

May 15, 1934.

C. A. CULVER

1,958,986

SIGNALING SYSTEM

Filed Aug. 30, 1928

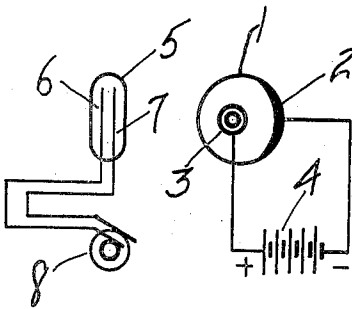


Fig. 1.

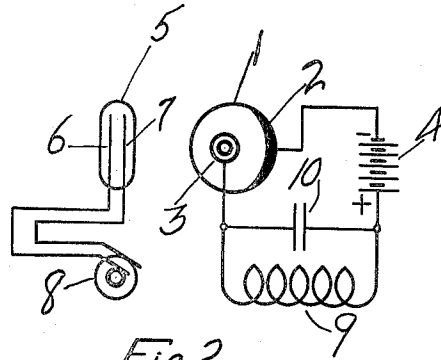


Fig. 2.

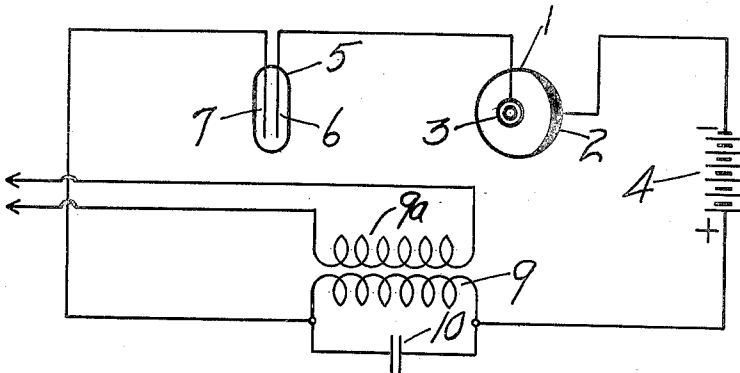


Fig. 3.

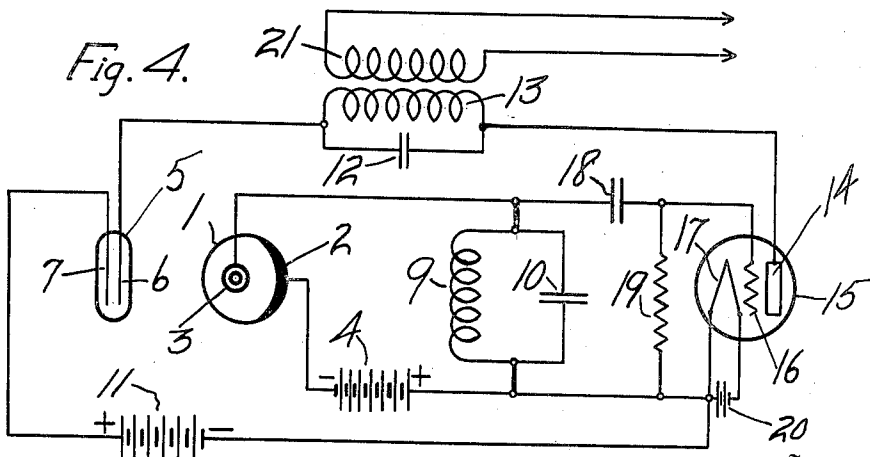


Fig. 4.

Inventor
Charles A. Culver

By

John B. Brady
Attorney

UNITED STATES PATENT OFFICE

1,958,986

SIGNALING SYSTEM

Charles A. Culver, Northfield, Minn., assignor to
Wired Radio, Inc., New York, N. Y., a corpora-
tion of Delaware

Application August 30, 1928, Serial No. 303,068

2 Claims. (Cl. 250—36)

My invention relates to signaling systems in general and more specifically to signaling systems of the type employing light-sensitive cells.

5 An object of my invention is to provide a system for producing oscillations of electrical energy.

Another object of my invention is to provide a system for generating oscillations of electrical energy the frequency characteristics of which
10 will be substantially constant.

Still another object of my invention is to provide a system for generating oscillations of electrical energy whereby the magnitude of the energy shall be at all times under easy and accurate
15 control.

Other and further objects of my invention reside in the specification following and in the accompanying drawing, wherein Figure 1 is a schematic illustration of an embodiment of my
20 invention; Figs. 2 and 3 are schematic illustrations showing modifications of the signaling system of my invention; and Fig. 4 is a schematic circuit arrangement illustrating the signaling system of my invention.

25 In Fig. 1 of the accompanying drawing, a light-sensitive element 1 is associated with a source of light variations 5. Light-sensitive element 1, having a cathode 2, an anode 3 and a source of energy 4, causes variations of electrical energy in the circuit interconnecting the
30 several parts when a source of light variations 5 causes variations of light to be incident upon the cathode 2 of light-sensitive element 1. In Fig. 2 of the accompanying drawing, light-sensitive element 1 is included in a circuit arrangement comprising inductance 9, capacity 10
35 and source of energy 4. The other reference characters correspond to those of Fig. 1 including a source of current variations 8 and source of light variations 5. Source of light variations
40 5 may be any type of glow-discharge tube whereby variations of current produce variations of light intensity. Such glow discharge tubes usually employ an inert gas such as neon in an
45 otherwise evacuated vessel containing electrodes 7 and 6. In Fig. 1 the source of light variations emitted from tube 5 causes variations in the photoelectron emission from cathode 2. Such variations in the photoelectron emission from
50 cathode 2 will effect corresponding variations of current in the circuit of which it is a part. In Fig. 2 such variations of current are employed to periodically charge the condenser 10. Condenser 10 is connected in multiple with an in-
55 ductance 9. Providing the resistance of the cir-

cuit is not excessive and the source of light variations from 5 sufficiently rapid, continuous wave oscillations will be produced. The frequency of such oscillations will depend on the values of inductance 9 and capacity 10 employed.
60 When the source of light variations from 5, producing variations of resistance in 1, has a frequency approaching the natural frequency of circuit 9—10, the magnitude of the oscillatory current will be relatively large.

65 Suppose, instead of employing an independent source of alternating energy 8 to actuate the glow lamp 5, I employ a circuit arrangement as shown in Fig. 3. Any slight variation of the current through glow discharge tube 5, will tend to modify the emission from the cathode 2. The magnitude of the current for energizing glow discharge tube 5 is proportional to and will be limited by the internal resistance of the particular
70 type of light-sensitive element employed. Because of the extremely small space current or saturation current, which is usually measured in microamperes, the generated current oscillations may be amplified by connecting the output coil
75 9a to the input circuit of a thermionic tube amplifier. Because of the high frequency electrical oscillations that may be produced, in such a circuit arrangement as illustrated in Fig. 3, this circuit arrangement may be employed as a master oscillator for any number of individual ther-
80 mionic tube amplifier circuits.

85 In Fig. 4 of the accompanying drawing a schematic circuit arrangement is shown employing a thermionic tube 15 for amplifying the generated electrical energy. Thermionic tube 15 has a control electrode 16, anode 14 and a cathode 17. Light-sensitive element 1, having a cathode 2 and anode 3, is employed in a series circuit arrangement including inductance 9 and capacity
90 10. The arrangement thus far is similar to the circuit arrangement illustrated in Fig. 2, wherein light-sensitive element 1 is employed in a series arrangement including inductance 9, capacity 10 and a source of electrical energy 4. By again referring to Fig. 4 and remembering the operation
95 of the circuit arrangement illustrated in Fig. 2, the operation of the system can be easily understood. Assuming a small change in the resistance of light-sensitive element 1, a corresponding variation of current is produced in the
100 circuit 9—10 which in turn produces an oscillatory current in the circuit 9—10. If an amplifying circuit is associated with the circuit 9—10 these high frequency oscillations of energy may be amplified. The oscillatory energy is associated
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with the input circuit of thermionic tube 15 causing a variation of potential applied to control electrode 16. The return circuit for control electrode 16 includes resistance 19 completing the circuit to cathode 17. Capacity 18 is employed for preventing the potential difference of control electrode 16 from reaching the circuit 9—10 and light-sensitive element 1. Variations of potential on control electrode 16 produce corresponding variations of current in the anode circuit.

The anode circuit comprises a connection from anode 14 to cathode 17 and includes source of energy 11, capacity 12, inductance 13 and glow-discharge tube 5. The capacity 12 and inductance 13 constitute a resonant circuit which may be tuned to the same frequency as that of resonant circuit 9—10. While the alternating current component of the output circuit from the amplifier tube may be largely trapped by the resonant circuit 12—13 and taken off through the inductance 21, it will be seen that the direct current component of this output circuit as passed through the series-connected glow tube 5 from the battery 11 will be a uni-directional pulsating current and will thus vary the intensity of illumination produced by the glow tube 5. The effective resistance of the resonant circuit 12—13 will be such as to provide a desirable protective resistance against excessive flow of direct current through the glow discharge tube, thus obviating the necessity for introducing a pure ohmic resistance into this circuit. As a matter of fact, glow discharge tubes such as those employed in my invention, may be operated to vary the illumination thereof by very small changes in the effective resistance of the circuit. Such changes are, of course, provided by the internal resistance of the amplifier tube.

Glow-discharge tube 5 responds to variations of current corresponding to variations of current in the circuit 9—10. The response to current variations is exhibited by variations in the intensity of the glow discharge. The variations in the glow-discharge or variations of light intensity are caused to be incident upon cathode 2 of light-sensitive element 1 thereby causing a periodic variation of resistance in the circuit 9—10. The magnitude of the current variations is of an increased value thereby causing an increase in the magnitude of the oscillatory energy in the circuit 9—10. This oscillatory energy is again

impressed on the control electrode 16 of thermionic tube 14 which in turn produces variations of current in the anode circuit and corresponding variations in the glow-discharge of tube 5. It is therefore evident that the value of the oscillatory energy is increased each time and the cycle of operation is repeated until saturation occurs. An output circuit 21 associated with inductance 13 may be connected to any suitable amplifying system (not illustrated) for amplifying the output of the oscillator shown in Fig. 4. Output circuit 21 provides means for connecting said oscillator into any system in which an oscillator is used.

It is understood that my invention is not to be restricted to the precise circuit arrangements illustrated in the accompanying drawing and described in the foregoing specification but only as defined in the scope of the appended claims.

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

1. An oscillatory circuit comprising a glow-discharge tube, a light sensitive device adjacent to and illuminated by said glow-discharge tube, a source of electrical energy and a parallel tuned circuit in series with said glow discharge tube whereby the frequency of electrical variations in said oscillatory circuit originating in said light sensitive device is determined and the intensity of discharge of said glow-discharge tube variably illuminates said light sensitive device, an amplifier tube having an input circuit which includes said light sensitive device and a second tuned circuit in shunt with said input circuit, said tube having an anode connected to the first said tuned circuit and the two said tuned circuits being substantially resonant to the same frequency.

2. An oscillator comprising a glow discharge tube, a photoelectric cell adjacent to and illuminated by said glow discharge tube, a tuned circuit electrically coupled to said photoelectric cell, an electron tube amplifier the input circuit of which includes said photoelectric cell and said tuned circuit, energizing circuits for said amplifier, a second and parallel tuned circuit in the anode circuit of said electron tube amplifier, and a load circuit electrically coupled to said second tuned circuit, said glow discharge tube being included in series with said second tuned circuit.

CHARLES A. CULVER.

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