

Aug. 13, 1968

J. A. HIRSCH

3,397,323

TIMER

Filed March 24, 1966

2 Sheets-Sheet 1

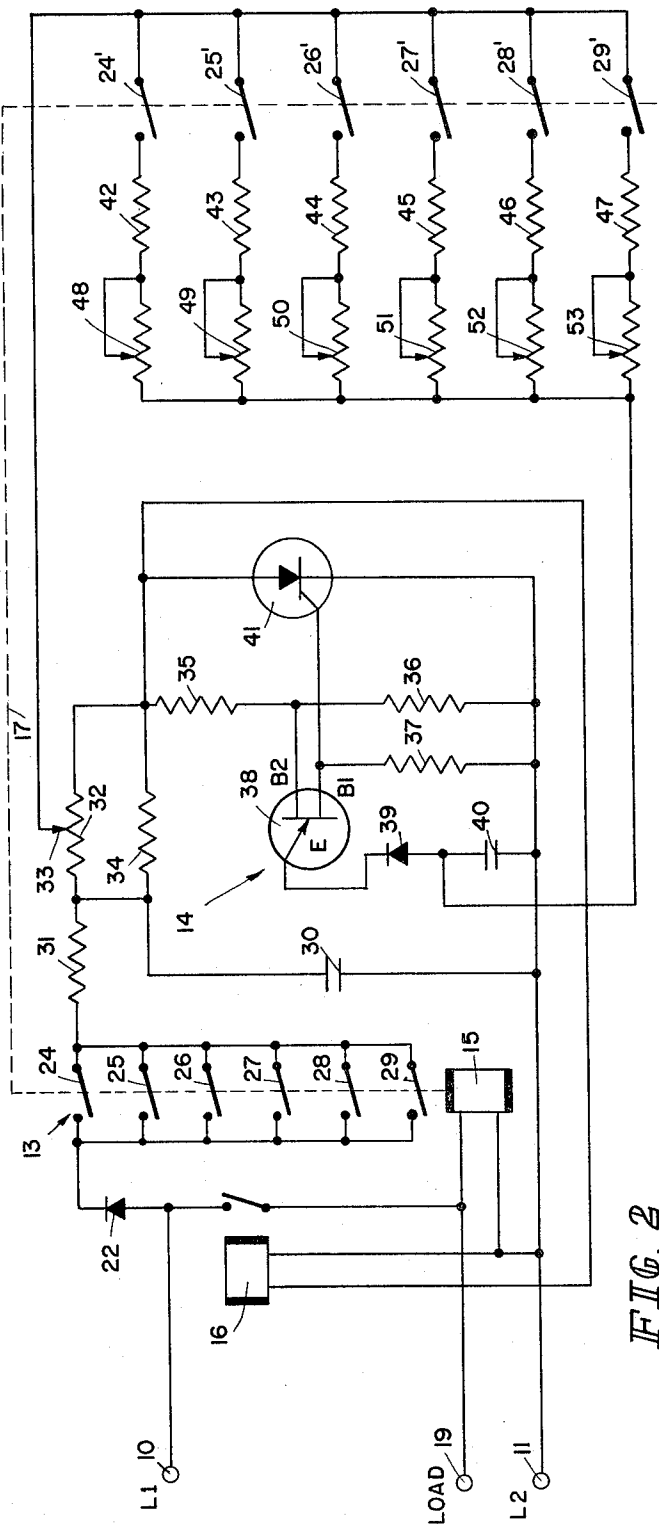


FIG. 2

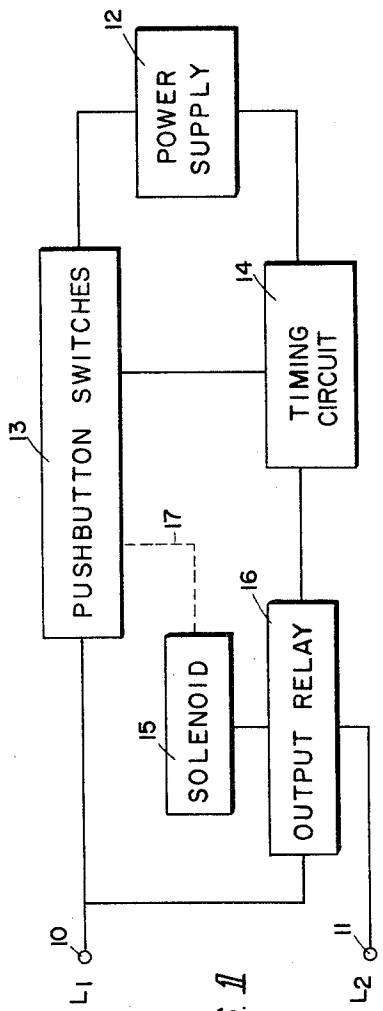


FIG. 1

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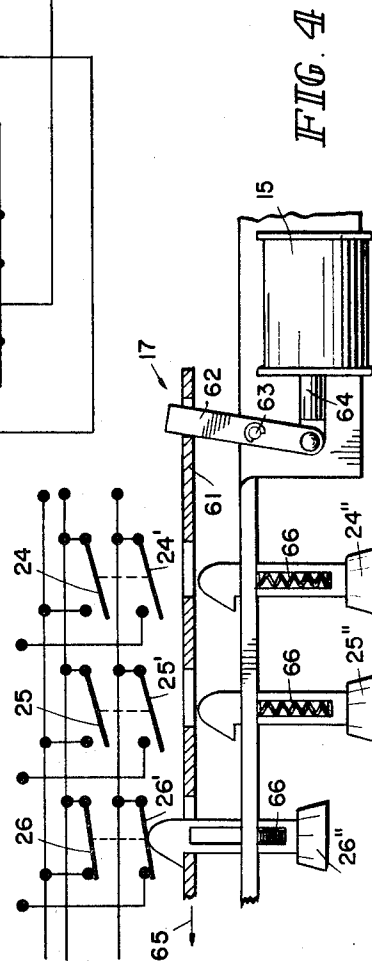
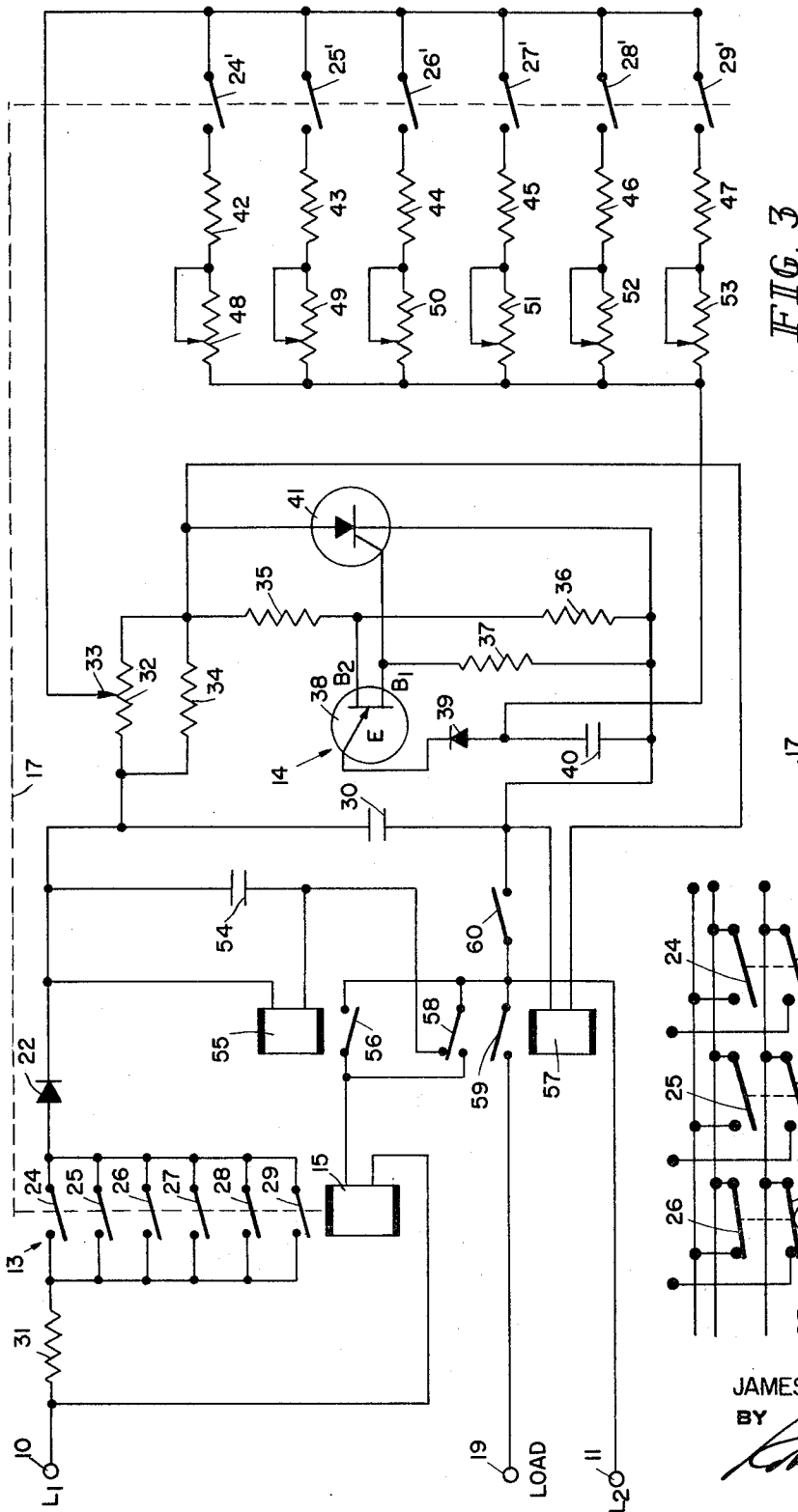
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TIMER

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2 Sheets-Sheet 2



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3,397,323
TIMER

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The present invention relates to timers and more particularly to the means and methods for providing a timer that operates for various fixed lengths of time, as set by a service man.

Mechanical timers are available for operating for various fixed lengths of time as are electronic timers. The present invention combines the reliability of an electronic timer with the low cost of a mechanical timer and, in addition, provides a timer that fails safe under most conditions.

The timer of the present invention has a plurality of switches for selecting a particular time interval and for starting the timer and energizing the load. There is an electrically operated means for latching a selected switch in an actuated position until the load is deenergized. One of the illustrative embodiments of this specification utilizes a separate switching means for energizing the timer and the load after a time interval selection has been made and the actuated switch has been latched.

The timer of the present invention is especially applicable for devices such as electronic ranges. A time interval which is optimum for a particular food can be selected by actuating a switch. The heating means and the timer can then be energized by closing a door of the range which operates the aforementioned switching means.

Other features of the timer of the present invention will become apparent as this specification progresses.

It is an object of the present invention, therefore, to provide an electronic timer that will operate for various fixed lengths of time as may have been previously selected by a service man.

It is another object of the present invention to provide a timer which combines the reliability of an electronic timer with the low cost of a mechanical timer.

It is a further object of the present invention to provide a timer that will fail safe under most conditions.

It is still another object of the present invention to provide a timer having selector switches for energizing said timer and a load and an electrically operated means for latching a selected switch in an operated position until said timer-deenergizes said load.

It is still a further object of the present invention to provide a timer having a selector switch means for selecting a particular time interval and another switch means for energizing said timer and a load.

The present invention, in another of its aspects, relates to novel features of the instrumentalities described herein for teaching the principal object of the invention and to the novel principles employed in the instrumentalities whether or not these features and principles may be used in the said object and/or in the said field.

Other objects of the invention and the nature thereof will become apparent from the following description considered in conjunction with the accompanying drawings and wherein like reference numbers describe elements of similar function therein and wherein the scope of the invention is determined rather than the dependent claims.

For illustrative purposes, the invention will be described in conjunction with the accompanying drawings in which:

FIGURE 1 is a block diagram of the timer of the present invention.

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FIGURE 2 is a schematic diagram of the timer of the present invention.

FIGURE 3 is a schematic diagram of the timer of the present invention showing the addition of a separate switch for starting the timing cycle after a particular time has been selected and the pushbutton is latched in

FIGURE 4 is a fragmentary view illustrating the operation of the pushbutton switches, latch bar, and latching solenoid.

Generally speaking, the present invention is a timer comprising: a power source; a relay means for applying power from said power source to a load and for energizing a solenoid; an electronic switching means for operating said relay means, so as to remove power from said load and de-energize said solenoid; a timing circuit for energizing said electronic switching means after a predetermined time, said timing circuit being connected to said electronic switching means; a plurality of timing networks for determining different time intervals for said timing circuit, said timing networks being connected to said timing circuit; a plurality of switches, each of said switches having a first contact member for energizing said relay means and a second contact member for connecting one of said timing networks to said power source so as to energize said timing circuit, said switches being connected to said power source and in circuit with said relay means, timing circuit, and said timing networks and means for latching said switches in an actuated position when said relay is energized, said latching means being connected to and operated by said solenoid so as to release said switches when said relay means is deenergized.

Referring now to the drawing, and particularly to the block diagram of FIGURE 1, the components and circuitry of the present invention can be visualized in conjunction with the following description:

The inputs to the timer are provided across the terminals 10 and 11 marked respectively as L1 and L2. Ordinarily the inputs will be 115 volt, 60 cycles per second. A power supply 12 is adapted to provide a useable direct current from the alternating current applied to terminal 10 and 11. It can be seen that the power supply 12 is coupled to the input terminals via the pushbutton switch 13. A timing circuit 14 is connected to the power supply 12 and to the pushbutton switches 13. The output of the timing circuit 14 is connected to an output relay 15 which energizes and deenergizes a solenoid 16. The solenoid 16 operates a latching means 17 which latches the pushbutton switches 13 in a manner that will be discussed later in this specification.

Referring now to FIGURE 2, a detailed schematic of one embodiment of the timer of the present invention may be discussed.

The alternating current for the timer is applied across the terminals 10 and 11 marked respectively as L1 and L2. A third terminal 19, designated as the load terminal in FIGURE 2, is connected to the terminal 10 by the output relay 16. The terminal 19 is also connected through the coil of the solenoid 15 to the terminal 11.

The power supply 12 is comprised of a diode 22, resistor 31, and capacitor 30 connected in series across L1 and L2 when the pushbutton switches 13 are operated. The pushbutton switches 13 are comprised of poles 2 through 29, and 24' through 29'. The poles 24 through 29 are all connected in parallel and in series with the power supply 12 so as to provide power for operating the timing circuit 14. The poles 24' through 29' are each connected in series with a timing resistor network for the timing circuit 14. The pole 24' is connected in series with the resistor 42 and the adjustable resistor 48, the pole 25' is connected in series with the resistor 43 and the adjustable

resistor 49, the pole 26' is connected in series with the resistor 44 and adjustable resistor 50, the pole 27' is connected in series with the resistor 45 and the adjustable resistor 51, the pole 28' is connected in series with the resistor 46 and the adjustable resistor 52, and the pole 29' is connected in series with the resistor 47 and the adjustable resistor 53. All of the poles 24' through 29' are connected to the tap 33 of the adjustable resistor 32. The adjustable resistor 32 is connected between the power supply resistor 31 and the timing circuit 14.

It can be seen that the pushbutton switches 13 are double pole-single throw switches. That is, a single pushbutton operates poles 24 and 24', another one operates poles 25 and 25', etc. The latching means 17 which connects all of the poles 24 through 29 and 24' through 29' is a solenoid operated means for holding said poles in an actuated position. A more detailed discussion of the latching means 17 will be provided in conjunction with FIGURE 4.

A resistor 34 is connected in series with the resistor 31 so as to be in parallel with the resistor 32 and in series with resistors 35 and 36. The resistors 35 and 36 comprise a voltage divider coupled across the anode and cathode of the silicon controlled rectifier 41. The anode of the silicon controlled rectifier 41 is connected through the coil of the output relay 16 to the terminal 11.

The timing circuit 14 is comprised of the resistor 37, junction transistor 38, diode 39, capacitor 40 and the various timing resistor networks connected to the pushbutton poles 24' through 29'. The voltage for charging the timing capacitor 40 is derived through one of the selected timing resistor networks associated with the poles 24' through 29'. Thus, there are six possible time intervals for the timing circuit 14 in the illustrative embodiment.

The base-two, B2, terminal of the unijunction transistor 38 is connected to a junction between the voltage divider resistors 35 and 36. Thus, when the unijunction transistor 38 fires, the voltage developed across the resistor 37 connected between the base-one electrode of the unijunction transistor and the cathode electrode of the silicon controlled rectifier 41 will be applied to the gate of said silicon controlled rectifier, thereby causing said rectifier to conduct.

Referring now to FIGURE 3, a second embodiment of the timer of the present invention can be discussed.

The circuit of FIGURE 3 is identical to the circuit of FIGURE 2 except for the addition of a capacitor 54, relay 55, relay 57, and the switch 60. The modified circuit of FIGURE 3, permits latching of the pushbutton switches 13 before the timing starts. In this case, the timing is initiated by the closing of the switch 60. It can be seen that the capacitor 54 is connected to the cathode of the power supply 12 diode 22 and that the relay 55 coil is coupled across the capacitor 54. The relay 55 operates the contact 56 which energizes the solenoid 15. The relay 57 operates the contacts 58 and 59 when said relay is energized by the closing of the switch 60.

Referring now to FIGURE 4, a fragmentary view showing the operation of the pushbutton switches 13, latching means 17, and solenoid 15 can be discussed.

The latching means 17 is comprised of the latch bar 61, linkage arm 62 for moving the latch bar 61, and the solenoid 15 plunger 64. It can be seen that the linkage arm 62 is pivoted at the point 63 so that the latch bar 65 will move in the direction of the arrow 65 when the solenoid 15 is energized and the plunger 64 is pulled in. It can be seen that the pushbutton 24' through 26' are spring loaded by the springs 66 so as to return to an open position when released by the latch bar 61.

With the above description of components and circuitry in mind, and by making reference to the drawing figures, the following analysis of operation will serve to convey the functional details of the present invention.

Referring now to FIGURE 2, it can be seen that power

is supplied to the pushbutton switches 13. When one of the switches is operated to close one of the poles 24 through 29 and an associated pole 24' through 29', direct current power is applied to the timing circuit 14 and a timing resistor network is selected. As soon as power is applied, the output relay 16 pulls in to close the contact 21 to energize the solenoid 15 and to provide power to the load. The solenoid 15 operates the latching means 17 to cause the selected pushbutton switch to be held in. After a predetermined time, determined by the timing circuit 14, the silicon controlled rectifier 41 shorts out the output relay 16 coil and the output relay 16 drops out. When the output relay 16 drops out, the solenoid 15 is de-energized to release the latching means 17 and to remove the power from the load. The timing of the de-energizing of the solenoid 15 and the removal of power from the load is not critical because the silicon controlled rectifier 41 will continue to conduct for a sufficient time after the power is removed from the circuit. A favorable side effect is created in that if a pushbutton is depressed again within about a second after it is released, it will not cause the timer to recycle. This is a desirable characteristic when the timer is used in an electronic range application.

Referring now to FIGURE 3, the operation of a second embodiment of the present invention can be discussed.

The timer shown in FIGURE 3 is modified to permit latching in of the selected pushbutton before the timing begins. In this case, the timing and energization of the load is initiated by closing the switch 60. The feature of starting the timing and energizing the load after a pushbutton selection is made is especially applicable for electronic range applications. That is, the time interval selection can be made in advance and the timing can be initiated by closing the range door to operate a switch such as the switch 61.

When one of the pushbutton switches 13 is selected and operated, the relay 55 is operated to close the contact 56 and a timing resistor network is selected. When the contact 56 is closed, the solenoid 15 is energized and the latching means 17 is operated to hold the selected pushbutton switch in. When the switch 60 is closed, power is applied to the timing circuit 14 and the relay 57 is pulled in to energize the load through the contact 59 and to maintain the energization of the solenoid 15 through the contact 58. When the timing circuit 14 times out, the silicon controlled rectifier 41 is gated on to shunt the relay 57, thereby deenergizing the load and the solenoid 15.

The silicon controlled rectifier 41 is an electronic switching means for shorting out the relay 15. More specifically it is a semiconductor device having an anode electrode, cathode electrode and a gate electrode for controlling conduction between said anode electrode and said cathode electrode, said anode electrode and said cathode electrode being connected across a coil of an electromagnetic switching device so as to shunt said coil when said gate electrode is energized.

The timing circuit 14 is a circuit means for providing an electrical output after a predetermined time so as to energize the silicon controlled rectifier 41.

The pushbutton switches 13 are a means for energizing the timing circuit 14, energizing the load, and selecting a timing network for said timing circuit.

The solenoid 15 and the latching means 17 are an electrically operated means for latching a selected pushbutton switch.

The output relay 16 is a switching means for energizing and deenergizing a load and the electrically operated means for latching a selected pushbutton switch.

The timer of the present invention has fail safe features under most conditions. For instance, should the solenoid 15 that operates the latching means 17 burn out, the selected pushbutton will return to an "off" position because there is nothing to hold it. If the selected pushbutton

switch is held in or if it does not return after the solenoid 15 is deenergized, the timer circuit 14 and the silicon controlled rectifier 41 will maintain the short across the output relay 16 coil. As long as the short is maintained across the coil of the output relay 16, the relay will remain dropped out until the pushbutton switch is restored to its "out" position. If the power fails, the solenoid 15 is deenergized and the unit is turned off and reset to zero.

The timer of the present invention, as hereinbefore described in two embodiments, is merely illustrative and not exhaustive in scope. Since many widely different embodiments of the invention may be made without departing from the scope thereof, it is intended that all matter contained in the above description and shown in the accompanying drawing shall be interposed as illustrative and not in a limiting sense.

What is claimed is:

1. A timer comprising: a power source; a relay means for applying power from said power source to a load and for energizing a solenoid; an electronic switching means for operating said relay means so as to remove power from said load and deenergize said solenoid; a timing circuit for energizing said electronic switching means after a predetermined time, said timing circuit being connected to said electronic switching means; a plurality of timing networks for determining different time intervals for said timing circuit, said timing networks being connected to said timing circuit; a plurality of switches, each of said switches having a first contact member for energizing said relay means and a second contact member for connecting one of said timing networks to said power source so as to energize said timing circuit, said switches being connected to said power source and in circuit with said relay means and said timing networks; and means for latching said switches in an actuated position when said relay is energized, said latching means being connected to and operated by said solenoid so as to release said switches when said relay means is deenergized.

2. A timer as in claim 1 wherein said electronic switching means is a semiconductor device having an anode electrode, cathode electrode, and a gate electrode for controlling conduction from said anode electrode to said cathode electrode, said anode and cathode electrodes being connected across said relay means.

3. A timer as in claim 1 wherein said switches are double pole-single throw switches.

4. A timer as in claim 3 wherein said switches are pushbutton, double pole-single throw switches and said latching means is a latch bar adapted to latch an actuated pushbutton when said solenoid is energized and to release an actuated pushbutton when said solenoid is deenergized.

5. A timer as in claim 1 wherein said timing networks are resistor networks coupled to a capacitor so as to provide a resistor-capacitor time constant for operating said timing circuit.

6. A timer comprising: a power source; a first relay means for energizing a solenoid, said first relay means being connected to said power source; a second relay means for applying power from said power source to said load and for maintaining said solenoid energized; an electronic switching means for operating said second relay means so as to remove power from said load and deenergize said solenoid; a timing circuit for energizing said electronic switching means after a predetermined time, said timing circuit being connected to said electronic switching means; a plurality of timing networks for determining different time intervals for said timing circuit,

said timing networks being connected to said timing circuit; a plurality of switches, each of said switches having a first contact member for energizing said first relay means and a second contact member for connecting one of said timing networks to said power source, said switches being connected to said power source and said timing networks; a switching means for energizing said second relay means and said timing circuit, said switching means being connected to said second relay means, said timing circuit, and said power source; and a means for latching said switches in an actuated position when said first relay means is energized, said latching means being connected to and operated by said solenoid so as to release said switches when said second relay means is deenergized.

7. A timer as in claim 6 wherein said switching means for energizing said second relay means and timing circuit is a manual switch for starting said timer after a particular time interval has been selected and one of said switches is latched in an actuated position.

8. A timer as in claim 6 wherein said timing circuit is a unijunction transistor timing circuit and said electronic switching means is a semiconductor device having an anode electrode, cathode electrode, and a gate electrode for controlling conduction from said anode electrode to said cathode electrode, said anode and cathode electrode being connected across said second relay means, and said gate electrode being connected to an output of said unijunction transistor timing circuit.

9. A timer comprising: an alternating current power source; a power supply circuit for providing a direct current voltage, said power supply circuit being connected to said alternating current power source; a relay means for applying power from said alternating current power source to a load and for energizing a solenoid; a semiconductor device for operating said relay means so as to remove power from said load and deenergize said solenoid, said semiconductor device having an anode electrode, cathode electrode and a gate electrode for controlling conduction from said anode electrode to said cathode electrode, said anode and cathode electrodes being connected across a coil of said relay means; a timing circuit for energizing said semiconductor device after a predetermined time, said timing circuit being connected to said gate electrode of said semiconductor device; a plurality of resistor timing networks for determining different time intervals for said timing circuit, said resistor timing networks being connected to said timing circuit; a plurality of single throw-double pole switches, each of said switches having a first contact member for energizing said relay means and a second contact member for connecting one of said timing networks to said power supply circuit so as to energize said timing circuit, said switches being connected to said power supply circuit and in circuit with said relay means, timing circuit, and said timing networks; and a latch bar for latching said switches in an actuated position when said relay is energized, said latch bar being connected to and operated by said solenoid so as to release said switches when said relay is deenergized.

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