

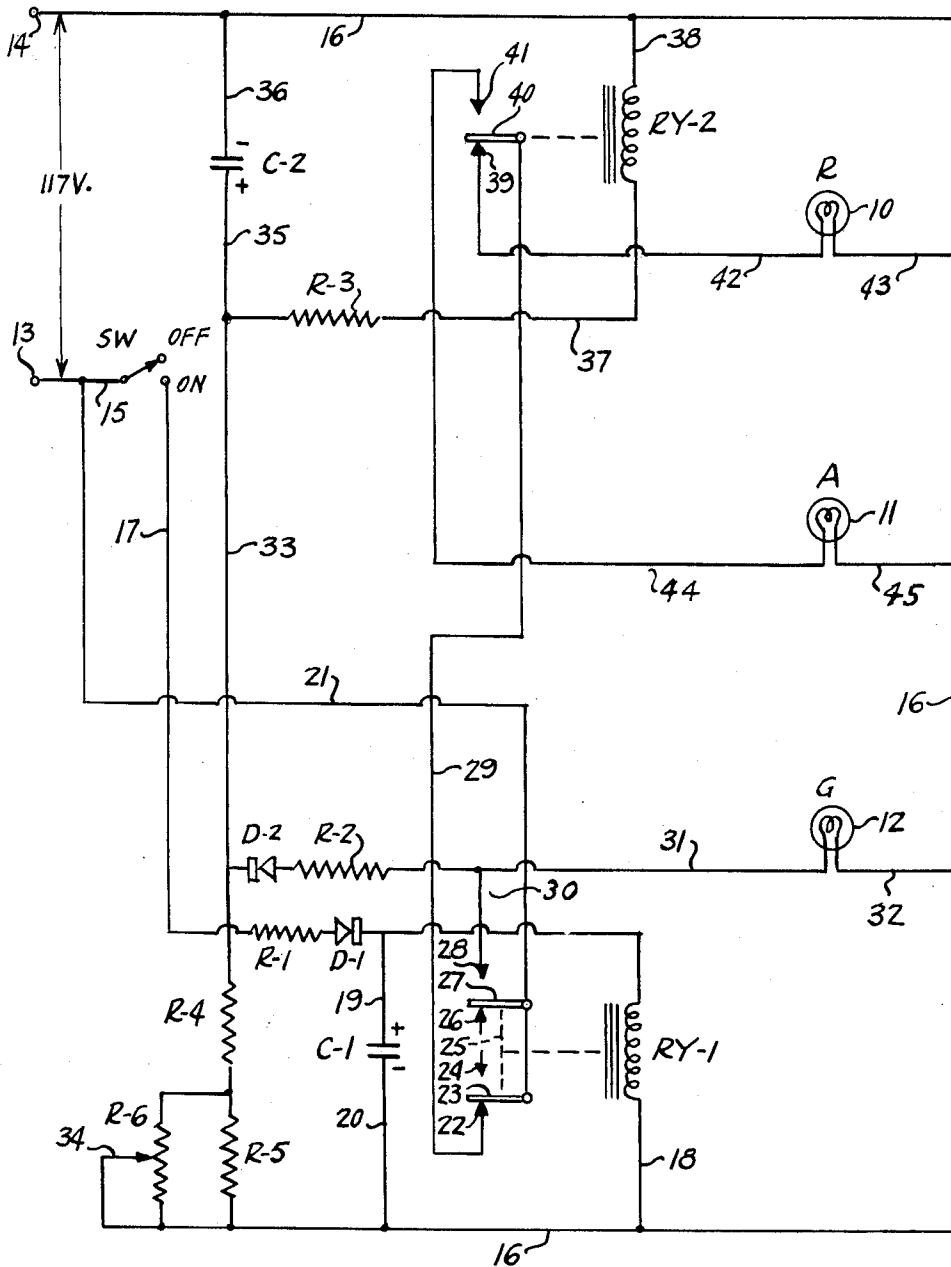
Sept. 15, 1964

J. C. LESHER

3,149,306

AUTOMATIC PHASE CONTROL FOR TRAFFIC LIGHTS

Filed May 18, 1962



INVENTOR.

JOHN C. LESHER

BY

Kimmel & Crowell

ATTORNEYS.

1

3,149,306

AUTOMATIC PHASE CONTROL FOR TRAFFIC LIGHTS

John C. Leshner, Erie, Pa., assignor to Rad-O-Lite, Inc.,
Erie, Pa., a corporation of Pennsylvania
Filed May 18, 1962, Ser. No. 195,876
4 Claims. (Cl. 340-41)

This invention relates to an automatic phase control for traffic lights.

The object of the present invention is to provide an automatic control circuit for traffic lights in which the periods of illumination of the three lights may overlap each other in variable degrees or may follow each other in sequence without either overlapping or interruption.

Another object of the present invention is to provide an automatic control circuit for traffic lights in which the master control for the three lights is a simple switch as distinguished from the rotary slip ring switches or master relays commonly used to control the timing cycle.

A further object of the present invention is to provide an automatic control circuit for traffic lights which circuit includes only conventional circuit components such as capacitors, rectifiers, relays and resistors.

Still other objects, advantages and improvements will become apparent from the following specifications, taken in connection with the accompanying drawing; in which the single figure represents the circuit diagram.

In the circuit diagram, red, amber, and green traffic signal lights are shown at 10, 11 and 12, respectively. For simplicity only three (3) lights for controlling traffic on a single street are shown. It will be obvious however that the circuit may be duplicated for a cross street at an intersection. The circuit is energized from an A.C. power line (not shown) which is connected to input terminals 13 and 14.

The master control for the three lights 10, 11 and 12 is a double pole, single throw switch SW. This switch has an "Off" contact and an "On" contact. As here shown, the switch is representative of the front end timing circuit of applicants' "Rad-O-Lite" ETC-400 Controller of applicants' copending U.S. application Serial No. 164,047. The power input terminal 13 is connected by a conductor 15 to the arm of the switch. A common return conductor 16 for the circuit is connected to the power input terminal 14.

The three lights 10, 11 and 12 are controlled jointly by a pair of relays RY-1 and RY-2. The relay RY-1 has two armatures 23 and 27, which are interconnected by a link 25. In the position shown, the relay is de-energized and the armature 23 is closed on a circuit making contact 22 and the armature 27 on a rest contact 26. When the relay RY-1 is energized, the armature 23 is closed on a rest contact 24 and the armature 27 on a circuit making contact 28.

The relay RY-2 is a single pole, double throw relay, having an armature 40 and dual contacts 39 and 41, both of which are circuit making and breaking contacts. In the position shown, the relay is de-energized and the armature 40 is closed on the contact 39; when the relay is energized, the armature is closed on the contact 41.

The energizing circuit of the relay RY-1 is from the On contact of the switch SW over a conductor 17, through a current limiting resistor R-1 and a diode rectifier D-1, the winding of the relay, and over a conductor 18 to the common return conductor 16. A capacitor C-1 is connected across the winding of the relay by conductors 19 and 20.

The energizing circuit of the relay RY-2 is over a con-

2

ductor 21, which is connected at one end to the conductor 15 ahead of the switch SW-1 and at its other end to both armatures 23 and 27 of the relay RY-1, the contact 28 of the latter relay, over conductors 30 and 31, through a current limiting resistor R-2 and a diode rectifier D-2, over a conductor 33, through a current limiting resistor R-3, over a conductor 37, through the winding of the relay RY-2, and over a conductor 38 to the common return conductor 16. A capacitor C-2 is connected across the second current limiting resistor R-3 and the winding of the relay by conductors 35 and 36. The energizing circuit for the relay RY-2 is also the first load circuit for the relay RY-1.

A time control for the relay RY-2 is comprised by a current limiting resistor R-4 and a fixed resistor R-5, which are connected in series between the conductors 31 and 33 and the common return conductor 16, and a variable resistor R-6, which is connected in parallel with the fixed resistor R-5. The common conductor 16 is connected at its end to the arm 34 of this variable resistor.

The second load circuit of the relay RY-1 is from the input terminal 13 over the conductor 21, to the first armature 23 and fixed contact 22 of the relay RY-1, over the conductor 29 to the armature 40 and fixed contact 39 of the relay RY-2, over the conductor 42 to the red light 10, and over the conductor 43 and the common return conductor 16 to the terminal 14. This is also the first load circuit for the relay RY-2.

The third load circuit for the relay RY-1 is from the input terminal 13 over the conductor 21 to the second armature 27 and fixed contact 28 of the relay, over the conductor 30 and the conductor 31 to the green light 12, and over the conductor 32 and the common return conductor 16 to the input terminal 14.

The fourth load circuit of the relay RY-1 is from the input terminal 13 over the conductor 21 to the armature 23 and fixed contact 22 of the relay, over the conductor 29 to the armature 40 and fixed contact 41 of the relay RY-2, over the conductor 44 to the amber light 11, and over the conductor 45 and common return conductor 16 to the terminal 14.

The circuit has been found to operate in a satisfactory manner with the following values for the circuit components:

45	C-1	-----	80 mfd., 115 volts.
	C-2	-----	150 mfd., 150 volts.
	R-1	-----	2.2 kilo-ohms.
	R-2	-----	470 ohms.
	R-3	-----	8.2 kilo-ohms.
50	R-4	-----	5.6 kilo-ohms.
	R-5	-----	47.0 kilo-ohms.
	R-6	-----	50.0 kilo-ohms.

It will be recognized however that different values may, for the above components, have to be employed according to the constants of the relays.

In the sequence of operation let it be assumed that the relays RY-1 and RY-2 are in the de-energized condition, as shown in FIGURE 1. The red light 10 is on.

The switch SW is now moved to the "On" position. The red light 10 now immediately goes out and the green light 12 comes on. The alternating 117 voltage is applied over the conductor 17, through the current limiting resistor R-1 and diode rectifier D-1 and conductor 19 to the capacitor C-1, and over the conductor 20 and the common return conductor 16. The diode rectifier D-1 provides positive half wave rectification and the capacitor C-1 is positively charged. The relay RY-1 is energized at the same time and contacts 22 and 23 are broken and

contacts 27-28 are made. The breaking of the contacts 22 and 23 opens the circuit through the red light 10 and it goes out. At the same time the making of the contacts 27 and 28 completes the circuit for the green light 12 and it comes on. The relay RY-1 continues to be energized as long as the resistor R-1 and the diode rectifier D-1 pass energy to the capacitor C-1 and the latter remains charged.

When the contacts 27 and 28 of the relay RY-1 were made they also passed the alternating 117 voltage to resistor R-2 and diode rectifier D-2. The latter provides positive half wave rectification. The positive half waves are impressed across the capacitor C-2 over the conductors 33 and 35 and the conductor 36 and common return conductor 16, thereby charging the capacitor C-2 positively. At the same time the voltage developed causes a current to flow through the resistor R-3, the conductor 37, the winding of the relay RY-2, and through the conductor 38 and the common return conductor 16. The relay RY-2 is energized and the contacts 39 and 40 are broken and the contacts 40 and 41 are made, and the relay RY-2 is held energized as long as the capacitor C-2 is charged. It will be noticed that the relay RY-1 is energized before the relay RY-2, since the normally open contacts 27 and 28 of the relay RY-1 are in the energizing circuit of relay RY-2 and the closing of these contacts depends upon the time delay factor of the relay RY-1.

In the sequence of operations thus far described, the red light 10 has gone out and the green light 12 has come on.

The switch SW is now turned to the "Off" position. The green light 13 now goes off, the amber light 11 comes on, and then goes off, and the red light 10 comes on and stays on.

When the switch SW is moved to the "Off" position, the energizing circuit of the capacitor C-1 is opened and the relay RY-1 is de-energized almost immediately. The armature 27 moves off the fixed contact 28 and the circuit of the green light 13 is opened. At the same time the armature 23 closes on the fixed contact 22, passing the 117 alternating voltage to the armature 40 and fixed contact 41 of the relay RY-2. This completes the circuit for the amber light 11. When the armature 27 was separated from the fixed contact 28 of the relay RY-1, the circuit through the resistor R-2 and the diode rectifier D-2 and capacitor C-2 began discharging from the negative side over the conductor 36, the common return conductor 16, the variable time control comprised by the resistors R-5 and R-6 through the current limiting resistor R-4 and over the conductors 33 and 35, to the positive side. Relay RY-2 will remain energized and hold the amber light 19 on, until the capacitor C-2 has been discharged through the variable time control comprised by the resistors R-5 and R-6. When the capacitor C-2 is discharged, relay RY-2 is de-energized and its armature 40 closes on the fixed contact 39. This again completes the circuit of red light 10 and the light comes on.

If the switch SW is moved again to the "On" position, the entire cycle of operation will be repeated.

Having now fully described by invention, what I claim as new and useful and desire to secure by Letters Patent of the United States is:

1. An automatic phase control system for sequential operation of traffic lights from an alternating current power source comprising circuit means, an alternating current energizing means therefor including dual terminal means, a cycle controlled single pole double-throw switch means operatively connected to said current energizing means, rectified current means including resistive current limiting means energized by said switch means, a first relay means including dual armature means and dual contacts therefor, one armature and contact being normally closed with one armature and a normally open contact cooperating with the other armature being normally open with respect to said armature, said armature cooperating with said switch means, an energizing rectified current

means for said first relay means from one terminal of the alternating power source through said switch means and the winding of said relay to the other terminal of the power line, a second relay means having a single armature means and dual contact means, one contact means being normally closed with respect to said armature means and one contact means being normally open with respect to said armature means, a second rectifying current means connected to said alternating current energizing means independently of said switch means operatively energizing said second relay means, said normally closed contact means of said first relay means sequentially connecting one terminal of said alternating current power line to a red traffic signal and to the other terminal means of said power line means, said open contact means of said first relay means consequently connecting one terminal of said power line means to a green light signal means and to the other terminal of said power line means, a resistive time delay capacitive discharge circuit operably connecting the armature winding of said first relay means to a timing circuit and capacitive charging circuit in parallel with the armature winding means of said second relay means, said second relay means being energized by the discharge of said capacitor means actuating said open contact means of said second relay means to sequentially connect, energize and display an amber light traffic signal means across both terminals of said power line means.

2. An automatic electrical phase control system for sequence operation of a plurality of traffic signal lights from a common alternating current energy source having two output terminals comprising, circuit means, alternating current energy means, a first relay means and energizing circuit means therefor including switch means interconnecting one side of said energy means to a current limiting resistor means in series with a first diode rectifier means connected in parallel with a capacitor and winding of the first relay means connected in parallel circuit arrangement with the other side of said energy source; a second relay means and energizing circuit means comprising conductor means connecting one of said output terminals of said energy means to the actuated armature contact means of said first relay means connected in parallel with a second capacitor means and current limiting resistor means connected to the winding of said second relay means, said second capacitor means and said winding being connected in parallel to the other energy output terminal; energized circuit means for sequentially controlling three traffic signal lights means in a predetermined pattern jointly controlled by said first relay means and said second relay means comprising circuit means interconnecting one terminal of said alternating current energizing means to the closed contact of said unenergized first relay means connected to the closed contact of said second relay means connected to a red signal traffic light means to the other terminal of said energy means; circuit means comprising switch means interconnecting one terminal of said energy means to a second closed contact of said energized first relay means connected to a green traffic signal light means to the other terminal of said alternating energy means; and circuit means comprising switch contact means interconnecting one terminal of said energy means to a closed contact of said unenergized first relay means connected to a closed contact of said unenergized second relay means connected to an amber traffic light signal means to the other terminal of said energy source to sequentially actuate said plurality of traffic light signals.

3. An automatic electrical phase control system for sequence operation of a plurality of traffic signal lights from a common alternating current source having two output terminals, as in claim 2, wherein said circuit means comprises control circuit means to de-energize the red traffic light signal means and energize the green traffic light signal means, and timing circuit means wherein said first relay means remains energized by said charged first capacitor means and said second relay means remains de-

5

energized to de-energize said green traffic light signal means and energize said amber traffic light signal means.

4. An automatic electrical phase control system for sequence operation of a plurality of traffic signal lights from a common alternating current source having two output terminals as in claim 3, wherein said timing circuit means comprises variable resistive current flow means co-operating with said charged first capacitor means to con-

5

6

trol the period of energizing said amber traffic light signal means.

References Cited in the file of this patent

UNITED STATES PATENTS

2,047,127	Huber	July 7, 1936
2,178,112	Barker	Oct. 31, 1939