay 10 to the opposite terminal of battery 5. Impulses interrupted by the coder 51 are thus supplied through the vibrating generator to the primary of transformer 13 and thence as alternating current to the rails of the track section 11. When the train leaves said sec-

tion the approach relay 10 is de-energized and relay 70 is energized as previously set forth. Armature 90 of relay 70 now engages front contact 91 while armature 93 of said relay engages front contact 94. The polarity of the contacts of the vibrating generator is thus reversed. When the train next enters the track section 11 the approach relay 10 is energized, but as previously pointed out, the relay 70 remains energized and thus current flows through the vibrating generator contacts in the reverse direction from that in which it flowed during the preceding operation. Upon the ensuing de-energization of approach relay 10, relay 70 is deenergized and its armatures 90, 93 engage the respective back contacts 91, 95 with the result that the polarity of the generator contacts is again reversed.

It will thus be apparent that through the relays 70, 71, provision is made for the reversal of the polarity of the vibrating generator contacts once in each complete cycle of energization and de-energization of the approach relay.

The terms and expressions which I have employed are used as terms of description and not of limitation, and I have no intention, in the use of such terms and expressions, of excluding any equivalents of the features shown and described or portions thereof, but recognize that various modifications are possible within the scope of the invention claimed.

I claim:

1. In combination, a vibrating generator of alternating current, said generator comprising a source of direct current and contacts alternately opened and closed, circuit closing means connected to said source for setting said contacts in operation, a pair of relays, means controlled by said circuit closing means and by said pair of relays for energizing one of said relays once in each cycle of operation of said circuit closing means, means comprising a front contact of the last mentioned relay for causing current to pass in one direction thru said generator contacts, and means comprising a back contact of said last mentioned relay for causing current to pass in the opposite direction thru said generator contacts.

2. In combination, a vibrating generator of alternating current, said generator comprising a source of direct current and contacts alternately opened and closed, circuit closing means connected to said source for setting said contacts in operation, a relay comprising a polarizing winding and an armature having a winding, means controlled by said circuit closing means for causing current to flow in such directions thru said windings as to change the position of said armature once in each cycle of operation of said circuit closing means, means comprising a contact engaged by said armature when in one position for causing current to pass thru said generator contacts in one direction, and means comprising a contact engaged by said armature when in another position for causing current to pass thru said generator contacts in the opposite direction.

3. In combination, a vibrating generator of alternating current, said generator comprising a source of direct current and contacts alternately opened and closed, circuit closing means connected to said source for setting said contacts in operation, a relay comprising a magnet having a short circuited element surrounding the same and an armature having a winding, means controlled by said circuit closing means for causing current to flow in such direction thru said windings as to

	change the position of said armature once in each cycle of operation of said circuit closing means, means comprising a contact engaged by said armature when in one position for causing	ture having a polarizing winding and a magnet having a polarizing winding, means for causing a flow of current in a given direction through the winding of said armature, and connections controlled by said armature for determining the direction of current flow through the winding of said magnet.	80
5	current to pass thru said generator contacts in one direction, means comprising a contact engaged by said armature when in another position for causing current to pass thru said generator contacts in the opposite direction.	6. In combination, a source of electrical energy, circuit establishing and disestablishing means connected to said source, a relay comprising a polarizing winding and an armature having a winding, and connections controlled by said means for causing current to flow through said windings in such directions as to change the position of said armature once in each circuit establishing and disestablishing cycle of operation of said means.	85
10	4. In combination, a vibrating generator of alternating current, said generator comprising a source of direct current and contacts alternately opened and closed, a relay operable for establishing a circuit from said source for operating	7. A relay comprising an armature having a polarizing winding and a magnet having a polarizing winding, connections controlled by said armature for causing a flow of current through one of said windings in such direction as to reverse the position of said armature when the other of said windings is energized, and a toggle spring connected to said armature for maintaining the latter in either of the positions which it assumes with respect to said magnet.	90
15	said contacts, a second and a third relay, means for at times energizing said second relay when said first relay becomes energized, means for energizing said third relay when said second relay is energized and said first relay is subsequently		95
20	de-energized, means for de-energizing said second relay when said third relay is energized and said first relay next becomes energized, means for maintaining said third relay in its energized condition after said second relay becomes de-energized until said first relay again becomes de-		100
25	energized, and means controlled by said third relay for reversing the polarity of said generator contacts.		
30	5. In combination, a relay comprising an arma-	PAUL N. BOSSART.	105
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