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DISCHARGE WAVE GENERATOR

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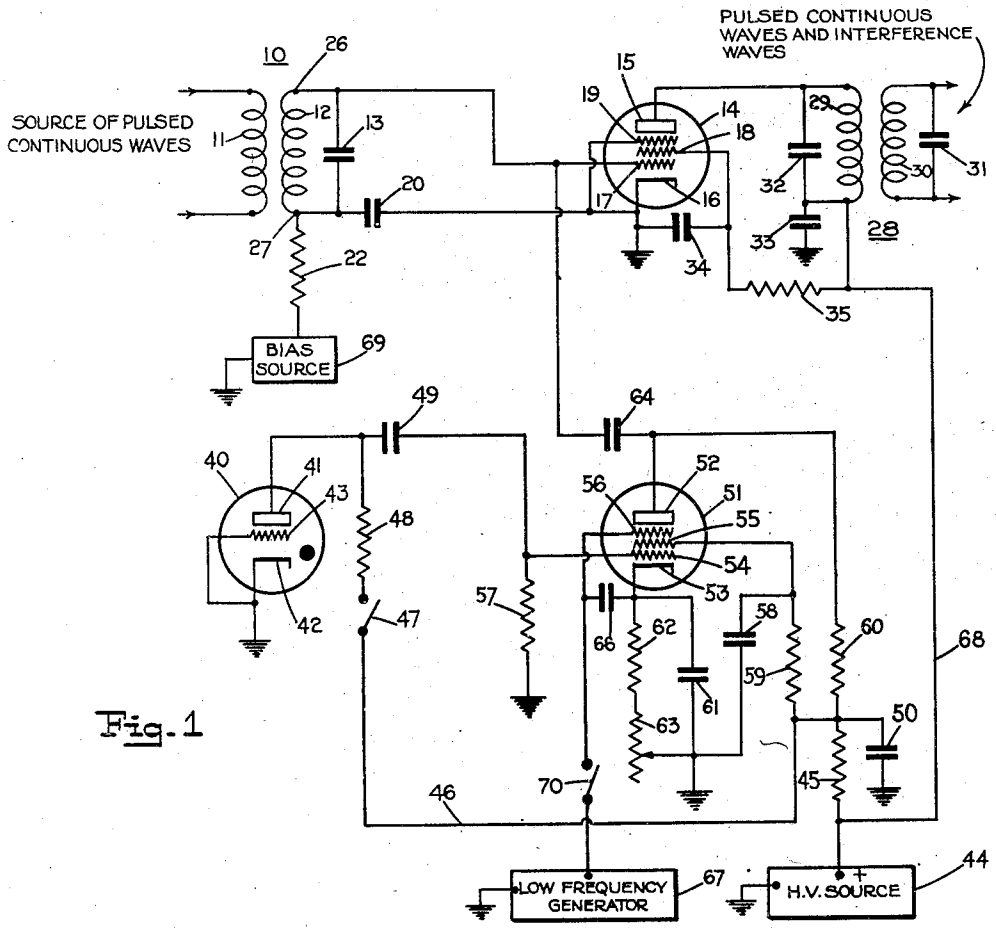


Fig. 1

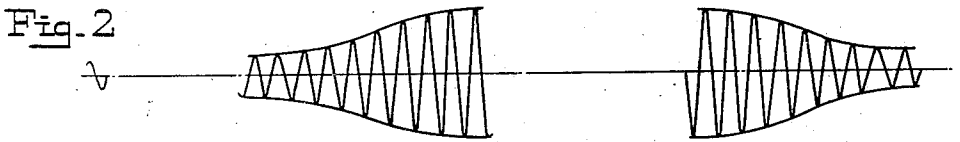


Fig. 2



Fig. 3



Fig. 4

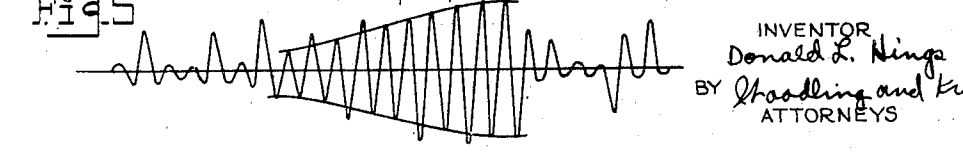


Fig. 5

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DISCHARGE WAVE GENERATOR

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My invention relates, in general, to a wave generator, and, more particularly, to a gaseous-discharge wave generator which may be adapted to inject into a pulsed continuous wave amplifier an interference-wave or discharge-wave which may be utilized to control and govern current responsive devices. The term discharge or interference wave as used in this application shall be defined as any form of wave energy produced from a space-discharge device.

An object of my invention is to provide for generating an interference-wave having damped components which may be injected into a pulsed continuous wave amplifier for modifying the energy of the pulsed continuous wave amplifier to control a current responsive device such as a limiter connected to the amplifier.

Another object of my invention is the provision of a gaseous-discharge tube, so connected as to be under a state of continuous ionization, thereby producing high-frequency discharges to be utilized in a control system for a reception system of pulsed continuous waves.

Another object of my invention is to provide for amplifying the high-frequency discharges of the gaseous tube and injecting the amplified energy into a pulsed continuous wave amplifier having pulses producing alternate spacer and marker intervals, whereby the injected energy may be utilized during the spacer intervals to control or govern current responsive devices connected to the amplifier.

Another object of my invention is to provide for governing and limiting the amount of gaseous-discharge energy which may be injected into a pulsed continuous wave amplifier.

Another object of my invention is to provide for modulating static discharge or interference-waves.

Another object of my invention is to provide for utilizing discharge-waves as carrier waves.

Another object of my invention is to produce an untuned, modulated discharge-wave.

Another object of my invention is to provide for injecting an untuned modulated discharge-wave into a pulsed continuous wave amplifier.

Other objects and a fuller understanding of my invention may be had by referring to the following description and claims, taken in combination with the accompanying drawing in which:

Figure 1 represents a diagrammatic illustration of a circuit embodying the features of my invention;

Figure 2 illustrates a pulsed continuous wave having off and on periods producing, respectively, alternate spacer and marker intervals;

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Figure 3 represents a discharge-wave as may be produced by a gaseous-discharge tube employed in my discharge-wave generator circuit;

Figure 4 represents an untuned modulated discharge-wave of random wave shape, which may be generated by my invention and injected into the pulsed continuous wave source; and

Figure 5 illustrates the wave form obtained across the output transformer of my system.

With reference to the drawing, the reference character 10 designates a transformer having a primary winding 11 which is adapted to be energized from a source of continuous wave pulses. The source of continuous wave pulses may be generated by any suitable means, as used in the transmission of intelligence by time constants, such as, for example, in the operation of a teleprinter.

The secondary winding 12 of the transformer 10 has a condenser 13 connected there across. The secondary winding 12 and the condenser 13 are tuned substantially to resonance at the frequency of the incoming continuous waves. The energy from the secondary winding 12 is conveyed to a high-frequency voltage amplifier tube 14. As illustrated, the amplifier tube 14 comprises a plate 15, a cathode 16, a control grid 17, a screen grid 18 and a suppressor grid 19. The control grid 17 is connected to the upper terminal 26 of the secondary winding 12 of the transformer 10. The cathode 16 is connected through a carrier or high-frequency by-pass condenser 20 to the lower terminal 27 of the secondary winding 12. The cathode 16 is connected to ground or to a point of reference potential. The plate 15 is connected to the upper end of a primary winding 29 of an output or coupling transformer 28. The secondary winding 30 of the output transformer 28 has a condenser 31 connected there across. The condenser 31 and the secondary winding 30 constitute a tuned circuit which may be tuned substantially to resonance at a frequency substantially equal to the frequency of the incoming pulsed continuous waves. A condenser 32 is connected across the primary winding 29 of the output or coupling transformer 28. The condenser 32 and the primary winding 29 constitute a tuned circuit which may be substantially tuned to resonance at a frequency substantially equally to the frequency of the pulsed continuous waves. The lower end of the primary winding 29 is by-passed to ground for carrier-wave frequency through a condenser 33. The screen grid 18 is connected to ground for carrier-wave frequency through a screen-grid by-pass condenser 34. The screen grid 18 is connected

through a voltage dropping resistor 35 to the positive side of a high-voltage source indicated by the reference character 44. The operation of the amplifier tube 14 is such that it amplifies the pulsed continuous waves supplied thereto from the transformer 10. The amplified energy is supplied to the output or coupling transformer 28. The Figure 2 illustrates an example of a pulsed continuous wave having off and on periods producing alternate spacer and marker intervals for the transmission of intelligence, such, for example, as may be employed in a teleprinter communication system. The Figure 3 shows spurious discharges such as may be present in a pulsed continuous wave system of reception. The spurious waves are of an uncontrolled character and are of random wave shape. The Figure 5 illustrates the wave form obtained across the output transformer 28, showing the carrier wave frequency having an envelope that has a slight variation of amplitude due to attenuation during the marker intervals. During the spacer intervals, the wave form of the output will be very irregular, but in accordance with the envelope of the discharge-waves, which are of spurious and uncontrollable character.

In my invention, I provide for injecting untuned modulated discharge-waves of random wave shape into the pulsed continuous wave system. I preferably generate the discharge-waves by means of gaseous-discharge tube 40, comprising a plate 41, a cathode 42 and a grid 43 which may be connected to the cathode 42. The plate 41 of the gaseous-discharge tube 40 is connected to the positive side of the high-voltage source 44 through a circuit, beginning at the high-voltage source, which includes an isolating resistor 45, a conductor 46, a switch 47, and a plate load resistance 48 which is connected to the plate 41. The gaseous-discharge tube is so connected that, when the switch 47 is closed, it is under a state of continuous ionization, thereby producing high-frequency discharges such as represented by way of example in Figure 3.

The discharges from the gaseous-discharge tube 40 are amplified by means of an amplifier tube 51 comprising a plate 52, a cathode 53, a control grid 54, a screen grid 55 and a suppressor grid 56. The plate 41 of the gaseous-discharge tube is connected to the control grid 54 of the amplifier tube 51 through a coupling condenser 49. The control grid 54 is connected to ground through a grid resistor 57. The cathode 53 is by-passed for high frequency to ground through a condenser 61. The cathode 53 is connected to ground through a fixed cathode bias resistor 62 and an adjustable gain resistor 63. The screen grid 55 is connected to the positive side of the high-voltage source 44 through a screen grid voltage dropping resistor 59 and the resistor 45. The screen grid 55 is by-passed to ground for high frequency through a by-pass condenser 58. The plate 52 is connected to the positive side of the high-voltage source 44 through a plate load resistor 60 and the isolating resistor 45.

In my discharge generator circuit, I may provide for modulating the discharge-waves by a low-frequency generator, such as indicated by the reference character 67, which may be of any suitable design, such, for example, as a tone generator operating at a low frequency as compared to the frequency of the continuous waves. The output of the low-frequency generator 67 may be connected by means of a switch 70 to the suppressor grid 56 of the amplifier tube 51, whereby the output of the amplifier 51 produces a modulated wave such as illustrated, for example, in Figure 4 of the drawing. With the switch 70 open, the injected amplified discharge-waves have a random peaked envelope, such as shown in Figure 3. The suppressor grid 56 is connected to the cathode 53 through a high-frequency by-pass condenser 66. The plate 52 of the amplifier tube 51 is connected to the control grid 17 of the amplifier tube 14 through a coupling condenser 64. Therefore, the amplified energy of the amplifier tube 51 is injected into the pulsed continuous wave system, with the result that the output of the coupling or output transformer 28 produces pulsed continuous waves plus untuned modulated discharge-waves. The condenser 50, which is connected intermediate the plate load resistor 60 and the isolating resistor 45, is employed to by-pass discharge-waves to ground and prevent them from being transmitted to the amplifier tube 14 and the output transformer 28 through the conductor 68 which is connected to the positive side of the high-voltage source 44. Accordingly, the discharge-waves are injected into the pulsed continuous wave system only through the control grid 17. The amplifier tube 51 functions as an amplitude modulator for the discharge-waves produced by the discharge-tube 40 and the low-frequency waves produced by the low-frequency generator 67. The tube 14 functions as an amplifier for the continuous wave pulses and the gain of the tube 14 may be controlled by a bias source 69 which is connected to the cathode 16 through an isolating resistor 22.

The output from the secondary winding 30 on the output transformer 28 may be utilized in any limiter system. By the use of an output wave which comprises controlled injected interference-waves, I am able to provide improved discrimination in a limiter system for the reason that the proportional amount of interference energy has been made larger than what it would be if the spurious waves only were present. Heretofore, it has been difficult to discriminate in limiter systems between the pulsed continuous waves and the spurious uncontrolled discharge-waves. By the use of my invention, I add controlled discharge-waves of a steady character, whereby discrimination can be readily obtained in a limiter system between the pulsed continuous waves and the interference-waves, since the injected interference-waves represent a larger amount of energy which may be employed as a source of steady power for control purposes. In other words, the energy representing the interference-waves has been made larger and steadier, whereby they may be used as a means of control. Although I have shown and described my invention with a certain degree of particularity, it is understood that changes may be made therein without departing from the spirit of the invention which are included within the scope of claims hereinafter set forth.

I claim as my invention:

1. In combination, an amplifier-modulator for amplifying pulsed continuous waves having off and on periods producing alternating spacer and marker intervals, a gaseous-discharge wave generator for producing high frequency discharge-waves, a load responsive to said discharge-waves connected to said amplifier-modulator, and means for injecting the high-frequency discharge-waves into the said amplifier-modulator for producing in said load said high-frequency discharge-waves at least during the spacer intervals.

2. In combination, a first amplifier-modulator for amplifying pulsed carrier waves having off and on periods producing alternate spacer and marker intervals, a gaseous-discharge tube for producing high frequency discharge-waves, a load responsive to said discharge-waves connected to said first amplifier-modulator, a second amplifier-modulator, a low frequency generator, means for connecting the gaseous-discharge tube to the second amplifier-modulator whereby the second amplifier-modulator amplifies the high frequency discharge-waves, means for connecting the low frequency generator to the second amplifier-modulator for amplitude modulating the amplified discharge-waves, and means for applying the amplitude modulated discharge-waves to said first amplifier-modulator for producing in said load high frequency discharge-waves at least during the spacer intervals.

3. In combination, a pulsed continuous wave system having a first amplifier-modulator tube including at least a grid, a gaseous-discharge tube for producing high frequency discharge-waves, a load responsive to said discharge-waves connected to said first amplifier-modulator tube, a second amplifier-modulator tube for amplifying the high frequency discharge-waves produced by the gaseous-discharge tube, said second amplifier-modulator tube having an output plate circuit, and means for connecting the output plate circuit to the grid of the first amplifier-modulator tube for injecting amplified high frequency discharge-waves into the pulsed continuous wave system.

4. In combination, a pulsed continuous wave system having a first amplifier-modulator tube including at least a grid, a gaseous-discharge tube for producing high frequency discharge-waves, a load responsive to said discharge-waves connected to said first amplifier-modulator tube, a second amplifier-modulator tube for amplifying the high frequency discharge-waves produced by the gaseous-discharge tube having an output plate circuit, means for connecting the output plate circuit to the grid of the first amplifier-modulator tube for injecting amplified high frequency discharge waves into the pulsed continuous wave system, said second amplifier-modulator tube having a grid, a low frequency generator, and means for connecting the output of the low frequency generator to the grid of the second amplifier-modulator tube thereby producing amplitude modulated discharge-waves in the plate output circuit of the second amplifier-modulator tube.

5. In a reception system for pulsed continuous waves having on and off periods producing alternate marker and spacer intervals, input means for receiving said pulsed continuous waves, a gaseous-discharge tube for producing an output voltage of random frequencies and amplitudes, an amplifier tube having a grid, means for applying the output of said gaseous-discharge tube to said grid, an amplifier-mixer tube having an output and first and second grids, a load connected to the output of said amplifier-mixer-tube, means for applying the pulsed continuous waves from said input means to said first grid of said amplifier-mixer tube, and means for applying the output of said amplifier tube to the second grid of said amplifier-mixer tube to thereby produce in said load a random wave during said spacer intervals and predominantly said pulsed continuous waves during said marker intervals.

6. In a reception system for pulsed continuous waves having on and off periods producing alternate marker and spacer intervals, input means for receiving said pulsed continuous waves, a gaseous discharge tube for producing an output voltage of random frequencies and amplitudes, a first amplifier-mixer tube having first and second grids, means for applying the output of said gaseous-discharge tube to said first grid, a low frequency generator having an output, means for applying the output of said low frequency generator to said second grid of said first amplifier-mixer tube to thereby produce a modulated envelope of the random discharge waves, a second amplifier-mixer tube having an output and first and second grids, a load connected to the output of said second amplifier-mixer tube, means for applying the pulsed continuous waves from said input means to said first grid of said second amplifier mixer tube, and means for applying the output of said first amplifier-mixer tube to the second grid of said second amplifier-mixer tube to thereby produce in said load a random wave during said spacer intervals and predominantly said pulsed continuous waves during said marker intervals.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,212,240	La Landle et al.	Aug. 20, 1940
2,227,596	Luck	Jan. 7, 1941
2,380,959	Frankel	Aug. 7, 1945
2,416,307	Grieg	Feb. 25, 1947

FOREIGN PATENTS

Number	Country	Date
637,949	France	May 11, 1928