Jan. 30, 1940. L. E. NORTON 2,188,611

IMPULSE GENERATOR

Filed June 18, 1938

FIG. 1.

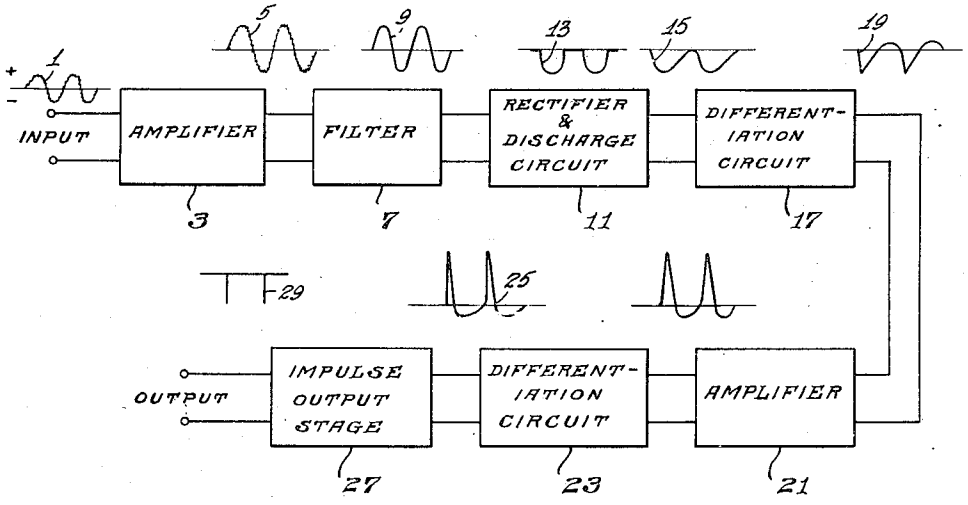
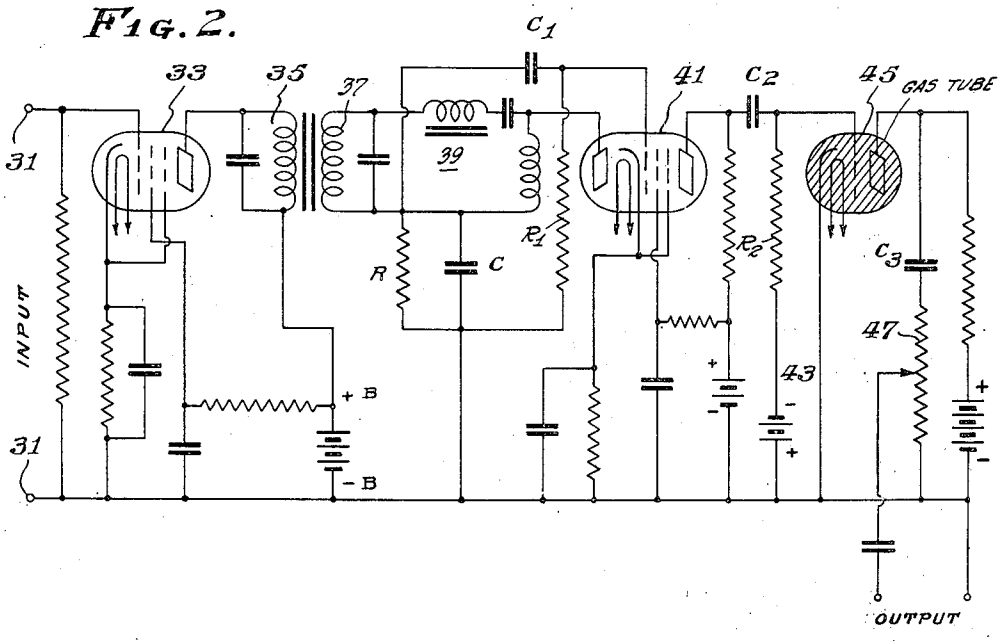


FIG. 2.



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IMPULSE GENERATOR

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7 Claims. (Cl. 250—36)

This invention relates to impulse generators and more specifically to impulse generators in which sinusoidal currents are applied to the input of the generator and sharply defined impulses, having a fixed phase with respect to the sinusoidal currents, are obtained in the generator output.

One of the applications of this invention is described in the copending application entitled "Continuously indicating radio compass", Serial No. 216,825, filed June 30, 1938, by David G. C. Luck, and assigned to the same assignee as the instant application. In the above-mentioned copending application, currents of sine wave form are derived from a rotating radio field. The phase of the field is determined by converting the derived sine wave currents into sharply defined impulses, which have a fixed phasal relation to the sine waves, and indicating the phase of the impulses with respect to a reference phase.

One object of this invention is the provision of means in which sharply defined impulses are generated from sine wave currents. Another object is to provide means for generating sharply defined impulses having fixed phasal relations with respect to the sine waves from which the impulses are generated. A further object is to provide means whereby sine wave currents may be rectified, the rectified currents made asymmetrical, the asymmetrical currents once or twice differentiated, and the differentiated currents applied to a gaseous discharge tube from which impulse currents are derived.

In describing the invention, reference will be made to the accompanying drawing in which:

Figure 1 is a block diagram illustrating the invention; and

Figure 2 is a schematic circuit diagram of one embodiment of the invention.

Referring to Fig. 1, currents of sine wave form 1, which may include undesired frequencies, are applied to the input of an amplifier 3. The amplified currents 5 are applied to a filter 7, which passes currents of the sine wave 9 desired. The sine wave currents are applied to a rectifier 11, which preferably is of the half wave type although full wave rectification may be used. The rectified currents 13 are applied to a discharge circuit having a time constant, which makes the wave form of the currents 15 asymmetrical. The currents of asymmetrical wave form are applied to a differentiation circuit 17. The term differentiation is used in the mathematical sense; i. e., the process of finding the derivative of a given function. The derivation of a function is the limiting value of the ratio of the increment of the function to the increment of the variable, as the latter increment approaches zero. Briefly the circuit derives the differential of the applied current, or the voltage derived depends upon the rate of change of the applied current. The negative portions 19 of the differentiated currents are of larger amplitude and more sharply defined than the positive portions. The differentiated currents may be applied to any amplifier 21 for further amplification, and thereafter applied to a second differentiation circuit 23. The amplifier, if it is a single stage, will reverse the phase of the applied currents. The last mentioned differentiated currents 25 have positive peaks which are quite sharply defined. The impulse output stage 27 is so negatively biased that only the upper portions of the positive peaks 25 are effective. The small negative swings may be neglected because C_3 discharges through resistance 47 only on positive grid swings to tube 45. The output currents 29 are very sharply defined negative impulses which have the same phasal relation as the sine wave input currents. Output currents 29 could also be sharply defined positive impulses by placing discharge resistance 47 in cathode circuit.

One practical embodiment of the invention is illustrated in Fig. 2. The input circuit 31 is connected to a thermionic amplifier 33. The output of the amplifier 33 includes a tuned circuit 35 which is resonant to signal currents of the desired frequency. The resonant circuit 35 is coupled to a second resonant circuit 37. The pair of circuits and a series circuit 39 form a filter which attenuates currents of undesired frequencies. The filter is connected to the diode section of a thermionic tube 41. The diode is connected to a discharge circuit including a resistor R and a capacitor C. The values of the constants C and R and the diode rectifier impedance are so related that the rectified currents have an asymmetrical form.

The discharge circuit CR is connected to the amplifier input section of the thermionic tube 41. The input section of the amplifier tube 41 includes a differentiating circuit which consists of a capacitor C_1 and a resistor R_1. The output circuit includes a second differentiating circuit C_2R_2. One terminal of the resistor R_2 is connected to a source of negative bias voltage 43. The positive terminal of the source 43 is connected to the cathode of a gaseous discharge tube 45. The junction of the capacitor C_2 and the resistor R_2 is connected to the grid of the

gaseous discharge tube 45. The output of the tube 45 includes a potentiometer 47 across which the output impulses are obtained.

Thus an impulse generator has been described in which sine wave currents are amplified, filtered and applied to a rectifier. The asymmetrical currents from the rectifier discharge circuit are differentiated, amplified and, if desired, again differentiated. These differentiated currents trigger a gaseous discharge tube. The output circuit of the discharge tube includes sharply defined impulse currents of the same phasal relation as the sine wave currents. If the input currents are of sufficient amplitude and of sufficiently pure sine wave form, the initial steps of amplifying and filtering may be omitted. Likewise, in some applications one differentiation may be used in place of two.

I claim as my invention:

1. The method of generating sharply defined impulses by means of a gaseous discharge device which includes rectifying sine wave currents, altering the wave form of the rectified currents to produce an asymmetrical wave form, differentiating said currents of asymmetrical wave form, applying said differentiated currents to said gaseous discharge device to establish therein gaseous discharge currents, and deriving therefrom sharply defined impulses.

2. The method of generating sharply defined impulses by means of a gaseous discharge device which includes rectifying sine wave currents, altering the wave form of the rectified currents to produce an asymmetrical wave form, differentiating said currents of asymmetrical wave form, amplifying said differentiating currents, applying said differentiated currents to said gaseous discharge currents device to establish gaseous discharge currents, and deriving therefrom sharply defined impulses.

3. The method of generating sharply defined impulses which includes rectifying sine wave currents, altering the wave form of the rectified currents to produce an asymmetrical wave form, differentiating said currents of asymmetrical wave form, amplifying said differentiating currents, further differentiating said amplified currents, establishing a gaseous discharge current as a function of said amplified differentiated currents, and deriving therefrom sharply defined impulses.

4. The method of generating sharply defined impulses which include amplifying sinusoidal currents, filtering said amplified currents, rectifying said amplified currents, altering the form of the rectified currents, differentiating said last mentioned currents, amplifying said differentiated currents, further differentiating said amplified differentiated currents, establishing gaseous discharge currents as functions of said last mentioned differentiated currents, and deriving from said discharge currents sharply defined impulse currents.

5. An impulse generator including, in combination, a source of sine wave currents, means for rectifying said currents, means including a discharge circuit for making the wave form of the rectified currents asymmetrical, means including a circuit for differentiating said currents of asymmetrical wave form, a gaseous discharge tube, means for applying said differentiated currents to said tube, and means including connections in the output circuit of said tube for deriving therefrom sharply defined impulses.

6. An impulse generator including, in combination, a source of sine wave currents, means for rectifying said currents, means including a discharge circuit for making the wave form of the rectified currents asymmetrical, means including a circuit for differentiating said currents of asymmetrical wave form, an amplifier connected to said differentiating circuit, a gaseous discharge tube, means for applying said amplified differentiated currents to said tube, and means including connections in the output circuit of said tube for deriving therefrom sharply defined impulses.

7. In a device of the character of claim 6, means for further differentiating said amplified differentiated currents.

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