

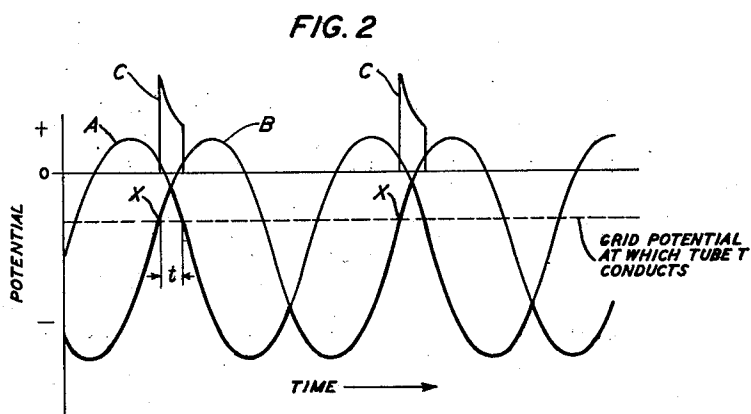
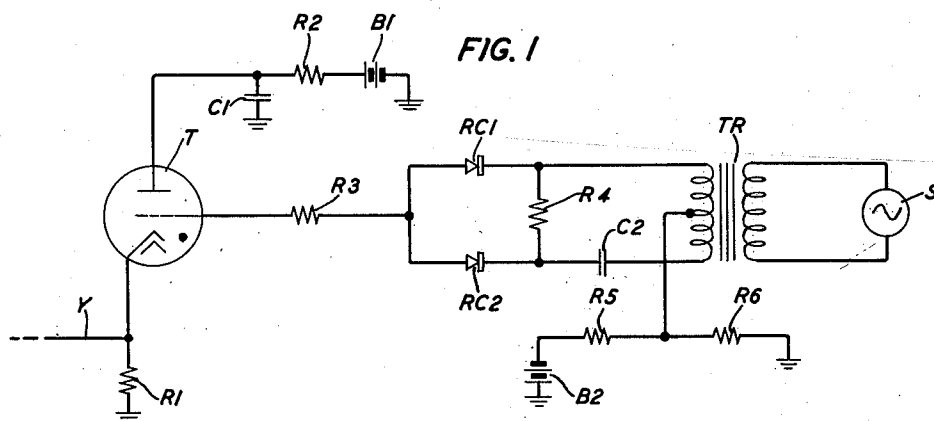
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PULSING CIRCUIT

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PULSING CIRCUIT

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2 Claims. (Cl. 250—27)

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This invention relates to pulsing circuits.

The present application is a division of our copending application Serial No. 670,358 filed May 17, 1946, which issued as Patent No. 2,484,612 on October 11, 1949, and which relates to identifying systems actuated by impulses, including therein a novel pulsing circuit which is the subject of the present application.

Identifying systems of the character disclosed in our above-mentioned application and many other systems require, for their actuation, repetitive impulses at regular intervals. Such systems are often capable of responding to impulses of extremely short duration and close spacing. For maximum economy in the time of operation, it is desirable that the impulses be as short, and the intervals between them as small, as can be tolerated by the responsive devices to which they are applied. The present invention discloses a new and novel means whereby impulses may be automatically produced at regular intervals, and both the duration of the impulses and the intervals between them may be made as short as, or even shorter than, can be accepted by known responsive devices.

A feature of the invention is a gas discharge device actuated by two alternating potentials nearly, but not quite, 180 degrees out of phase, produced from a single alternating-current source.

Another feature of the invention is a means whereby a discharge device is actuated by the more negative of two alternating potentials differing in phase.

Another feature of the invention is the employment of rectifying means for selecting portions of the alternating-potential waves for application to the discharge device.

Still another feature of the invention is a means whereby the two alternating potentials have greater negative amplitude than positive amplitude, which results in very short periods of actuation of the discharge device.

Another feature of the invention is a means for self-suppression of the conduction in the discharge device to shorten the intervals during which said device conducts.

The features, construction, and operation of this invention will be apparent from the description which follows, the appended claims, and the drawing, in which:

Fig. 1 shows the pulsing circuit; and

Fig. 2 is a graph of potentials in the circuit plotted against time.

The pulsing circuit, shown in Fig. 1, comprises a three-element gas discharge tube T, which may be of any suitable type. The cathode of this tube is connected to ground through resistor R1 and the anode is supplied with positive potential, normally sufficient to cause the tube to conduct

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over a circuit extending from battery B1 through resistor R2, the anode-cathode space of said tube, and resistor R1 to ground. The anode is also connected to one pole of capacitor C1, the other pole of said capacitor being grounded.

The control grid of tube T is connected through resistor R3 to one pole of each of the two rectifiers RC1 and RC2, which may be of any suitable type. These rectifiers are poled to oppose passage of positive currents to the control grid of tube T. The other poles of the two rectifiers RC1 and RC2 are joined by resistor R4 which, with capacitor C2 in series therewith, is connected across the left-hand winding of the transformer TR. The right-hand winding of said transformer is supplied with alternating-current from the source S. Resistors R5 and R6 are connected in series across the poles of battery B2 and to the mid-point of the left-hand or secondary winding of transformer TR to provide, at the junction of said resistors, a suitable negative direct current bias potential for the grid of tube T over the upper half of the secondary winding of transformer TR, rectifiers RC1 and RC2, resistor R3, to the grid of said tube.

The negative potential at the junction of resistors R5 and R6, transmitted through the upper half of the left-hand winding of transformer TR, rectifier RC1, and resistor R3, to the grid of tube T, prevents conduction in said tube until the latter is permitted to conduct, as described later. With tube T non-conducting, capacitor C1 is, therefore, charged to the potential of battery B1. Alternating-current from the source S in the right-hand winding of transformer TR induces corresponding alternating potential in the left-hand winding of said transformer. This alternating potential is applied directly to rectifier RC1 from the upper terminal of the left-hand winding of transformer TR. It is also applied, from said terminal, to rectifier RC2 but, in this case, through resistor R4. Succeeding cycles of alternating-current in the left-hand winding of transformer TR charge, and recharge in the opposite polarity, capacitor C2 through resistor R4. The charging of capacitor C2 through resistor R4 requires time, so that current, being diverted from rectifier RC2 for the charging of capacitor C2, the change of potential at rectifier RC2 is delayed relative to the change at rectifier RC1. This results in a shift of phase at rectifier RC2 relative to the phase at rectifier RC1. The amount of this phase shift depends upon the values of capacitor C2 and resistor R4. By suitable choice of the elements R4 and C2, this delay may be made anything from zero to one-half cycle of the alternating-current. The negative potential available at the junction of resistors R5 and R6 combines with these alternating potentials to produce alternating poten-

tials at the rectifiers RC1 and RC2 which have greater negative amplitude than positive amplitude relative to ground. It is a property of rectifier networks that the potential at the common point of the rectifiers will be substantially equal to the most negative of the potentials applied to the free terminals thereof. It will be observed that the most negative voltage resulting from a combination of two sine waves nearly but not quite 180 degrees apart will rise to a value more positive than the zero axis of said waves, as shown by the heavy line in Fig. 2. In said figure, the "O" axis of the sine waves above the O axis of the waves indicates the potential supplied from battery B2 through the voltage dividers R5 and R6. In Fig. 2, curve A represents the resulting potential at the right-hand terminal of rectifier RC1 and curve B the resulting potential at the right-hand terminal of rectifier RC2.

Due to the poling of the rectifiers RC1 and RC2, the potential applied to resistor R3 will be substantially equal to the most negative value of the potentials applied to the right-hand terminals of the rectifiers. The potential at said control grid is, therefore, the resultant of the two potentials transmitted through rectifiers RC1 and RC2, respectively, and is represented by the heavy curve in Fig. 2. It will be observed, in this figure, that the phase shift, described above, has been made such by an appropriate choice of the elements R4 and C2 that the resultant potential at the control grid of tube T (represented by the heavy curve) rises, at each cycle of alternating-current, above the grid potential at which tube T conducts (said potential being represented by the dashed line). It also rises above the potential supplied by the potentiometer bias at the common terminal of resistors R5 and R6. This would not be the case if rectifiers RC1 and RC2 were perfect rectifiers since in such a case the leakage currents in the back direction would not exist. At each of the points X, tube T, therefore, conducts over the previously described circuit from battery B1 through resistor R2, the anode-cathode space of tube T, and resistor R1 to ground. Conductor Y thereupon suddenly becomes positive due to the potential drop in resistor R1. The potential drop in resistor R2 also lowers the potential at the anode of tube T and capacitor C1 discharges through the anode-cathode space of tube T and resistor R1 to ground, maintaining, for a short time, the conduction in tube T and the potential on conductor Y. As said capacitor discharges, however, its discharge potential falls until, because of the potential drop in resistor R2, the anode potential of tube T is insufficient to maintain conduction in said tube, which is thereby extinguished, causing the potential on conductor Y suddenly to fall to zero. As shown by the heavy curve in Fig. 2, the potential of the control grid of tube T also thereafter becomes more negative, preventing conduction in said tube until it is again actuated by potential applied to its control grid through rectifiers RC1 and RC2.

It will be observed that tube T starts to conduct at point X in Fig. 2 and that the conduction is due to potential on the control grid of said tube transmitted through rectifier RC2 and represented by curve B. This is, at the indicated moment of time, the more negative of the potentials represented by curves A and B. The two potentials represented by these curves are applied through

the rectifiers and resistor R3 to the control grid, but they are not additive and the potential of said control grid is always that of the more negative of the two potentials, as shown by the heavy curve in Fig. 2. The potential applied to the control grid of tube T (heavy curve) exceeds the grid potential at which said tube conducts, during the time t . For a given rise of potential (heavy curve) above the conduction level (dashed line), the steeper the curves A and B are at the points where they cross the dashed line, the shorter is the time t . Assuming curves A and B to be of sine-wave form, time t is, therefore, shortened by the greater negative than positive amplitude of the potentials represented by curves A and B.

By this arrangement, conductor Y is thus periodically energized during intervals which may be made, by an appropriate choice of the elements of the circuit, as short as desired, consistent with the characteristics of tube T. The potential on conductor Y is represented at C in Fig. 2. The repetition rate is, of course, the frequency of the alternating-current source S and may be made any desired rate by choice of a suitable source.

Such very short, repeated pulses are admirably adapted for the actuation of a wide range of electronic and other devices. Conductor Y may be connected to actuate or control such devices in any suitable manner.

While we have illustrated our invention by one embodiment thereof, it will be evident to those skilled in the art that other arrangements than the one shown may equally well be used, without departing from the spirit of the invention as defined by the appended claims.

What is claimed is:

1. A pulse generator comprising a source of alternating potential, means responsive to said alternating potential for producing two alternating potentials having a phase difference of less than 180 degrees and having greater negative than positive amplitude, rectifying means responsive to the negative half cycles of said two alternating potentials, means responsive to said rectifying means for producing pulses, and means responsive to said pulse producing means for suppressing a part of each of said pulses.

2. A pulse generator comprising a source of alternating potential, means responsive to said alternating potential for producing two alternating potentials having a phase difference of less than 180 degrees and having greater negative amplitude than positive amplitude, responsive rectifying means for transmitting the most negative portions of said two alternating potentials, means responsive to the more positive of said transmitted potentials for producing pulses, and means responsive to said pulse producing means for suppressing a part of each of said pulses.

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