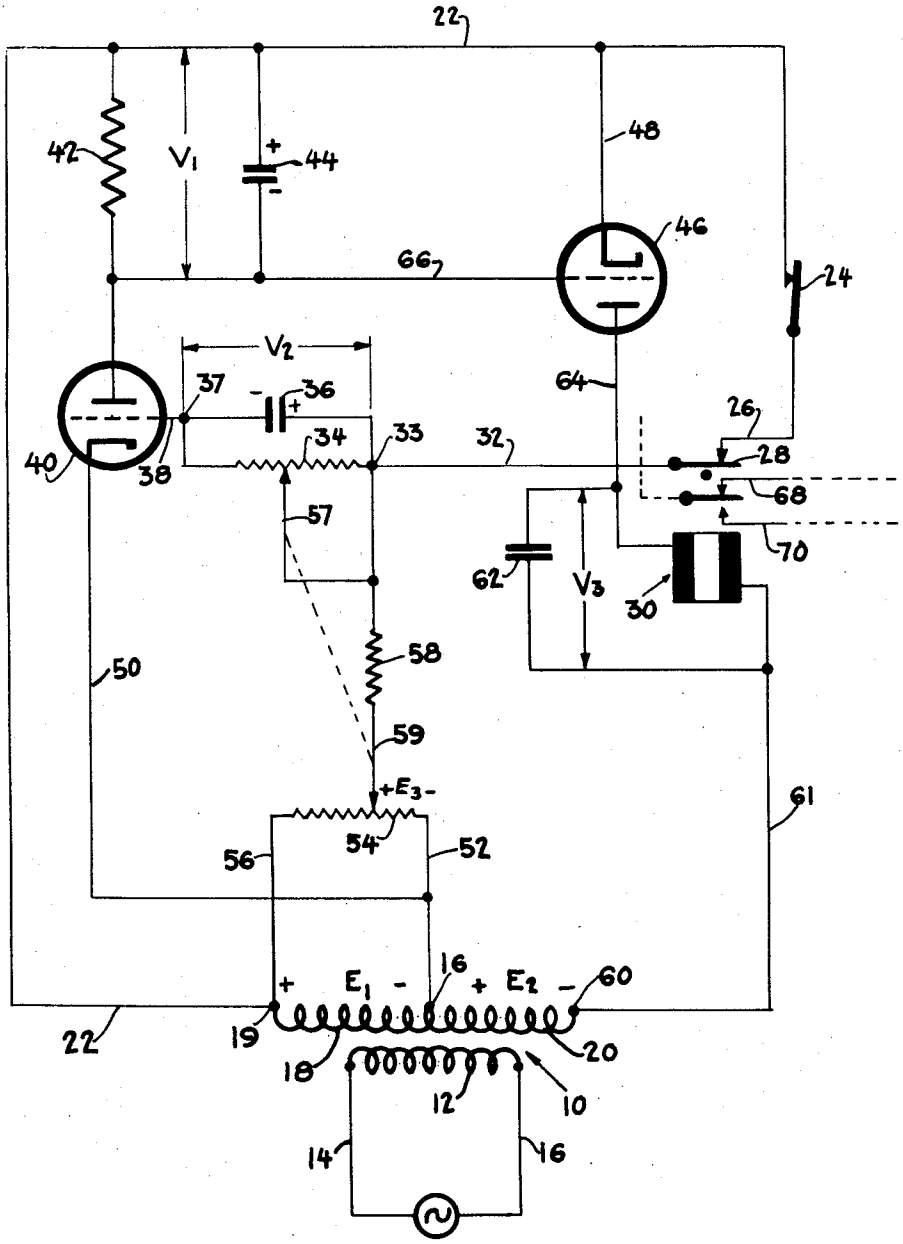
May 24, 1960 C. A. HACHEMEISTER 2,938,152

ELECTRICAL TIMING CIRCUIT

Filed Dec. 16, 1957



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United States Patent Office 2,938,152
Patented May 24, 1960

2,938,152

ELECTRICAL TIMING CIRCUIT

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Filed Dec. 16, 1957, Ser. No. 703,124

4 Claims. (Cl. 317—142)

This invention relates to an electrical control circuit, particularly to an electrical timing circuit, and has for its primary object to provide a timing circuit having rapid recovery and substantially short time intervals for fully automatic filling machines of the type disclosed in United State Patent No. 2,660,336.

Another object of the invention is to provide a timing circuit for automatic dispensers of liquid or viscous material.

Yet another object of the invention is to provide a timing circuit for use in a dispenser adapted to inject measured quantities of liquid of viscous material into containers moving at a substantially high rate of speed.

Still another object of the invention is to provide a timing circuit in which the time interval can be readily varied.

A further object of the invention is to provide a timing circuit which is accurate in repetitive operation and which is controlled by the power line frequency.

A still further object of the invention is to provide a timing circuit in which the timing is initiated by the opening of a switch rather than the conventional closing of a switch.

Other and further objects will be obvious upon an understanding of the illustrative embodiment about to be described, or will be indicated in the appended claims, and various advantages not referred to herein will occur to one skilled in the art upon employment of the invention in practice.

A preferred embodiment of the invention has been chosen for purposes of illustration and description and is shown in the accompanying drawings, forming a part of the specification, wherein the single figure shows a schematic view of an electrical timing circuit in accordane with the invention.

Referring now to the drawing, there is shown a transformer **10** having its primary winding **12** connected by leads **14** and **16** to a suitable source of power, such as a conventioned 115 volt, 60 cycle alternating current line. The transformer **10** has a secondary winding with a mid-tap **16**, so that the secondary winding is sub-divided into two winding portions **18** and **20** with the voltages E_1 and E_2, respectively.

The outer end **19** of the secondary winding portion **18** is connected by a lead **22** to a single pole, single throw switch **24**, thence by a lead **26** through an upper, break contact **28** of a relay **30** and by a lead **32** to a juncture **33** of an adjustable resistor **34** in parallel with a capacitor **36**. The other juncture **37** of the resistor **34** and capacitor **36** is connected by a lead **38** to a grid of a vacuum tube **40**.

The outer end **19** of the secondary winding portion **18** is also connected by the lead **22** to a resistor **42** and a capacitor **44**, in parallel, and by a lead **48** to a cathode of the vacuum tube **46**.

The mid-tap **16** of the secondary winding of transformer **10** is connected by a lead **50** to a cathode of the vacuum tube **40** and, by lead **52**, to one terminal of an adjustable resistor **54**, the other terminal of resistor **54** being connected to the outer end **19** of winding portion **18** via lead **56**. A resistor **58** is interposed between adjustable resistors **34** and **54**, which adjustable resistors are of the potentiometer type with sliding contacts **57**, **59** mechanically coupled together, as shown in dotted lines, to operate as a unit. Resistor **58** is provided to prevent a short circuit across the secondary winding portion **18** when the sliding contact **59** is at the extreme right of resistor **54**, as seen in the drawing, with switch **24** closed.

The outer end **60** of the other secondary winding portion **20** is connected by lead **61** to a winding of the relay **30** and to a capacitor **62**, both of which are in parallel, the other sides of the relay winding and capacitor **62** being connected by a lead **64** to the plate of the vacuum tube **46**. The grid of vacuum tube **46** is connected by a lead **66** to the plate of vacuum tube **40**, as well as to the other side of the parallel resistor **42** and capacitor **44**.

The operation of the timing circuit will now be described. Assuming that switch **24** and relay contact **28** are in their normally closed positions, as shown on the drawing, and assuming the power line is energized, the alternating current voltage E_1 is applied, through lead **22**, closed switch **24**, lead **26**, closed relay contact **28**, lead **32**, resistor **34** in parallel with capacitor **36**, and lead **38**, between the grid and, via lead **50**, the cathode of vacuum tube **40**. During positive alternation of the voltage E_1 the side of the capacitor **36** at the juncture **33** becomes positive while the other side of the capacitor at the juncture **37** becomes negative, thereby withdrawing from the grid of vacuum tube **40** some of the grid's electrons. Thus the grid becomes positive and conducts current on positive peaks of the voltage E_1 to develop an average voltage V_2 across the parallel resistor **34** and capacitor **36**, polarized negative at juncture **37**, as indicated. The value of this voltage V_2 is approximately equal to the crest value of the voltage E_1.

The voltage E_1 is also applied, through lead **22** and resistor **42** in parallel with the capacitor **44**, between the plate and, via lead **50**, the cathode of vacuum tube **40**. The plate conducts current on the positive peaks of the E_1 voltage because the grid voltage is essentially in phase with the impressed plate voltage and there is developed an average voltage V_1 across the parallel resistor **42** and capacitor **44**.

The entire secondary voltage, that is, E_1 plus E_2, is applied through lead **61**, winding of relay **30** in parallel with the capacitor **62**, and lead **64**, between the plate and, via leads **22** and **48**, the cathode of vacuum tube **46**. Since the voltage V_1, developed because of the rectification by tube **40**, produces a large negative bias on the grid of tube **46** (via lead **66**), tube **46** does not conduct current even when its plate voltage is positive relative to its cathode.

The timing circuit is now ready and, to start its timing interval, the switch **24** is opened, either manually or automatically by a container as it moves by. The grid-to-cathode voltage of vacuum tube **40** then becomes $E_3—V_2$, where voltage E_3 is sinusoidal and voltage V_2 becomes a decaying exponential voltage. Voltage E_3 is made sufficiently smaller than voltage E_1 by means of the voltage divider (resistor) **54**, so that the vacuum tube **40** is rendered ineffective.

The voltage V_1 across resistor **42** and capacitor **44** then decreases to the point where the grid-to-cathode bias on the vacuum tube **46** becomes sufficiently small to allow tube **46** to conduct current and thereby develop an average voltage V_3 across the winding of relay **30**. Relay **30** energizes in a circuit that can be traced from the outer terminal **60** of the secondary winding of transformer **10** via lead **61**, winding of relay **30**, lead **64**, plate and

cathode of vacuum tube **46**, lead **48** and thence over lead **22** to the outer terminal **19** of the secondary winding. Relay **30**, in operating, opens the normally closed contact **28** and also any other contacts associated with this relay, such as a solenoid by-pass break contact **68**, and closes a make-contact **70** for energizing a circuit, such as a discharge valve solenoid circuit. The switch **24** may now be closed without disturbing the subsequent operation of the timing circuit.

The voltage V_2 continues to decay until it causes the grid-to-cathode voltage on vacuum tube **40** to become less negative. When the cut-off grid voltage corresponding to the transformer voltage E_1 is reached, vacuum tube **40** becomes conductive, voltage V_1 is increased and vacuum tube **46** is rendered ineffective. Relay **30** accordingly releases to restore contacts **28**, **68** and **70** to their initial conditions. Thereupon, with switch **24** and relay contact **28** closed the timing circuit is restored to its initial condition for another timing interval by the reopening of switch **24**.

It is ot be particularly noted that the circuit for the timing capacitor **36** and resistor **34** includes no external resistance, as in conventional practice. The capacitor **36** and parallel resistor **34** are connected directly across the grid of vacuum tube **40** and the transformer winding portion **18** under control of the serially connected trigger switch **24** and relay contact **28**. Consequently, the low resistance of the grid-cathode conduction circuit of the vacuum tube **40** enables the capacitor **36** to be charged much faster then heretofore had been possible. Also, this low resistance factor permits triggering or starting of the time interval by switch **24** at short aperiodic time intervals without appreciably affecting the time interval subsequent to said triggering.

For shorter periods, the time interval is primarily controlled by the frequency of the power source and is equal to an integral number of periods of the power line voltage plus a part-period which is controlled by adjusting the amplitude of the alternating current grid-bias voltage E_3 of vacuum tube **40** and, to a minor degree, the time-constant of capacitor **36** and resistor **34**.

Should the power line voltage change (within the normal limits), the ratios of all the voltages which are pertinent to accurate timing remain substantially constant. Because the timing is affected only by the ratios of voltages, usual power line fluctuations therefore have very little affect on the time interval.

From the foregoing description, it will be seen that the present invention provides a practical, reliable and fast operating timing circuit particularly for automatic dispensers of liquid or viscous material.

As various changes may be made in the form, construction, and arrangement of the parts herein, without departing from the spirit and scope of the invention and without sacrificing any of its advantages, it is to be understood that all matters are to be interpreted as illustrative and not in any limiting sense.

What is claimed is:

1. An electronic timing device comprising, in combination, a transformer, a primary winding in said transformer adapted for connection to an alternating current supply source, a secondary winding in said transformer with a mid-tap, a first electronic tube with an anode, cathode and grid, said mid-tap of said secondary winding being connected to said cathode, a capacitor in parallel with a resistor interconnected between one terminal of said secondary winding and said anode, a second capacitor in parallel with a second resistor interconnected between said one terminal of said secondary winding and said grid, a third resistor bridged across said mid-tap and said one terminal of said secondary winding, means interconnecting said third resistor and said second resistor, a second electronic tube with an anode, cathode and grid, a relay interposed between the other terminal of said secondary winding and the second anode, said second cathode being connected to said one terminal of said secondary winding, said first anode being connected to said second grid, a normally closed switch, and a normally closed contact of said relay, said switch and said closed contact being serially interposed between said one terminal of said secondary winding and said second resistor.

2. An electronic timing device in accordance with claim 1, wherein said second and third resistors are adjustable.

3. An electronic timing device comprising, in combination, a transformer, a primary winding in said transformer adapted for connection to an alternating current supply source, a secondary winding in said transformer with a mid-tap, a first electronic tube with an anode, cathode and grid, said mid-tap of said secondary winding being connected to said cathode, a capacitor in parallel with a resistor interconnected between one terminal of said secondary winding and said anode, a second capacitor in parallel with an adjustable resistor interconnected between said one terminal of said secondary winding and said grid, a voltage divider bridged across said mid-tap and said one terminal of said secondary winding, and connected to said adjustable resistor, a sliding contact for said adjustable resistor and voltage divider mechanically coupled for unitary movement, the sliding contact for said adjustable resistor being connected to a terminal of said adjustable resistor opposite said grid, a second electronic tube with an anode, cathode and grid, a relay interposed between the other terminal of said secondary winding and the second anode, said second cathode being connected to said one terminal of said secondary winding, said first anode being connected to said second grid, a normally closed switch, and a normally closed contact of said relay, said switch and said closed contact being serially interposed between said one terminal of said secondary winding and said adjustable resistor.

4. An electronic timing device comprising, in combination, a transformer, a primary winding in said transformer adapted for connection to an alternating current supply source, a secondary winding in said transformer with a mid-tap, a first electronic tube with an anode, cathode and grid, said mid-tap of said secondary winding being connected to said cathode, a capacitor in parallel with a resistor interconnected between one terminal of said secondary winding and said anode, a second capacitor in parallel with an adjustable resistor interconnected between said one terminal of said secondary winding and said grid, a second adjustable resistor bridged across said mid-tap and said one terminal of said secondary winding, a sliding contact for said adjustable resistors mechanically coupled for unitary movement, the sliding contact associated with said first adjustable resistor being connected to a terminal of said first adjustable resistor opposite said grid, a fourth resistor interconnected between said sliding contacts, a second electronic tube with an anode, cathode and grid, a relay interposed between the other terminal of said secondary winding and the second anode, said second cathode being connected to said one terminal of said secondary winding, said first anode being connected to said second grid, a normally closed switch, and a normally closed contact of said relay, said switch and said closed contact being serially interposed between said one terminal of said secondary winding and said first adjustable resistor, said switch being opened to initiate a timing interval of said device.

References Cited in the file of this patent

UNITED STATES PATENTS

2,454,168	Hartwig	Nov. 16, 1948
2,516,422	Rockafellow	July 25, 1950
2,790,115	Elliot	Apr. 23, 1957
2,890,750	Depken	June 16, 1959

FOREIGN PATENTS

136,892	Australia	Apr. 4, 1950