Nov. 19, 1946. R. C. LOCKE 2,411,442

PULSE GENERATOR

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Fig. 1.

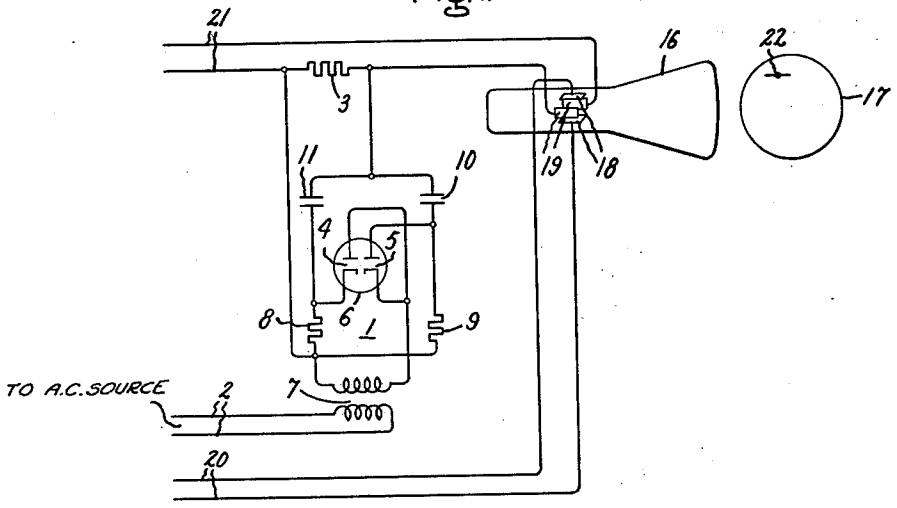


Fig. 2.

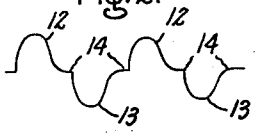
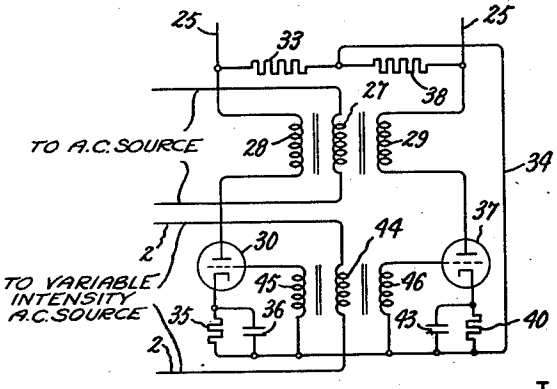


Fig. 3.



Inventor:
Raymond C. Locke,
by Harry E. Dunham
His Attorney.

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2,411,442

PULSE GENERATOR

Raymond C. Locke, Schenectady, N. Y., assignor to General Electric Company, a corporation of New York

Application December 1, 1943, Serial No. 512,473

4 Claims. (Cl. 250—27)

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My invention application is a continuation in part of my parent application Serial No. 465,662, filed November 16, 1942, entitled Directive radiant energy apparatus, and which is assigned to the assignee of this present application.

My present invention has for one of its objects to provide a novel pulse generating system having means for producing pulses spaced equally in time and of alternate polarity.

The novel features which I believe to be characteristic of my invention are set forth with particularity in the appended claims. My invention itself, however, both as to its organization and method of operation, together with further objects and advantages thereof, may best be understood by reference to the following description taken in connection with the accompanying drawing in which Fig. 1 represents an embodiment of my invention, Fig. 2 represents the character of pulse wave produced thereby and Fig. 3 shows a second embodiment of my invention.

Referring to Fig. 1 of the drawing, I have shown my pulse generator 1 connected between a suitable source of alternating current of, for example, 400 cycles and which may be connected to the terminals 2 and a load device comprising resistance 3. The generator 1 comprises a pair of diodes 4 and 5, which may be arranged in a single envelope 6 and the cathodes of which are connected to the opposite terminals of the secondary winding of transformer 7 through resistance 8. The anodes are likewise connected to the opposite terminals of the secondary winding of the transformer through a second resistance 9, the two resistances 8 and 9 having a terminal in common connected to one terminal of the secondary winding of the transformer. Thus the anode of diode 5 is connected to the cathode of diode 4 through the two resistances 9 and 8. This anode of diode 5 is also connected to the cathode of diode 4 through two capacitances 10 and 11. The load device 3 has one terminal connected to the point between condensers 10 and 11 and its other terminal connected to the point between resistances 8 and 9.

In the operation of this circuit the two diodes are alternately conducting. When either diode conducts, it produces a potential on its respective resistance 8 or 9, which in turn charges the corresponding condenser 11 or 10. The time constant of each of these condensers and the respective resistance is such that this charge is held over between the conducting periods of the discharge device, leaking off only gradually through the respective resistance. The result is that the anode of each diode is biased negatively relative to its cathode by an amount dependent upon the magnitude of the impressed voltage and current flows through each diode only during a

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portion of a half cycle when its anode is positive, being zero for an interval at the beginning of the half cycle and for another interval just prior to the end of the half cycle. That is, current flows in the respective device only when the steady bias is overcome by the impressed alternating voltage. The duration of these intervals is substantially constant during variations in intensity of the voltage supplied at terminals 2 since the bias voltage automatically developed on the respective condenser increases in the same ratio as the impressed alternating voltage. Thus current pulses of the form indicated at 12 and 13 in Fig. 2 are produced across the resistance 3, these pulses being of alternate polarity and each pulse being shorter than a half cycle of the 400 cycle wave supplied at terminals 2, the successive pulses being spaced apart in time by a period of substantially zero current indicated at 14. As the intensity of the alternating voltage supplied at terminals 2 increases the intensity of the pulses 12 and 13 increases, the charge on the condensers 10 and 11 increases in the same ratio with the impressed voltage, and the duration of the different pulses thus remains constant.

My invention has particular utility in radio echo apparatus in which the position of remote objects is indicated upon the screen of a cathode ray device. I have indicated in Fig. 1 a cathode ray device 16 having on its right end, as shown in Fig. 1, a viewing screen which I have represented by the circle 17. This cathode ray oscillograph has vertical deflecting plates 18 and horizontal deflecting plates 19 between which voltages may be applied through terminals 20 and 21 so related as to produce a spot 22 on the screen of the cathode ray device which moves over the screen in accordance with the position of the remote object to be indicated. In certain applications, especially where the object to be indicated is an airplane, it is desirable that the spot have a form suggestive of an airplane. This result is readily effected for the use of my invention in which the pulses represented in Fig. 2 are produced across the resistance 3 and hence between the horizontal deflecting plates 18 where they operate to deflect the ray to the right during the positive pulses and to the left during the negative pulses while leaving the ray centered upon the spot 22 during the short intervals 14. Thus the spot 22 is more illuminated than the projections to the right and to the left from the spot with the result that the spot takes on a form very suggestive of an airplane.

If desired, the alternating potential applied to the terminals 2 may be varied in intensity with the range of the remote object, in which case the pulses 12 and 13 vary in intensity correspondingly thereby varying the lengths of the wings

to agree with the distance to the remote target. Thus the wings may be long when the target is nearby and short when the target is more distant.

Fig. 3 shows a modification of my invention employing triodes in place of the diodes which are capable of producing a wave between their output terminals 25 of substantially the form of the wave illustrated in Fig. 2. Anode voltage of the 400 cycle frequency and of constant intensity is supplied between the anode and cathode of the two triodes through a three-winding transformer having a primary winding 27 and secondary windings 28 and 29 The anode circuit for the triode 30 extends from the anode thereof through the winding 28, resistance 33, conductor 34 and cathode resistance 35 which is shunted by a condenser 36 back to the cathode of the diode. Similarly the anode circuit of triode 37 extends from the anode thereof through winding 29, resistance 38, conductor 34, cathode resistance 40 shunted by a condenser 43 back to the cathode of the discharge device. Windings 28 and 29 are poled oppositely so that when one of the anodes is positive in potential with respect to its cathode, the anode of the opposite device is negative with respect to its cathode whereby these devices are alternately conducting. The terminals 2 of Fig. 3 correspond to the terminals 2 of Fig. 1 and have impressed therebetween the 400 cycle voltage variable in intensity. This voltage is supplied between the control electrodes of the two discharge devices through a three-winding transformer having a primary winding 44 and secondary windings 45 and 46, these secondary windings also being poled oppositely and being so poled that the control electrodes of the two devices are positive when their anodes are positive and negative when their anodes are negative. Thus pulses of current flow alternately in the two devices and through respective resistances 33 and 38, these pulses of current producing a bias voltage on the cathode resistances 35 and 40 shunted by the respective condensers 36 and 43. These condensers are of sufficient capacitance that this bias voltage is maintained during the intervals when the anodes of the devices are negative and the current is interrupted. This bias voltage is sufficiently great that a delay is produced in each half cycle of the alternating current wave supplied to the winding 27 before the discharge device becomes conducting, and similarly the discharge device becomes nonconducting by reason of this bias voltage prior to termination of the positive half cycle. Thus the pulses of current flowing in the two devices are shorter than a half cycle of the alternating current wave with the result that the portions 14 of the wave occur which in the operation described maintain the ray of the cathode ray tube at its center position 22 thereby producing the bright spot having the oppositely extending wing portions as previously described. The circuit of Fig. 3 has the advantage that it may have high impedance across terminals 2. That is, the bias voltage between the control electrodes and cathodes may be such as to reduce the grid current to a small or even zero value thus maintaining high impedance between the grid and cathode electrodes.

While I have shown a particular embodiment of my invention, it will of course be understood that I do not wish to be limited thereto since different modifications both in the circuit arrangement and in the instrumentalities employed may be made, and I contemplate by the appended claims to cover any such modifications as fall within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. In combination, a source of alternating electromotive force of varying intensity, a pair of diodes connected across said source in opposite sense the anode of one diode and cathode of the other being connected together through a resistance path and a capacitance path, and a load circuit connected between an intermedaite point on said resistance path and an intermediate point on said capacitance path, said resistance and capacitance paths being so proportioned that said alternating electromotive force of varying intensity is reproduced in said load circuit as pulses of alternating polarity and correspondingly varying intensity and spaced apart in time by substantially constant amounts as the intensity of said electromotive force increases.

2. In combination, a source of alternating voltage, a pair of unilateral conducting devices, means to supply said voltage to said devices in opposite sense, means responsive to rectified current flowing in each of said devices to produce a steady unidirectional voltage across the respective device varying in intensity with, but slower than, variations in intensity of said alternating voltage and poled to prevent flow therein during periods when the instantaneous intensity of said alternating voltage is less than said steady voltage, an output circuit connected to said devices in which current pulses occur only during periods when the instantaneous intensity of said alternating voltage exceeds said unidirectional voltage, and signal indicating means controlled by said pulses.

3. The combination, in a system to generate pulses spaced apart in time and alternating in polarity, of a pair of electron discharge devices, means to supply alternating current to said devices to render said devices alternately conducting, means responsive to current in said devices to produce a bias opposing the flow of current in said devices until overcome by the alternating potential supplied by said first means whereby the pulses of current flowing in said two devices are spaced apart by a desired time interval, a load circuit, and means to supply to said load circuit potential of constant magnitude during said desired time intervals and varying in opposite directions from said magnitude in response to said current pulses in the respective devices.

4. The combination, in a system to generate pulses spaced apart in time and alternating in polarity, of a pair of electron discharge devices each having an anode and a cathode, a parallel combination of resistance and capacitance connected between the anode of one of said devices and the cathode of the other, a load circuit connected between an intermediate point on said capacitance and an intermediate point on said resistance, and a source of alternating electromotive force connected in an input distinct from said load circuit and extending from one of said intermediate points through said source to the cathode of said one of said devices and to the anode of said other device.

RAYMOND C. LOCKE.