

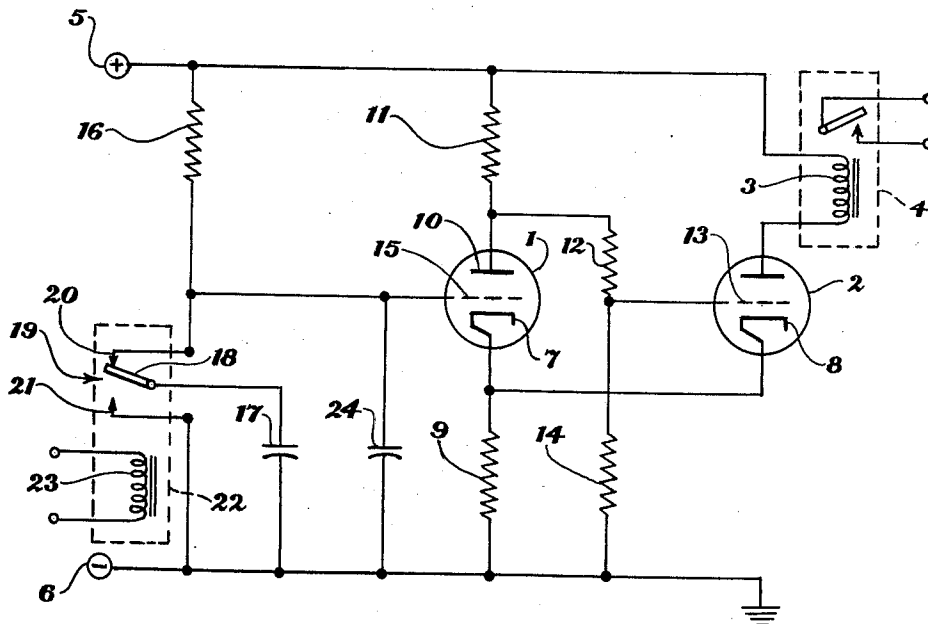
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M. D. DE MONG

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TIME DELAY MONOSTABLE ELECTRONIC CONTROL UNIT

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Maurice D. DeMong
INVENTOR.

BY *A.D. O'Brien*
Q. Baxter Warner
ATTORNEYS

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TIME DELAY MONOSTABLE ELECTRONIC CONTROL UNIT

Maurice D. De Mong, Torrance, Calif., assignor, by mesne assignments, to the United States of America as represented by the Secretary of the Navy

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1 Claim. (Cl. 250—27)

This invention relates to a time-delay monostable electronic control unit and particularly to such a unit responsive to a triggering operation for energizing a relay or other load device and for maintaining such load device actuated for a predetermined time interval.

It is frequently desired to control a relay or other load device in response to a series of spaced momentary triggering impulses or operations and to maintain such relay operative so long as, but only so long as, the spacing between successive triggering impulses does not exceed some predetermined value.

It is an object of this invention to provide an electronic control unit capable of producing this result and which may conveniently be controlled by momentary triggering operations of a triggering switch.

A further object is to provide such a unit comprising a monostable electronic flip-flop unit responsive to operation of a triggering switch to change to its unstable state for a period determined by a capacitor-resistor timing circuit incorporated therein, and effective to maintain the unit in said unstable state for another such period if the triggering switch is again actuated before the expiration of the first timing period.

Other objects and advantages of my invention will become apparent from the following description and claim especially when considered in the light of the accompanying drawing wherein the single figure is a schematic diagram of an embodiment of the invention.

As shown in the drawing the control unit comprises a first electronic tube 1 which controls the operation of a second electronic tube 2 having a load device such as the coil 3 of a relay 4 in series therewith. Operating voltages for the tubes are obtained from positive terminal 5 and negative terminal 6 which are adapted to be connected across a suitable source of D.C. potential (not shown).

The cathodes 7 and 8 of tubes 1 and 2 are directly connected together and to one end of a common cathode resistor 9 of relatively high value. The anode 10 of tube 1 is connected by resistor 11 to positive terminal 5 and by a relatively high value resistor 12 to the grid 13 of tube 2, which grid is in turn connected to negative terminal 6 by resistor 14.

The grid 15 of tube 1 is connected to the positive terminal 5 by a high value resistor 16 which constitutes part of the time-controlling portion of the unit. A main timing capacitor 17 has its one side connected to the negative terminal 6 and its other side to the movable contact 18 of a single-pole double-throw triggering switch 19, the normally-closed contact 20 of which is connected to the grid 15 of tube 1. The normally-open contact 21 of switch 19 is connected directly to the negative terminal 6 so that when contact 18 is operated from its normal position it breaks the circuit from condenser 17 to grid 15 and simultaneously shunts the capacitor to discharge it.

Switch 19 may be actuated in any way desired, but is shown herein, for purposes of illustration, as con-

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stituting the switch contacts of a suitable triggering relay 22 having a coil 23 which, upon energization thereof by application of a suitable control pulse thereto will actuate the switch 19 to open the circuit between movable contact 18 and stationary contact 20 and close the circuit from contact 18 to contact 21. Deenergization of coil 23 will result in return of the switch contact 18 to its normal position shown in the drawing.

An auxiliary capacitor 24, preferably of considerably lower capacity than capacitor 17 is connected directly from grid 15 to negative terminal 6.

With switch 19 in its normal position shown and appropriate voltages applied to terminals 5 and 6, the tube 1 will normally be heavily conducting due to the positive voltage applied to the grid 15 thereof by way of resistor 16. This will cause a relatively large voltage drop to obtain across cathode resistor 9 so that the cathode of tube 2 will be considerably positive with respect to its grid 13 and will therefore be completely cut off. The grid 15 of tube 1 will be substantially at the same potential as its cathode 7 and capacitors 17 and 24 will be charged positively to this same value. This condition is completely stable and will be maintained until a triggering operation is applied to switch 19.

When, as by application of a short pulse to coil 23, switch 19 is momentarily actuated, capacitor 17 will be shorted and rapidly discharged to ground potential. However this will have no effect upon the unit until switch 19 is restored to its normal position upon decay of the triggering pulse, whereupon the major portion of the charge on capacitor 24 will flow rapidly into capacitor 17 until the two capacitors are equalized at a potential slightly above ground potential but still considerably below that of cathode 7. This will substantially instantly cut off tube 1, raising the anode potential thereof and resulting in an increase in potential on the grid 13 of tube 2. Meanwhile the decrease in current through tube 1 results in a decrease in cathode potential in tube 2 so that tube 2 will become conductive to thereby energize the relay or load device 4. The cathode potential of both tubes will thereupon assume a new value determined by the current flow through tube 2. This new value will however still be appreciably higher than the grid voltage on tube 1 so that the latter will remain non-conducting.

Meanwhile capacitors 17 and 24 will begin to charge exponentially through resistor 16, gradually increasing the grid potential on tube 1 until, at a time determined by the circuit constants, the grid 15 becomes sufficiently positive to again permit tube 1 to conduct. The resulting drop in potential on the anode 10 will cause a corresponding drop in grid potential on tube 2 until a point is reached where tube 2 will once again be cut off, deenergizing load relay 4. The time which elapses between energization and deenergization of the relay in response to a triggering impulse may be readily controlled by selection of appropriate values for resistor 16 and for capacitors 17 and 24.

If, however, a second triggering impulse is applied to switch 19 while the unit is still in its unstable state (tube 2 conducting) another timing cycle will be initiated and the relay 4 will remain energized. During the momentary actuation of switch 19 to discharge capacitor 17, capacitor 24 will maintain blocking voltage on the grid 15 until switch member 18 once again returns to its normal position, to initiate a new timing cycle. Thus tube 1 will remain cut off and tube 2 conducting at least until the end of the new timing interval.

Thus each actuation of the triggering switch 19 serves to first prepare the unit for a new timing cycle, without affecting the then-existing operating state of the unit, and then, upon return of the switch to its normal position,

actually starts the new timing cycle and, if the load device is not already energized, energizes the latter, maintaining it energized for the duration of the timing cycle.

While the values of the various components will of course depend upon the high voltage available, the tubes used and the desired duration of the timing interval, they are not particularly critical and may be varied quite widely without materially affecting the operation. Obviously certain changes in the specific flip-flop circuitry shown may be made without departing from the spirit and scope of the invention as defined by the appended claim.

I claim:

A monostable electronic control unit for use with a supply of direct current potential and responsive to triggering signals from a source thereof, said unit comprising first and second electron discharge tubes, each having an anode, a cathode, and a control grid, a first resistor directly connecting the cathodes of said tubes to the negative side of said supply, means for rendering said first tube normally conductive including a second resistor and a third resistor directly connecting the anode and grid respectively of said first tube to the positive side of said supply, a load device connecting the anode of said second tube to the positive side of said supply, and energized by the output of said second tube, means for rendering said second tube nonconductive whenever said first tube is conductive and conductive whenever said first tube is nonconductive, including a fourth resistor and fifth resistor connecting the grid of said second tube to the anode of said first tube and to the negative side of said supply respectively, a first capacitor having one side thereof connected to the negative side of said supply, a single-pole double-throw switch having its common terminal connected to the other side of said first capacitor and movable between a first position in which

said first capacitor is connected in circuit directly between the negative side of said supply and the grid of said first tube, and a second position in which said circuit is opened and said first capacitor is simultaneously shunted directly across the negative side of said supply to discharge said first capacitor, means for moving said switch to said second position in response to a triggering signal from said source and to said first position in the absence of a triggering signal from said source, the movement of said switch from said second position to said first position biasing the grid of said first tube to render the first tube nonconductive for a period of time determined by the rate of charge of said first capacitor through said third resistor, and a second capacitor of lower capacity than said first capacitor connected directly between the grid of said first tube and the negative side of said source to maintain said first tube nonconductive during a subsequent movement of said switch to said second position and back to said first position occurring within said period of time, whereby said load device is energized in response to each triggering signal and remains energized for at least said period of time after each triggering signal and for so long as the time interval between successive triggering signals is less than said period of time.

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