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VOLTAGE GENERATOR HYPERBOLIC WAVE FORM

Filed July 8, 1947

FIG. 1

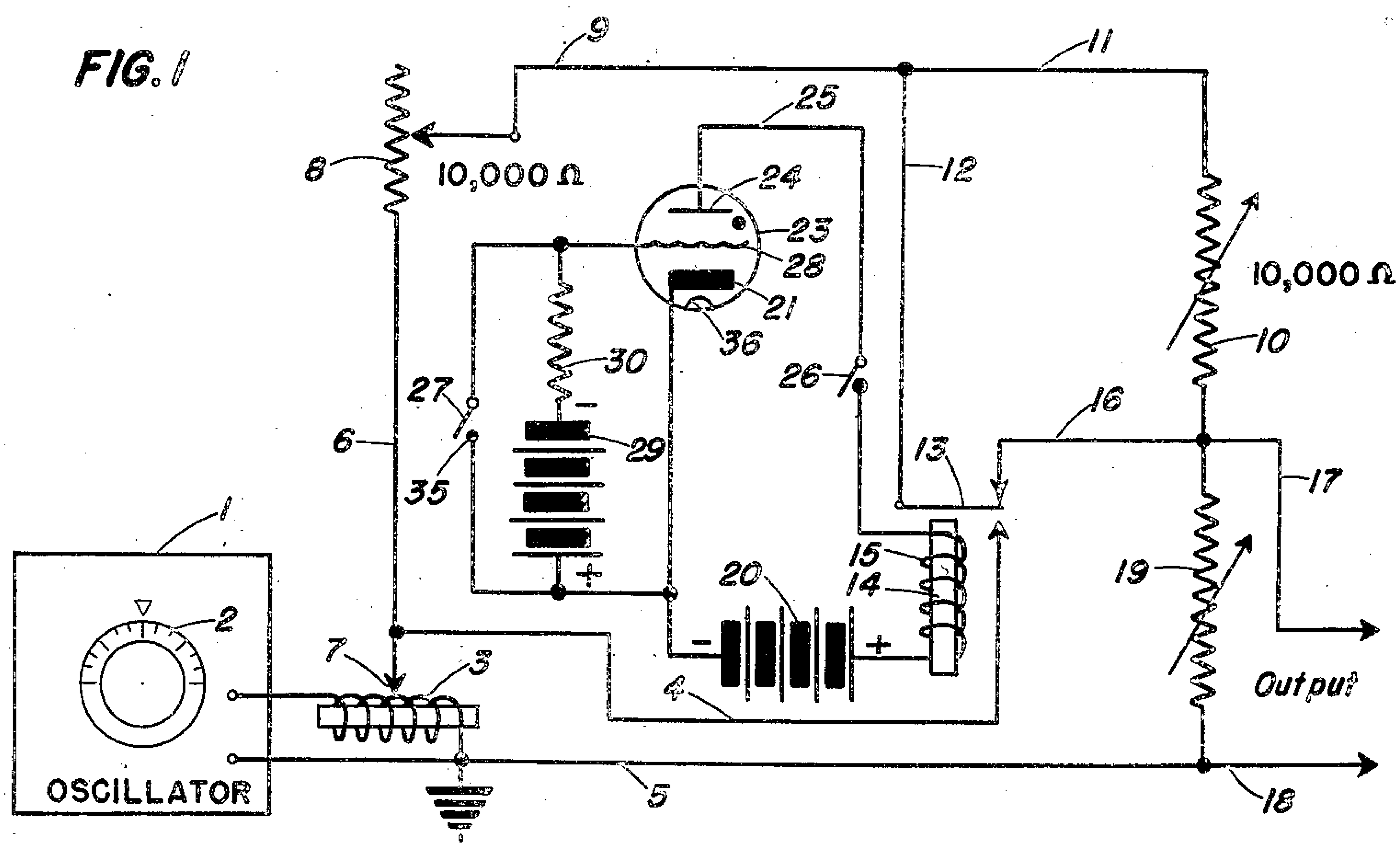
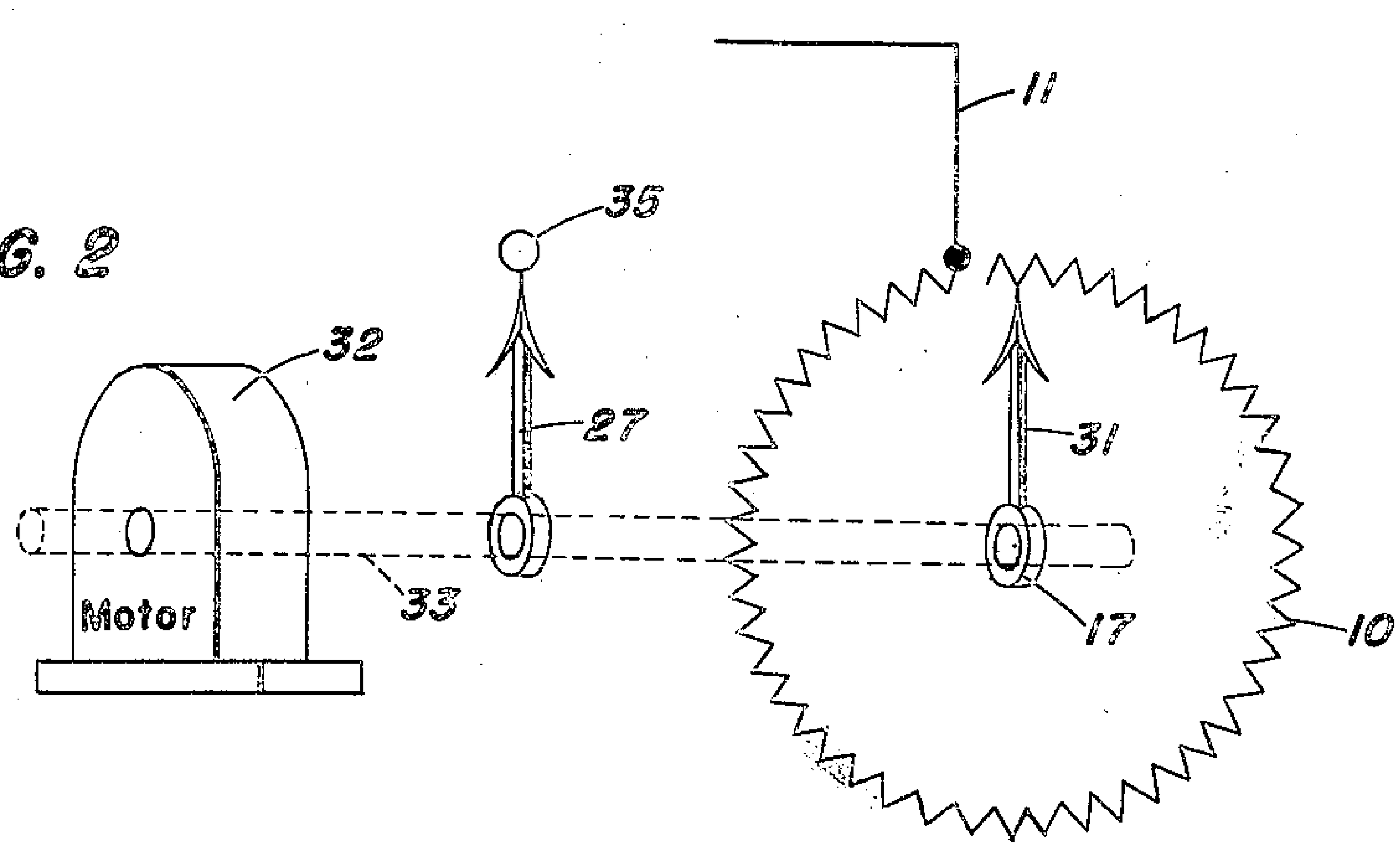


FIG. 2



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VOLTAGE GENERATOR, HYPERBOLIC WAVE FORM

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6 Claims. (Cl. 171—97)

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The object of this invention is to provide a method of and means for generating an oscillating or other fluctuating voltage having a hyperbolic envelope.

More specifically it relates to a system for producing an oscillating voltage of uniform amplitude, and for modulating this voltage hyperbolically, usually in the sense that the maxima of successive oscillations increase with elapsed time according to the desired hyperbolic variation.

A further object is to provide automatic means for varying the impedance of a circuit at a substantially uniform rate, while applying an oscillating voltage of constant amplitude to the impedance, whereby the current through the circuit, which varies inversely as the impedance, will grow at an ever-increasing rate, closely approximating the manner in which the ordinates of an equilateral hyperbola increase as the corresponding abscissas decrease.

While it is clear that many ways may be used to produce this result, the present disclosure will be confined to a single preferred embodiment of the invention, for purposes of illustration.

In the accompanying drawings, which are purely diagrammatic:

Fig. 1 shows one circuit that may be used in practicing the invention.

Fig. 2 shows mechanical details of the rotating elements of this circuit.

With reference to Fig. 1, there is shown an oscillator 1 that may be of any desired kind, the oscillator 1 includes an adjusting dial such as 2 for varying the generated frequency. The output of this oscillator is fed to the input terminals of a transformer 3, here shown as an auto-transformer of the iron-core type.

Connected as shown, the member 3 will act as a step-down transformer, feeding to two conductors 4 and 5 a voltage lower than that generated in the oscillator 1. Inasmuch as the circuit does not require the highest voltage output of the oscillator, this step-down transformation is a very desirable feature, as it diminishes the current drain of the oscillator and has much less tendency to disturb its constancy of voltage and/or frequency. The conductor 5 may be grounded, as shown, to stabilize the circuit, although this is not always requisite.

A conductor 6 leads from a shiftable contact 7 of the transformer 3 to one end of a resistor 8, here shown as approximately 10,000 ohms in value. This resistor 8 however is preferably variable as shown, its slider being connected to a

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conductor 9. Another resistor 10, also nominally 10,000 ohms, is connected to the other end of the conductor 9 by a conductor 11, a common conductor 12 leading from the junction of the conducting wires 9 and 11 to a movable-contact arm 13 of a relay 14. The relay 14 has a winding 15. A wire 16 leads from the upper contact of the relay 14 to the other end of the resistor 10, and also is connected to one wire 17 of the output wires 17 and 18.

The conductor 4, connected through the wire 6 to one end of the resistor 8, leads to the lower contact of the relay 14. The wire 5 continues as the output wire 18, a variable resistor 19 being bridged across the wires 17 and 18 to control manually the voltage delivered at the output end of the device.

The relay winding 15 has one end thereof connected to the positive terminal of a battery or other current source 20, the negative terminal of which is connected to the cathode 21 of a gas-containing thermionic tube 23, here shown as of the three-electrode type. The specific tube illustrated is the "884" type, often called a thyratron. The plate 24 of the tube is connected to the other end of the winding 15 through a wire 25 and a switch 26, the latter being manually actuable. Another switch 27 is provided to control a conductor connecting the cathode 21 and the grid 28 of the tube 23.

A relatively high negative potential is applied to the grid 28 by a battery 29, with a protective or current limiting resistance 30 in series therewith, between the grid 28 and cathode 21. The switch 27 is connected directly across the grid 28 and the cathode 21, and when closed will bring the grid 28 to the same potential as the cathode 21.

The resistor 10 preferably is of the type shown in Fig. 2, namely, one in which the resistance element is arranged in substantially a full circle. This resistor is so constructed that the resistance thereof varies uniformly with the angular position of a radial arm 31. This arm 31 is preferably continuously rotatable, by means of a motor 32 and shaft 33. The arm of the switch 27 in the grid circuit is also carried by the shaft 33, so as to rotate in synchronism with the arm 31, and so as to close the switch 27 at the same instant that the radial arm 31 delivers the maximum value of the resistor 10.

The operation of the circuit is as follows:

When the switch 26 is closed manually, the plate circuit of the tube 23 is completed through the winding 15 of the relay 14 and the battery 20, but practically no current will flow in this circuit, due to the blocking of the grid 28 by the high negative potential due to the battery 29.

At this time, the oscillations from the oscillator 1 will pass through the transformer 3, and some of their energy will produce an output at the wires 17 and 18 that is attenuated by the resistor 8 and the resistor 19. This energy will flow through the wires 9 and 12, the movable element 13 of the relay 14, and the wires 16 and 17.

When the switch 27 closes the grid circuit the grid potential falls to that of the cathode 21, and a relatively large current will flow in the plate circuit. This will magnetize the core of the relay 14, and cause the movable contact 13 to leave the upper fixed contact and rest against the lower contact instead. The relay 14 is of a very quick-acting type, so that the shift takes place almost instantaneously.

When the contact 14 is thus depressed, the resistor 8 will be short-circuited, so that energy may flow through the wires 4, 11, and 12 to one end of the resistor 10, which is thus substituted in the circuit for the resistor 8.

In order to create no disturbance due to this substitution, the resistor 8 is preferably high enough to be adjustable to equality with the maximum value of the resistor 10.

The effect of rotation of the radial arm 31 is to decrease the value of the resistance in the rheostat 10 at a uniform rate, down nearly to zero. During this decrease, the current flowing through the rheostat 10 will increase inversely as the resistance left in the circuit, thus giving the desired hyperbolic rate of increase of amplitude of the oscillations appearing at the output end of the circuit, at the terminals 17 and 18.

While the specific example used for illustrating the invention employs a source of oscillations of harmonic type and of uniform amplitude, it is clear that the invention is broad enough to include other varying current of voltages, of any desired wave form, even non-periodic. The invention, therefore, is to be construed as limited solely by the following claims.

We claim:

1. A circuit for modulating oscillations, comprising a variable resistor, means for varying the value thereof from maximum to minimum at a uniform rate, a substantially constant resistor the value of which is approximately equal to the maximum of the variable resistor, a source of oscillations, the said substantially constant resistor normally being connected in series with the said source of oscillations, and means for substituting the said uniformly varying resistor in place of the said substantially constant resistor.

2. A circuit, including a resistor the value of which periodically changes continuously from maximum to minimum, means for normally short-circuiting the said resistor, and means for removing the said short circuit at the instant that the said resistor is at a maximum value, the said last named means being mechanically actuated by the same means that produces the periodic variations in the said resistor.

3. A circuit as defined in claim 2, with a second resistor the value of which is substantially equal to the maximum of the said variable resistor, the said second resistor being normally in circuit, and wherein the said second resistor will be removed from the circuit at the same instant that the short circuit is removed from the said variable resistor.

4. A circuit, including a series resistor, means for normally short circuiting the said resistor, a second resistor, means for normally maintaining the second resistor in series with the circuit, a switch co-acting with the said two means which will short circuit the second resistor and simultaneously remove the short circuit from the first one, and a thyratron-controlled circuit for actuating the said switch.

5. A circuit as defined in claim 4, wherein the switch that co-acts with the said two means is a relay having a winding operable by the plate current of the thyratron.

6. A circuit, comprising a source of oscillations, a resistor decreasable in equal steps between its maximum and minimum values and rapidly restorable to its maximum value in a single step, the said resistor being interposable into series with the said source, whereby the amplitude of the oscillations increases stepwise inversely with the resistance, and means for inserting the said resistor into the circuit at an instant that its resistance is a maximum, the said means comprising a relay and a switch controlled in synchronism with the said resistor, the said switch serving to actuate the relay at the proper instant.

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