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ELECTRICAL TIMING SYSTEM

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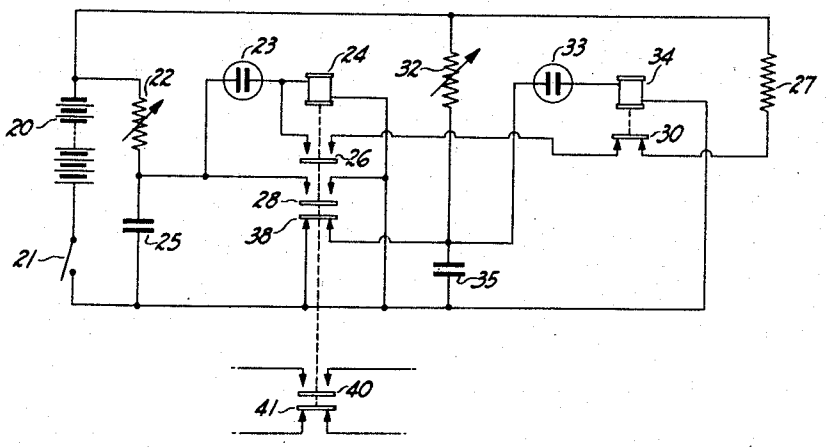


FIG. 1

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ELECTRICAL TIMING SYSTEM

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The present invention relates to timing devices adapted to delay commencement of an initiated operation and to determine the duration thereof, such devices being employed in signalling apparatus, welding equipment, heating arrangements, and the like.

More particularly, the present invention relates to electrical timing circuits employing tubes of the kind which become conductive only when a critical minimum voltage is applied thereto, in combination with means for building up the required voltage over a predeterminable period of time.

It is the principal object of the present invention to provide a timing system adapted to delay operation of a device controlled thereby and capable of maintaining the controlled device in operating condition for a predetermined interval of time.

It is another object of the present invention to provide an electric timing system which is capable of providing the desirable results referred to above without need for electronic tubes requiring filament power.

It is a specific object of the present invention to provide an automatic control system adapted to periodically start and terminate operation of a device controlled thereby over an indefinite period of time, and having means for predetermining the duration of the re-occurring periods of operation as well as of the intervals of inactivity between successive operational periods.

It is still another object of the present invention to so arrange an electric timing system of the type referred to that weak currents incident to the operation thereof are at no times conducted through relay contacts so that failure due to corrosion of contacts is impossible.

Other objects of the present invention will appear from a description of the accompanying drawing, wherein the single figure shows a time delay system embodying my invention.

The system of my invention utilizes a plurality of tubes each of which possesses two electrodes and is of the type filled with an inert gas such as neon; it is unable to conduct any appreciable current until a sufficient voltage is placed across its electrodes to ionize the gas, whereupon it will conduct current until the applied voltage decreases below a critical value required to keep the gas ionized.

According to my invention systems utilizing tubes of the type described may be arranged so as to be capable of controlling not only commencement, but also duration of an initiated

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operation over accurately predetermined periods of time. Additionally, such systems may be made to predetermine the duration of intervals between a series of sequential operations at will.

An arrangement of this type is illustrated by way of example in the figure, wherein **20** is a battery, **21** a master control switch, **22** a timing resistor, and **25** a condenser, all connected in series. Condenser **25** in turn is connected across a gas discharge tube **23** of the type previously described, and a relay **24**. Means are provided in the form of a normally open relay-operated contact **28** shunted across condenser **25** to prevent inopportune recharging of said condenser **25** upon closing of said contact **28**. Relay **24** is connectible across battery **20** through a reducing resistor **27**, a normally open relay-operated contact **26**, and a normally closed relay-operated contact **30**.

Battery **20** is arranged to charge a second condenser **35** through a second timing resistor **32**. Condenser **35** is connected across a second gas discharge tube **33** and a second relay **34**, which latter may be of a much simpler form than relay **24**. Charging of condenser **35** upon closing of master control switch **21** is initially prevented by a normally closed relay-operated contact **38** shunted across condenser **35**.

When master control switch **21** is closed, condenser **25** is charged from battery **20** through timing resistor **22** until the voltage stored up in condenser **25** is sufficient to ionize tube **23** whereupon the discharge current of condenser **25** through tube **23** will operate relay **24** to close initially open contact **26**, thus connecting relay **24** across battery **20** and establishing a desired working status for whatever apparatus may be controlled by relay **24**, relay-operated control switches for such apparatus being indicated at **40** and **41** in the figure. According to my invention, actuation of relay **24** is arranged to also close initially open contact **28** which shunts condenser **25** so that the same is discharged and cannot be recharged as long as contact **28** remains closed. In addition, actuation of relay **24** is arranged to open initially closed contact **38** so that condenser **35** may now charge from battery **20** through timing resistor **32**. As soon as condenser **35** is charged to a voltage sufficient to ionize tube **33**, relay **34** disposed in the circuit of tube **33** is excited, in which condition it is arranged to open normally closed contact **30**, thus interrupting the circuit supplying relay **24** with current from battery **20**. As a result thereof, relay **24** returns to inoperative position, terminat-

ing whatever operation may be controlled by said relay. In addition, deenergization of relay **24** opens contacts **26** and **28** and closes contact **38** establishing conditions under which condenser **25** may recharge while condenser **35** is discharged and is prevented from recharging. As a result thereof, relay **34** is deenergized and permits return of relay-operated contact **30** to its normal closed position. Hence initial conditions are established throughout the system, permitting condenser **25** to recharge and introducing a new cycle of operation.

The time delay between initiation of an operation by closing of master control switch **21** and actual commencement of an operation as controlled by actuation of relay **24** may be predetermined by selecting proper values for timing resistor **22** and condenser **25**, either or both of which may be made variable. The duration of operation of a device controlled by the system of my invention may be predetermined by selecting the proper values for timing resistor **32** and condenser **35** which may likewise be made variable to permit adjustment to suit particular requirements. The time interval between successive operations of a controlled mechanism is again determined by the values of resistor **22** and condenser **25**. In view of the simple task to be performed by relay **34** in the system of my invention as against the diversified control operations of relay **24**, it will be understood that a relay of the simplest and most inexpensive construction may be used as relay **34** so that the cost of a second relay in addition to the more complex main control relay **24** will be very small.

In a practical embodiment of my invention according to the figure I employed components having the following values:

Voltage of battery **20**: 125 volts.
Capacity of condenser **28**: 4 microfarads.
Capacity of condenser **38**: 4 microfarads.
Critical voltages of tubes **23** and **35**: ionizing voltage, 105 volts; deionizing voltage, 85 volts.
Value of resistor **22**: 15 megohms.
Value of resistor **32**: 10 megohms.
Value of resistor **27**: 15,000 ohms.
Relay **24**: 5,500 ohms.
Relay **34**: 5,500 ohms.

I claim:

1. An electric timing system including a first and second capacitor, normally disabled means for charging said second capacitor, a first gas discharge tube and a first relay in series and connected across said first capacitor, a second discharge tube and a second relay in series and connected across said second capacitor, a circuit including in series said first relay, a normally open contact, a normally closed contact, and a source of voltage, said first relay being adapted, upon excitation, to close said normally open contact and to render effective said normally disabled means for charging said second capacitor, and said second relay being adapted, upon excitation, to open said normally closed contact.

2. An electrical timing system having a source of voltage, first and second circuits, each including a condenser, and a gas discharge tube and a relay connected across said condenser; normally effective means for charging the condenser of said first circuit from said source of voltage, and normally ineffective means for charging the condenser of said second circuit from said source of voltage; and a third circuit including said source of voltage, the relay of said first circuit, a normally open contact and a normally closed contact, said first relay being adapted upon excitation thereof through discharge current from said first condenser to close said normally open contact and to render effective said normally disabled means for charging said second condenser, while disabling said normally effective means for charging said first condenser, and said second relay being adapted upon excitation thereof to open said normally closed contact.

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