ABSTRACT: This is a timing device having only electrical terminals and using a relay with a bucking coil. One of the coils of the relay activates the timing cycle while the bucking coil, after a predetermined time cancels the cycle.
This invention relates to a long time interval heavy direct current timing device for controlling window heaters or the like of the order of about ten minutes in automotive applications.

There is a need for a long interval timer in automotive applications to control and limit the battery drain caused by heavy current devices such as electric heaters driven from the battery source. Manual switching of the prior cut for such heavy current devices results in the operator sooner or later omitting to turn off such a switch. Prior attempts to provide timing circuits for controlling such devices have resulted in inconsistent time periods available from the devices produced as well as a time period which is highly variable with any one device depending on temperature. Again prior devices are relatively complex to install, requiring many electrical connections and fastenings of mechanical parts to the degree that a special installation is required.

It is a main object of the invention to provide a long interval heavy current DC timing device for automotive use in the form of a packaged unit having three electrical terminals only and adapted to provide a timing interval of the order of 10 minutes with a tolerance of the order of ±2 minutes and having a timing interval greater at +40°F than at -40°F.

With the foregoing and other objects in view the invention generally concerns a long time interval heavy direct current device for automotive use actuable by a pushbutton pulse-type switch in the ignition circuit and comprising: a load terminal, a battery terminal, an actuating switch terminal and a chassis ground connection; a relay having a first relay winding, a second bucking winding and normally open contacts; a timing resistor and charging condenser in series between the battery terminal and ground through said normally open contacts; a holding resistor between said load terminal and said switch terminal, said first winding being connected between said switch terminal and said ground connection; a transistor having an anode connected between said timing resistor and condenser; voltage dividing resistor and condenser; voltage dividing resistors in series between said load terminal and said ground connection, said transistor having a gate connected between said voltage dividing resistors to determine the voltage at which said condenser discharges through said transistor, said transistor having a cathode connected to energize said bucking winding to said ground connection to energize said bucking winding in opposition to said first winding with said condenser discharge thus to open the contacts of said relay after a period of time determined substantially by said timing resistor and said condenser.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an electrical schematic of the device of the invention showing one manner of connecting same in an automobile circuit shown in part in chain lines; and

FIG. 2 is a perspective view of the mechanical form of the device of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to the drawings the device 10 of the invention is generally confined within an enclosure or housing 11 rising from mounting base 12 adapted to be grounded to an automobile chassis. A battery connection terminal 13, an ignition actuating switch terminal 14 and a load terminal 15 extend exteriorly of the housing 11. A pushbutton type switch 16 will normally be used to initiate the time cycle of the device of the invention from the ignition circuit having ignition switch 17 and the ignition switch 18 as such as heating coils 19 and an indicator light 20 in parallel therewith to chassis ground 21.

When pushbutton switch 16 is momentarily closed, terminal 13 connected by line 27 to the first winding 23 through line 28 to ground 21 causes contacts 25, 26 to close thereby connecting battery voltage to line 29 and load terminal 15 to energize the load. Holding resistor 30 connected between the load terminal by line 29 and the switch terminal by line 31 immediately on closure of contacts 25,26 commences to discharge battery voltage to the battery terminal 13 and the first winding 23 even though switch 16 may be quickly opened. Relay 22 will be held energized until released by the timing circuit now to be described.

Timing resistor 32 and charging condenser 33 are connected in series between the load terminal 15 and ground 21. A positive voltage is applied from line 29 through resistor 34 to gate 35 at a potential determined by voltage dividing series resistor 36 connecting to line 28 and ground 21. The unjunctiotype transistor 37 is idle during the timing cycle of voltage build up in condenser 33. When the control voltage between the gate 35 and anode of transistor 37 connected between timing resistor 32 and condenser 33 becomes forward biased, the gate fires causing a negative resistance between anode and transistor cathode 38 in series with bucking winding 24 to line 28 and ground. The condenser charge thus passes through the bucking winding 24 to reduce total flux in relay core 39 to zero thereby releasing the relay contacts 25,26 to the normal open position.

The thermistor 40 in parallel with timing resistor 32 is intended to overcompensate for temperature responsive characteristics of condenser 33 to give the longest cycle time at the lowest operating temperature and a lesser cycle time at higher temperatures in order to deliver more total heat from an electric heater at lower temperatures than at higher temperatures. The range of operation characteristics considered with relation to cycle time extends from -40°F to +140°F as a convenient range for test, though operation is designed to extend substantially beyond each end of such range.

The resistor 41 may have a value of 200 ohms while a resistor 34 may have a value of 1,000 ohms with the resistance 36 at 22Ω ohms and the resistor 32 at 1.8 ohms. A convenient value for the capacitor 33 is 220 microfarads and the thermistor may have a resistance of 1 MΩ.

1. A long time interval heavy direct current device for automotive use actuable by a pushbutton pulse-type switch in the ignition circuit and comprising: a load terminal, a battery terminal, an actuating switch terminal and a chassis ground connection, a single relay having a first relay winding, a second bucking winding and normally open contacts; a timing resistor and polarized charging condenser in series between the battery terminal and ground through said normally open contacts; a holding resistor between said load terminal and said switch terminal and said ground connection; the transistor having an anode connected between said timing resistor and condenser; voltage dividing resistor and condenser; voltage dividing resistors in series between said load terminal and said ground connection, said transistor having a gate connected between said voltage dividing resistors to determine the voltage at which said condenser discharges through said transistor, said transistor having a cathode connected to energize said bucking winding to said ground connection to energize said bucking winding in opposition to said first winding with said condenser discharge thus to open the contacts of said relay after a period of time determined substantially by said timing resistor and said condenser.

2. A long time interval heavy direct current device for automotive use actuable by a pushbutton pulse-type switch in the ignition circuit as set forth in claim 1 wherein the thermistor is placed in parallel with said timing resistor.
UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION


Inventor(s) Rodney Hayden

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 1, lines 46 and 47, delete "to energize", add -- through --.

Column 2, lines 54 and 55, add after the word termin -- said first winding being connected between said switch terminal --: Column 2, lines 61 and 62, add after the word winding -- to said ground connection to energize said bucking winding --.

Signed and sealed this 2nd day of November 1971.

(SEAL)
Attest:

EDWARD M. FLETCHER, JR. ROBERT GOTTSCHALK
Attesting Officer Acting Commissioner of Patents