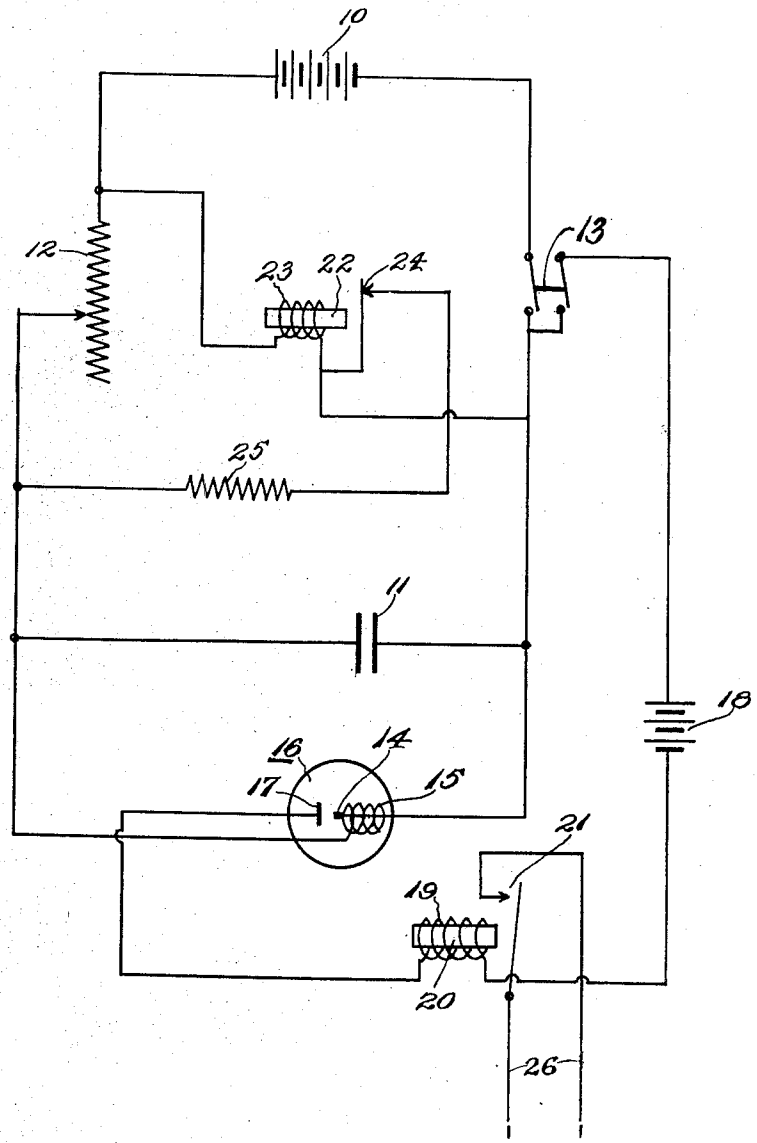
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ELECTRIC TIMING APPARATUS

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ELECTRIC TIMING APPARATUS

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This invention relates to an electrical timing method and apparatus, and, more particularly, to a method of and means for producing movement at a definite interval after the completion of an electric circuit.

It is a general object of the present invention to provide a novel method of and means for producing a predetermined time delay by static electric means.

One of the features of the invention comprises effecting a definite time delay by the rate of charging of a condenser from a predetermined electromotive force.

Another feature of the invention comprises effecting the operation of a translating device by the discharge of a condenser at a predetermined time after the initiation of a charging circuit for the condenser.

A further feature of the invention comprises the method of determining a time interval by charging a condenser through a resistance and causing a discharge of the condenser when its voltage reaches a predetermined threshold value, said discharge effecting the operation of a translating device at an interval after the closing of the condenser charging circuit determined by the value of the said resistance.

An important object of the invention consists in the provision of the necessary apparatus and circuits for carrying out the aforementioned methods.

Other and further features and objects of the invention will be more apparent to those skilled in this particular art upon a consideration of the accompanying drawing and following specification wherein is disclosed a single exemplary embodiment of the invention; it being understood, however, that such changes may be made therein as fall within the scope of the appended claims without departing from the spirit of the invention.

The single figure of the drawing is a schematic and diagrammatic representation of the apparatus and circuits for carrying out the invention.

In a large number of arts it is often necessary and highly desirable to be able to effect the operation of a translating device or the closing of a particular electrical circuit at a definite time interval after a certain happening. It is desirable that this time interval be always the same under any predetermined set of conditions and that it be adjustable within reasonable limits in a simple manner. The present invention provides a simple method of and apparatus for producing this result and is illustrated simply as means for closing one circuit at a desired interval after the initial closing of another circuit. Obviously, the first mentioned of these circuits may operate any desired apparatus and the second mentioned may be closed in any desired manner.

Referring to the drawing there is shown at 10 a source of substantially constant E. M. F. It is adapted to be connected to a suitable condenser 11 thru the circuit shown and including an adjustable resistance 12 and a circuit closer 13 of any desired type.

The condenser has one terminal connected to an anode 14 and the other to the control element or grid 15 of a tube 16. This tube is of the so-called "grid glow" type and includes in addition to the elements mentioned, a cathode 17. Included in a separate circuit between the anode 14 and the cathode 17 is a second source of direct current 18 and one pole of the double pole circuit closer 13. The characteristics of the tube 16 are such that no current flows from the source 18 between the cathode and the anode until the residual gas in the tube is ionized. This is effected when the grid 15 reaches a definite predetermined potential in respect to the anode.

The winding 19 of a relay 20 is interposed in the circuit of the current source 18 so that when the switch 13 is closed, the tube 16 becomes conducting and current commences to flow, the relay contacts 21 are closed to end the interval which was initiated by the closing of the circuit maker 13. The interval is determined by the time taken to charge the condenser 11 to the voltage necessary to cause the grid 15 to ionize the gas in the tube 16. Thus the length of the interval can be adjusted by adjusting the resistance 12 to change the charging rate of the condenser.

Obviously any desired means may be used to operate the circuit maker 13 so that the contacts 21 shall open and close in accordance with the present invention to regulate the flow of current in a circuit 26 which may connect with any electrical device which it is desired to operate at predetermined time intervals.

The circuit maker 13 must remain closed during the time interval. In order to insure the constancy of successive intervals it is necessary that the condenser be fully discharged between intervals. This may be conveniently done by means of a relay 22 whose winding 23 is arranged to be connected across the source 10 when the circuit maker 13 is closed. The contacts 24 of this relay are arranged in series in a circuit including the resistance 25 which is shunted around the condenser. When current flows to the condenser from the source 10, the relay holds the contacts 24 open so that the condenser charges. When the circuit maker 13 is opened the relay winding is deenergized and the contacts close by gravity or otherwise, thereby shunting the resistance across the condenser to fully discharge it and place it in condition for the measurement of the next interval. The opening of switch 13 causes the opening of the energizing circuit of relay 22 which in turn results in the deenergization of

that relay. When the condenser discharges, the potential of the grid 15 is reduced and current flow from the source 18 stops thus allowing the contacts 21 to separate by the action of gravity, or otherwise. The glow tube has the characteristic of becoming conducting when the potential of the grid reaches a certain predetermined value. After it has reached this value the tube remains conducting until the potential of the grid has decreased to a certain value when the tube again becomes nonconducting. The latter condition will eventually be reached as the condenser is discharged.

The grid glow tube is of especial value in this circuit since its grid draws practically no current. It may be considered as a true potential operated device. Thus the condenser may be of small capacity since it does not have to supply any current to operate the relay 20.

It should be noted that, if the circuit maker 13 is opened after its initial closure before the expiration of the time interval effected by the apparatus, the full interval, and not only the remaining time, will be measured by the apparatus upon the next closure of the circuit maker 13.

What I claim is:

1. Apparatus of the type described including, in combination, a source of substantially constant E. M. F., a condenser in series therewith, means to close the circuit thru said source and condenser to charge the condenser at a desired rate, a glow tube having an anode, a cathode and a control element, the condenser being in parallel with the anode and control element of said tube, a circuit connected between the anode and cathode of said tube including a source of current, a switch element and a current flow indicating means, said tube permitting the flow of current in said second circuit only upon the attainment of a predetermined potential in said condenser, the closing of said first circuit initiating a desired interval and the flow of current in said second circuit ending said interval.

2. Apparatus of the type described including, in combination, a source of substantially constant E. M. F., a condenser in series therewith, means to close the circuit thru said source and condenser to charge the condenser at a desired rate, a relay in said circuit and connected to said condenser to discharge the same, a three element glow tube connected to said condenser so as to draw no current therefrom, a second circuit connected to said tube including a source of current, a current-flow indicating means, a circuit closer operating simultaneously with that of the first circuit, said tube permitting the flow of current in the second circuit only upon the attainment of a predetermined potential in said condenser, the closing of said first circuit initiating a desired interval and the flow of current in said second circuit ending said interval, said circuit closers when shifted to inoperative position simultaneously de-energizing the tube and its associated current flow indicating means in the second circuit, interrupting the current to the first circuit, discharging said relay and the condenser to zero potential and thus leaving the apparatus in a re-set condition for a repeated operation.

3. Apparatus of the type described including, in combination, a source of substantially constant E. M. F., a condenser in series therewith, means to close the circuit thru said source and condenser to charge the condenser at a desired rate, a relay in said circuit and connected to said condenser to discharge the same, a three element glow tube connected to said condenser so as to draw no current therefrom, a second circuit connected to said tube including a source of current, a current-flow indicating means, a circuit closer operating simultaneously with that of the first circuit, said tube permitting the flow of current in the second circuit only upon the attainment of a predetermined potential in said condenser, the closing of said first circuit initiating a desired interval and the flow of current in said second circuit ending said interval, said circuit closers when thrown to inoperative condition simultaneously de-energizing the tube and the current flow indicating means, interrupting the current to the first circuit, de-energizing the relay in the first circuit, said relay discharging the condenser to zero potential and thus leaving the apparatus in a re-set condition for a repeated operation and said discharging being independent of the time required for the condenser to reach the predetermined potential.

4. A switch device, a condenser, a charging circuit for said condenser controlled by said switch device, a discharge circuit for said condenser, a three-electrode gas-filled tube having its grid connected to said condenser, an operating circuit for said tube controlled by said switch device, and a second switch device in the operating circuit of said tube.

5. In a timing apparatus a condenser, means including a circuit when effective for varying the charge on said condenser from a normal initial value toward a different final value, and means including a circuit when effective for restoring the charge on said condenser substantially to said initial value from any value between said initial value and said final value, switching means connected to each of said means and having two alternative operating conditions one condition for rendering the first named means effective and the second named means ineffective and the other condition for rendering said second named means effective and said first named means ineffective, a three electrode tube having a grid connected to said condenser, and having an operating circuit controlled by said grid so as to become conducting only upon the charge on said condenser reaching said final value and also controlled by said switching means so as to be conducting only when said switching means is in the first condition.

6. Switch means having two operating positions, a condenser, means including a circuit controlled by said switch means in its first position for varying the charge on said condenser from an initial value toward a different final value, means controlled by said switch means in its other position and including another circuit for restoring the charge on the condenser substantially to its initial value, a three electrode electronic tube having its grid connected to said condenser and having an operating circuit controlled by said grid and by said switch means so as to become conducting only upon the charge on said condenser reaching said final value while said switch means is in its first position, a second switch means including an electro-magnetic coil in the operating circuit of said tube and a switch member controlled by said coil.

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