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SWITCHING DEVICE

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Fig. 1.

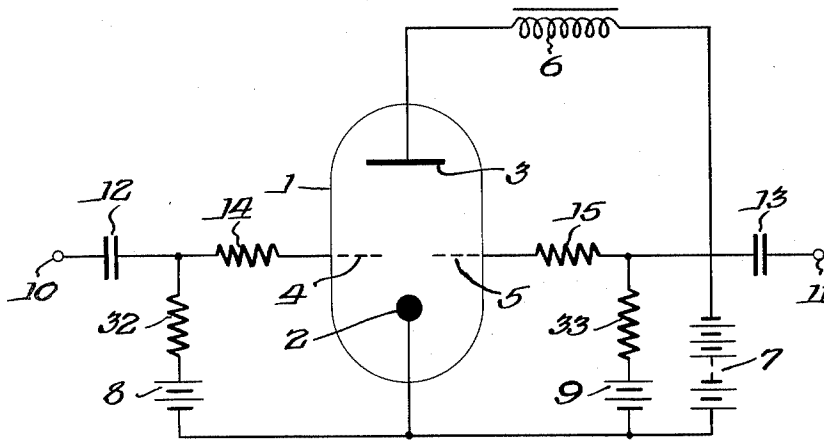
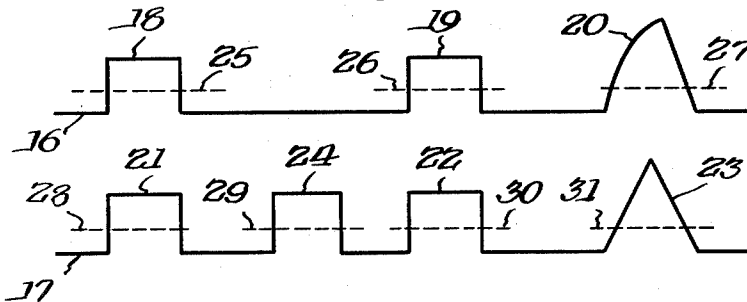


Fig. 2.



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SWITCHING DEVICE

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Claims priority, application Germany November 29, 1950

2 Claims. (Cl. 315—168)

This invention is concerned with a switching device comprising a discharge tube having a plurality of identical control grids and associated resistors for causing the tube to become conductive only responsive to the cathode potential on both control grids.

There are many instances in the switching art, which require tubes operating in the nature of valves which are to be controlled by impulses. It is desired, in circumstances in which a plurality of impulses are conducted to the control electrodes of a tube, to cause such tube to become conductive only in the simultaneous presence of impulses of several impulse series.

The invention solves this problem by the provision of a discharge tube equipped with two or more control electrodes, and comprising circuit means for separately conducting to the control electrodes the potentials which initiate the ignition of the tube. For example, if two separate impulse series are delivered to two separate control electrodes, the tube will become conductive only when two impulses occur simultaneously. There are provided for this purpose, in accordance with the invention, control electrodes of identical value, which are so constructed and arranged for co-operation with limiting elements that the tube is, by negative bias potentials, normally nonconductive (or extinguishes after having become conductive), and that the ignition of the tube is obtained by simultaneously connecting to all the control electrodes potentials higher than required for cancelling the negative bias thereof. The limiting elements limit the potentials of the control electrodes to a value which approximately corresponds to the cathode potential.

The invention will now be described with reference to the accompanying drawings, in which—

Fig. 1 is a circuit diagram illustrating an example of the invention; and

Fig. 2 shows curves to represent the action of certain limiting resistors of Fig. 1.

The circuit shown in Fig. 1 represents an example of the use of a tube which readily permits explanation of the operation thereof. The invention, however, is not limited to the example shown, as it may be used for numerous other switching and control purposes, especially in the telephone art in which potentials may be used having a different time sequence than simple series of impulses.

The tube is indicated by numeral 1. It is provided with a cathode 2 and an anode 3. The tube may contain additional electrodes which have not been shown, to keep the drawing simple. The elements which are essential for the invention are the control electrodes, for example, two identically constructed control grids 4 and 5. The electrical response of these control grids is identical. This means that approximately identical potentials are required on both grids to cause the tube to fire and to extinguish and hold it inoperative, respectively. The arrangement is such that both grids must be brought approximately to cathode potential by negative bias thereon.

In order to satisfy these requirements, the grids, as seen

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in the direction of discharge, may be disposed serially with small spacing therebetween and may have substantially identical operating response. It is, however, more favorable to dispose the grids one next to the other, especially in telescoping relation, in such a manner that the individual electrode elements are interlaced in comblike fashion.

Numeral 6 indicates a device controlled by the tube 1 in the anode output circuit thereof, and 7 is the source of anode potential. Negative bias potentials are conducted to the two control grid electrodes 4 and 5 from the sources 8 and 9 so as to hold the tube normally inoperative.

The control potentials are placed on the terminal contacts 10, 11 and are connected with the control grid electrodes, either directly or by way of suitable capacitors 12 and 13. Ahead of the two control electrodes are the resistors 14 and 15 which provide for the previously mentioned limiting functions. These resistors prevent a disconnect control in the positive range and thereby cause additionally a control which is independent of the amplitude and curve form of the control or trigger impulses.

The limiting operation is indicated in Fig. 2. There are assumed to be two impulse series 16 and 17. In the impulse series 16 there are three successive impulses 18, 19 and 20. In the impulse series 17 there are four successive impulses 21, 22, 23 and 24. Three of these impulses, namely, the impulses 21, 22 and 23, are in register with the impulses 18, 19 and 20 of the impulse series 16 which occur simultaneously therewith. There is no impulse in the series 16 which corresponds to the impulse 24 in the series 17, so that no firing of the tube would occur at this instant, it being of course assumed that the two impulse series are fed to the circuit, Fig. 1, by way of the terminals 10, 11. The tube will ignite in the three remaining instances where impulses of the two series coincide.

The limiting resistors 14 and 15 limit the amplitude of the impulse voltage always to a value which is indicated in Fig. 2 by the dotted lines 25, 26, 27 and 28, 29, 30, 31. It will be noted that the amplitude and the form of the original impulses thus become immaterial. In the case of the impulses 20 and 23, the width at the base thereof will be controlling.

Fig. 1 also shows resistors 32 and 33 in the biasing circuits of the control grids. These resistors are so dimensioned that the impulse voltages are thereby loaded as little as possible.

The illustrated embodiment provides only two control electrodes, but it will be understood that additional such electrodes may be provided in order to carry out control operations depending on three or more criteria.

Suitable and known means—omitted from the drawing to keep it simple—may be provided for extinguishing the tube, for example, means such as described in "Wave Forms" 1949, McGraw-Hill Book Company, New York, pages 612 and 614.

Changes may be made within the scope and spirit of the appended claims.

I claim:

1. In an impulse coincidence switching device for signalling the simultaneous occurrence of impulses in separate impulse series, a discharge tube comprising a plurality of electrodes within an envelope, said electrodes including a cathode and an anode and at least two functionally identical control electrodes disposed between said cathode and said anode, said identical control electrodes being respectively identically positioned relative to said cathode and said anode, identical bias potentials connected to said control electrodes over functionally identical limiting resistor means respectively cooperating there-

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with for keeping said tube normally nonconductive, circuit means for simultaneously conducting to said control electrodes over said limiting resistor means respectively different series of impulses containing impulses of respectively different amplitudes and shapes and occurring in respectively different sequence, said limiting resistor means being operative to limit the potentials of said impulses conducted thereover to the control electrodes respectively cooperating therewith to values corresponding substantially to the cathode potential so as to cause said tube to become conductive solely at instants when an impulse in one of said series conducted to one of said control electrodes coincides with an impulse in the other series conducted to the other control electrode, regardless of the characteristics of said coinciding impulses, and means in the anode circuit of said tube for signalling the coincidence of said impulses.

2. An impulse-coincidence switching device comprising a discharge tube having a cathode and an anode, a plurality of at least two functionally entirely identical control electrodes disposed respectively identically with respect to said cathode and anode, identical limiting resistor means cooperating with each of said control electrodes, means for supplying to said control electrodes by way of said limiting resistor means identical negative bias potentials so as to keep said tube normally nonconductive, means for conducting to one of said control electrodes by way of the limiting resistor means respectively cooperating therewith

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a first series of predetermined impulses, means for simultaneously conducting to another one of said control electrodes by way of the limiting resistor means respectively cooperating therewith a second series of predetermined different impulses, the normal potentials of all said impulses exceeding the values required for cancelling said bias potentials, said limiting resistor means being operative to limit the potentials of the impulses conducted thereover to the control electrodes respectively cooperating therewith to values corresponding approximately to the cathode potential so as to cause said tube to become conductive solely at instants when an impulse in said first series conducted to said one of said control electrodes coincides with an impulse in said second series conducted to said other one of said control electrodes regardless of the normal wave form or amplitude of said coinciding impulses.

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