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THERMIONIC TRIGGER DEVICE

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Fig. 1

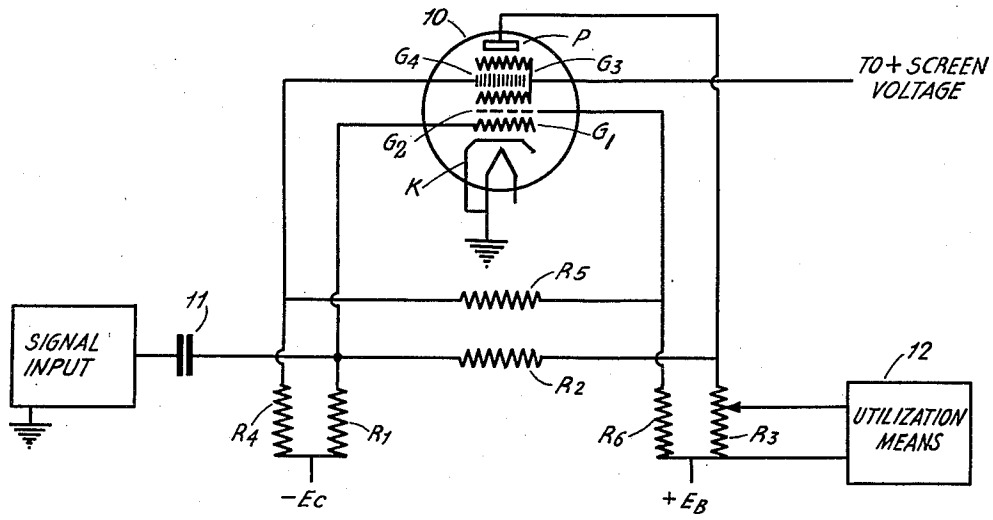
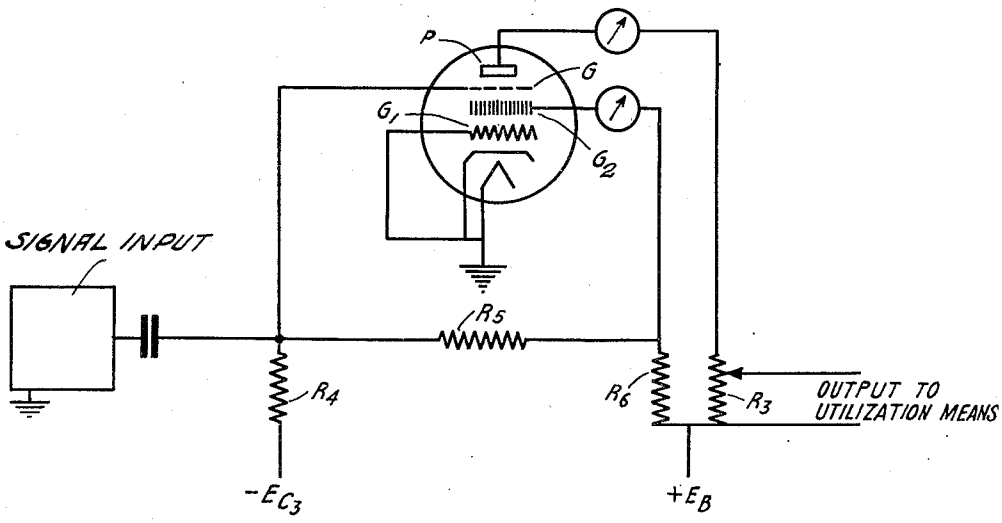


Fig. 2



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THERMIONIC TRIGGER DEVICE

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6 Claims. (Cl. 178—70)

This invention comprises an improved thermionic trigger device for assuming either of two conditions of electrical stability in response to signal impulses.

The trigger device commonly known and used in the communication field comprises a pair of three-electrode thermionic valves each valve of which has its anode cross coupled to the control electrode of the associated valve so that the entire device has two degrees of electrical stability. In the operation of such a device there is a predetermined maximum anode current flow in one of the valves and a predetermined minimum anode current flow in the other valve, or the reverse, the change being controlled by potentials from the signal impulses applied to the input terminals of the trigger. To make the circuit unstable, the anode of each valve is connected to the control electrode of the other valve so that when a signal impulse of one polarity causes a change in the anode current and, therefore, in the anode potential of one of the valves, this change is immediately augmented by the consequent changes in the control electrode and anode potentials in the other of the valves. As a consequence, the valves are held at unequal bias until a signal impulse of opposite polarity is received which causes the condition of the bias to be reversed. Such an arrangement is described in U. S. Patent 1,844,950, granted February 16, 1932 to J. L. Finch, to which reference is made for a more detailed description of the two thermionic valve trigger device.

The present invention provides a more simple and inexpensive thermionic trigger device than those heretofore used and, in brief, comprises a circuit involving a single valve containing a plurality of control electrodes and a plurality of anodes. The novel features and advantages of the invention are more fully disclosed in the subsequent detailed description having reference to the accompanying drawing, in which Figure 1 illustrates a preferred embodiment of the invention as applied to a telegraph circuit, and Figure 2 a modification thereof.

In Figure 1 is shown a thermionic trigger device comprising a multi-electrode valve 10 having one of its grid electrodes coupled through blocking condenser 11 to any suitable input circuit to which signal impulses are applied, and having its output electrode coupled to any suitable utilization circuit such as a printer, recorder or telegraph transmitter circuit. Inasmuch as the improved trigger device of the invention is applicable to the same circuits as the trigger devices of the past and in a similar manner, it will be understood that the utilization circuit 12 may comprise an element in either a transmitter or a receiver circuit. For examples of different applications of trigger devices in communication circuits, reference is made to U. S. Patents 1,844,950, granted February 16, 1932 to J. L. Finch; 1,822,000, granted September 8, 1931 to L. L. Young; 1,901,951, granted March 21, 1933 to C. R. Dunham, et al.; 1,995,181, granted March 19, 1935 to A. Kahn, and U. S. application Serial No. 660,366, filed March 11, 1933 by J. L. Callahan et al.

Thermionic valve 10 is shown in Fig. 1 as a five electrode or so-called pentagrid tube having a cathode K, first and second grids G1 and G2, respectively, a screen grid G3, another grid G4 and an anode P. In the circuit herein employed, G1 and G4 are used as control grids and G2 as a grid-like anode; grid G3 acts to accelerate the electron stream and also to shield G4 from the first two grids. A source of negative bias potential —EC supplies the control grids G1 and G4 with suitable potentials through resistances R1 and R4, respectively. Similarly, a source of positive potential +EB supplies the grid-like anode G2 and the anode P with suitable potentials through resistances R6 and R3, to which there is connected utilization means 12. For aiding in effecting a change in the stability of the device and in order to augment any change in bias potential on the electrodes due to the occurrence of a signal impulse there are provided resistances R5 and R2 which interconnect the anode electrodes G2 and P respectively with the grid electrodes G4 and G1.

From the foregoing, it will be seen that the resistance network is similar in design to the network employed in the two thermionic valve trigger device.

The values of the sources of potential —EC and +EB and of the resistors are so chosen that normally when no signal impulse is being received, grid G1 functions to partially block the electron stream emanating from the cathode K so that the number of electrons passing through this grid is of the order of, let us say, half the number as when G1 is slightly positive. The electrons passed by G1 reach grid-like anode G2 and cause a current to flow through resistance R6 which is in circuit with source +EB. The values of resistances R5 and R4 connecting the grid-like anode terminal of G2 to source —EC are such that the fall in potential in R6 due to the flow of current therein will cause grid G4 to

pass substantially the remainder of the electron stream to anode P and thus enable current to obtain in R3 which is in circuit with utilization means 12. Resistances R1 and R2 are of such value that the flow of current in R3 and the consequent potential changes do not affect the bias of grid G1 under the conditions outlined above.

The receipt of a signal impulse, however, over condenser 11 of such polarity as to make the grid G1 positive will cause more electrons to be collected by the grid-like anode G2 and greater current to flow in R6; consequently engendering a greater fall of potential in R6. The bias of G4 which is connected to R6 through R5 will thus be changed to a more negative potential whereby there is obtained a decrease in the number of electrons reaching anode P, a condition which augments the change and thus further increases the positive potential on G1. More current will now flow in R6 until either the current taken by grid-like anode G2 reaches saturation or until the current in anode P ceases completely. The grids G1 and G4 are now biased unequally and there is a predetermined maximum anode current in G2 and a predetermined minimum anode current in P, a condition which will continue until an impulse of negative polarity is received over the input circuit through condenser 11 at which time the potential conditions of the grids G1 and G4 and the currents in the anodes G2 and P will reverse. The receipt of such a pulse which makes the grid G1 negative will cause a decrease in the number of electrons reaching anode G2 and thus a decrease in the flow of current in R6; consequently there will be a decrease in the fall of potential in R6 and an increase in the application of positive potential from +EB through R6 and R5 upon grid G4 which, in turn, will attract more of the electrons passing through the grid G1 and thus enable current to flow through R3. It will be apparent, of course, from the foregoing that the current in R6 will reach a predetermined minimum, but will never cease completely since a condition of this sort will prevent the flow of any current to anode P. Each condition of electrical stability, it is to be understood, continues until changed by the occurrence of a signal impulse having a polarity opposite to that of the previously received impulse, hence, the name "locking circuit" which is usually applied to these trigger devices.

Utilization means 12 will, of course, respond to these changes in electrical stability of the trigger device, more specifically, to the changes in the anode current flow and in the anode potentials of G2 and P, either to record the signals on suitable apparatus or else to transmit the signals to a distant receiver.

Figure 2 illustrates a modification of the invention as applied to a different type of thermionic valve wherein the first grid G1 is permanently connected to the cathode so as to be at ground potential and the positive screen is dispensed with. The operation of this embodiment is as follows:

A positive impulse applied to the input causes the grid G to become slightly positive and thereby enables that part of the electron stream which has passed through G2 to be attracted by the positive potential on anode P. Since the electrons in the space beyond G2 have now been given a path to anode P, they will continue their travel to that plate in preference to reversing their direction and returning to G2 as they would do if G were at a negative potential. Thus, of the total electron stream, a portion only reaches G2 and passes down through R6, thereby decreasing the current flow and the consequent IR drop in R6, due to the fall in potential therein, as a result of which the junction point between R5 and R6 becomes more positive, and through the medium of the voltage divider R4, R5 enables the potential of G to go further positive. When a negative impulse is applied through the input to G the electrons are partially turned back from anode P and are attracted by the positive potential on G2, thus causing an increase in the current in that circuit and an increase in the resultant IR drop across R6. This then produces a further decrease in bias on G until the electrons have been completely cut off from P and all return to G2, thus giving the resultant condition of maximum stable current in this circuit.

As a practical example, the resistances of figures may have the following numerical values:

R4	500,000 ohms
R5	150,000 ohms
R6	250,000 ohms
R3	5,000 ohms

It will thus be seen that there is obtained in Figure 2 the same type of action as in Figure 1 with a much simpler circuit due to the omission of a number of resistor elements.

I claim:

1. In an electron discharge device having a cathode, a first grid, an anode in the form of a grid, a second grid and another anode all within a single envelope, the method of operation which comprises biasing said grids so that a predetermined maximum current flows in one of said anodes and a predetermined minimum current flow in the other anode and applying a momentary potential to one of said grids whereby there is caused a predetermined minimum current flow in said one anode and a predetermined maximum current flow in said other anode.

2. In combination, an electron discharge device comprising a cathode, a first grid, another grid, an anode in the form of a grid intermediate said two grids and another anode farthermost removed from said cathode all within a single container, means for applying positive potentials to said grid-anode and said other anode with respect to said cathode, resistances located between said anodes and said means, means for suitably biasing said first grid and said other grid, a resistance interconnecting one of said last grids with one of said anodes whereby the application of a potential to said one grid due to a signal impulse causes a change in current flow in its associated anode which is augmented by a potential change occurring across said interconnecting resistance, signal input means, connections from said cathode and said one grid respectively to said signal input means, and utilization means in circuit with said first resistances.

3. In combination, an electron discharge device comprising a cathode, a first grid, another grid, an anode in the form of a grid intermediate said two grids and another anode farthermost removed from said cathode all within a single container, means for applying positive potentials to said grid-anode and said other anode with respect to said cathode, resistances located between said anodes and said means, additional means for supplying said first grid and said other grid with bias potentials, a resistance individual to

each of said anodes and interconnecting an anode with one of said other grids whereby the application of a potential to one of said last grids due to a signal impulse causes a change in current flow in its associated anode which is augmented by a potential change occurring across the interconnecting resistance which is in circuit with said last anode and the other grid, signal input means, connections from said cathode and said one grid respectively to said signal input means, and utilization means in circuit with said first anode resistances.

4. In combination, an electron discharge device comprising a cathode, a first grid, another grid, an anode in the form of a grid intermediate said two grids and another anode farthermost removed from said cathode all within a single container, means for applying positive potentials to said grid-anode and said other anode with respect to said cathode, resistances located between said anodes and said means, additional means for supplying said first grid and said other grid with bias potentials, a resistance interconnecting one of said last grids with one of said anodes whereby the application of a potential to said other grid due to a signal impulse causes a change in current flow in the system which is augmented by a potential change occurring across said interconnecting resistance, signal input means, connections from said cathode and said other grid respectively to said signal input means, and a utilization circuit coupled to said anode resistances.

5. In combination, an electron discharge device comprising a cathode, a first grid, another grid, an anode in the form of a grid interposed between said two grids and another anode farthermost removed from said cathode, a screen grid shielding said other grid and located between said two anodes, all within a single container, a source of negative potential, individual resistors connecting said first and other grid to said source of negative potential, a source of positive potential and individual resistors connecting said grid-anode and said other anode to said last source, a resistor connecting said first grid with said other anode, and a resistor connecting said other grid with said grid-anode, a signal input circuit, connections from said cathode and one of said two grids to said signal input circuit, and a utilization circuit coupled to said anode resistors which are located between said source of positive potential and said anodes.

6. In combination, an electron discharge device comprising a cathode, a first grid adjacent said cathode, a second grid, a grid-anode intermediate said two grids, and another anode farthermost removed from said cathode, all within a single container, a connection from said first grid to said cathode, means for biasing said second grid negative with respect to said cathode, a source of potential for applying positive potentials of said grid-anode and said other anode with respect to said cathode, a resistance between each of said anodes and said source of potential, utilization means coupled to one of said resistances, an impedance interconnecting said second grid and said grid-anode, and means for applying signal impulses to said second grid.

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