TRAFFIC CONTROL LIGHT WITH MEANS RESPONSIVE TO A POWER FAILURE

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References Cited

UNITED STATES PATENTS

3,013,257 12/1961 Ippolito 315/219

3,047,727 7/1962 McAllise 307/66

3,114,095 12/1963 Palmer 307/66

3,189,788 6/1965 Cady 315/129

3,411,036 11/1968 Casey 315/129

FOREIGN PATENTS OR APPLICATIONS

22,593 5/1935 Australia 340/43

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ABSTRACT

A traffic control light is provided with a supplemental lamp which is illuminable by a secondary power source. Switching means are also provided which are responsive to a failure of the primary power source to connect the supplemental lamp to the secondary source so that the supplemental lamp is illuminated in a flashing mode to continue traffic control.

11 Claims, 7 Drawing Figures
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TRAFFIC CONTROL LIGHT WITH MEANS RESPONSIVE TO A POWER FAILURE

This invention relates generally to traffic control signals and more particularly to a traffic control signal having an emergency power supply for continuing traffic control during a power failure.

Traffic control signals are conventionally powered by a public source of power. That is, the traffic control signals are controlled and powered by the electricity provided by public utilities. In the event of a power breakdown at the public utility or a power failure caused by a shortened or broken high-power line, the conventional traffic control signal is not operable. At an urban city intersection, such an occurrence can not only cripple the flow of traffic, but can also lead to a dangerous situation which is susceptible to causing traffic accidents.

Accordingly, it is an object of this invention to provide a new and improved traffic control signal which includes a secondary source of power with stored energy for providing an emergency illumination to maintain traffic control in a flashing mode when the primary source of power has been disabled.

Another object of the invention is to provide a new and improved traffic control signal which includes a lamp means which is illuminable by a secondary power source which is capable of providing illumination of an intensity great enough to be easily seen even in bright daylight conditions.

Still another object of the invention is to provide a new and improved traffic control signal which includes a secondary source of power which is capable of energizing a secondary means of illumination for an ample period of time to correct the failure of the primary source of power.

A still further object of the invention is to provide a new and improved traffic control signal which includes a secondary source of power which is maintained at an operable level over long periods of time in which the secondary source is not used.

The objects of the invention are achieved by providing a traffic control signal which comprises a first lamp means and a second lamp means. The first lamp means is illuminable by a primary power source. A secondary power source is also provided. Means responsive to a failure of the primary power source is provided for connecting the second lamp means to the secondary source so that the second lamp will be illuminated to continue traffic control during the power failure.

Other objects and many of the attendant advantages of this invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings wherein:

FIG. 1 is a front elevational view of a traffic control signal embodying the invention;

FIG. 2 is a sectional view taken along the line 2-2 in FIG. 1;

FIG. 3 is a schematic block diagram of the circuitry utilized in the invention;

FIG. 4 is a schematic diagram of the AC to DC converter utilized in the invention;

FIG. 5 is a schematic diagram of the charging circuit utilized in the invention;

FIG. 6 is a schematic diagram of the flasher circuit utilized in the invention;

FIG. 7 is a schematic diagram of the oscillator utilized in the invention.

Referring now in greater detail to the various figures of the drawings wherein similar reference numerals refer to similar parts, a traffic control signal embodying the invention is shown generally at 20 in FIG. 1.

The traffic control signal basically comprises a plurality of casings 22, 24 and 26, each of which houses a lamp means. Each of the casings includes a rectangular box 28 in which a lamp assembly 30 is mounted. The boxes 28 include an open front portion adjacent which a front lid 32 is pivotably secured by means of a pair of hinges 24. The front lids 32 each include a tinted glass lens 36 which are preferably red for use in casing 22, amber for use in casing 24 and green for use in casing 26. As best seen in FIG. 1, each of the boxes 28 includes a frame 38 for supporting the lamp assembly 30. As best seen in FIG. 2, the lamp assembly 30 includes a reflector 40, a lamp socket 42 and a lamp 44. In casing 24, an additional lamp 46 is also provided as will be set forth in greater detail hereinafter. Lamp 44 is preferably a conventional incandescent lamp which is normally utilized in a traffic control signal. Similarly, the casings 22, 24 and 26 are conventional and are secured together by a pair of posts 48 and 50. Secured to the rear of casing 28 is a secondary power supply pack 52. It should be understood that casings 22 and 26 may also be supplied with a power pack where it is desired to provide a secondary source of illumination in either of these casings. In the instant embodiment, the power pack is utilized with the central casing 24 which is equipped with an amber lens 36 so that an amber blinking signal is provided in the case of the loss of the primary source of power of the traffic control signal.

The lamp 46 is supported by a circular plastic insert 54 which includes a plurality of wire strips 56 wound about the insert 54 and a loop of lamp 46. The lamp 46 preferably comprises an elongated glass tube wound in the shape of a coil and having an ionizable gas provided therein which is preferably neon.

The second lamp 46 is thus wound about the first lamp 44 in close proximity thereto and is provided adjacent the lens 36 so that the illumination thereof is capable of being seen outside of the casing by passengers in vehicles and pedestrians when it is energized.

The plastic insert 54 includes a plurality of radially extending projections 58 which engage recesses provided in the inner periphery of reflector 40. The resiliency of the plastic insert 58 enables the insert to be retained within the reflector and may be easily inserted or removed by manually deforming the insert. Thus, either inserting a new lamp in a casing or in the alternative moving a lamp to another casing is facilitated by the insert.

It should be understood that the second lamp and power pack associated therewith is typically provided in the middle or amber section of a traffic control signal facing in one direction and placed in the top casing or the casing with the red lens of a traffic control signal facing in the transverse direction of traffic.

The power pack 52 includes a switching means therein which is responsive to the conventional power source provided to the traffic control signal which automatically switches into operation when there is a failure of the conventional power source. The power pack includes a flashing circuit which provided a pulsating power supply to the lamp 46 so that a constant blinking is desired which warns people to proceed with caution when the lamp 46 is provided behind the amber lens. When the lamp is provided behind the red lens, the flashing illumination indicates that a full stop should be made prior to entering the intersection. The power pack and supply is preferably secured to the rear wall of the casing by suitable fasteners or welding.

The circuitry utilized in the power pack 52 is best seen in FIG. 3. Basically, the power pack 52 comprises an AC to DC converter 100, a battery charger 102, a DC rechargeable battery 104, a relay 106, a flasher circuit 108 and a high-voltage oscillator 110. The AC to DC converter is connected to the primary power source which is normally a 117-volts AC power source.

The 117-volts AC power source is also connected to the conventional switching circuits 112 that are provided in the traffic control signal for energizing the appropriate lamp 44 in accordance with the traffic control time pattern. The conventional switching circuits 112 are thus in turn connected to each of the lamps 44 provided in the traffic control signal casings 22, 24 and 26.

The AC to DC converter 100 is connected via lines 114 and 116 to a battery charger 102 and across the coil 118 of relay 106.
It should be noted that where the primary source of power provided is a direct current source, the AC to DC converter may be a permanent magnet to provide the desired level of DC voltage directly to the lines 114 and 116.

The battery charger 102 is provided to maintain the DC battery 104 in an operable condition so that the voltage across the output terminals does not deteriorate with age. That is, the DC battery 104 is preferably a 12-volts rechargeable battery. This means that the DC battery 104 can maintain as high a voltage as 14 volts across the terminals. However, when a long period of time elapses and the DC battery is not used, the voltage across the positive and negative voltage of the battery ultimately deteriorates below 10 volts.

When the battery voltage falls below 10 volts, the battery charger 102 senses this condition and charges the battery until the voltage thereacross is 14 volts. When the voltage across the battery reaches 14 volts, the battery charger is turned off until such time as the voltage across the terminals of the battery has deteriorated to a level of 10 volts or less.

The battery charger is connected directly to the negative terminal of DC battery 104 via line 120. The second output line 122 of battery charger 102 is connected to a first terminal 124 of relay 106. Relay 106 includes a pair of switches 126 and 128.

Each of the switches 126 and 128 includes an arm 130 and a pair of terminals 124 and 132. Arms 130 of switches 126 and 128 are connected to terminal 132. However, when the relay coil 118 is energized, the arms are drawn against terminal 124 as shown in FIG. 3. Therefore, as long as 117 volts are applied to the AC to DC converter 100, a DC voltage is applied across relay coil 118 by the AC to DC converter 100.

Arms 130 of switches 126 and 128 are connected to arm 134 of "on-off" switch 136. Switch 136 is a conventional toggle switch and is used as a service switch which is opened only during servicing and repair of the control light. Thus, normally switch 136 is closed when the secondary power pack 52 is placed into operation for sensing a failure of primary power. Terminal 138 of switch 136 is connected to the positive terminal of the DC battery 104.

It can therefore be seen that the battery charger 102 is connected across the positive and negative terminals of DC battery 104 when relay 106 is energized but is disconnected from the DC battery when the relay 106 is deenergized as a result of a failure in the 117-volts AC primary power source. Thus, while normal operation of the traffic control signal by the primary power source ensues, the battery charger 102 is connected to the DC battery to insure the operability thereof if and when a failure of the primary power source occurs.

The negative terminal of the DC battery 104 is also connected via line 140 to flasher 108 and high-voltage oscillator 110 via which terminal 132 of switch 126. Relay 106 is connected to the input of flasher 108 via line 142. The output of flasher 108 is connected via line 144 to the high-voltage oscillator. The high-voltage oscillator is in turn connected via output lines 146 and 148 to the terminals of the lamp 46.

Flasher 108 causes a pulsating voltage signal on line 144 at a rate of 60 pulses per minute. The higher voltage level is maintained on line 144 for a ½-second period thus providing 6½-second periods of voltage to the input line 144 to the high-voltage oscillator 110. The high-voltage oscillator 110 requires the higher voltage at line 144 in order to be operated. During the period of high voltage on line 144, the oscillator 110 provides a very high voltage high-frequency oscillation on lines 146 and 148, which causes ionization of the gas in lamp 46 and thereby provides a pulsating or flashing illumination 60 times per minute. The flasher 108 is operable only when there is a failure of the primary power source and the line 142 is connected to the positive terminal of the DC battery 104 via switch 136. Relay 106 is responsive to the failure of the 117-volts AC primary power source because the relay coil 118 is deenergized when there is a failure of the primary power source. When relay coil 118 is deenergized, it causes the arms 130 of switches 126 and 128 to be drawn to their normal position against terminals 132. This causes the flasher 108 to be connected to the DC battery 104 via switch 128 thereby causing the flasher 108 to be operated. When the flasher is operated, it causes the flashing illumination at lamp 46.

It can therefore be seen that a powerpack circuit is provided which enables a high-intensity illumination of lamp 46 yet which is not a large drain on a DC battery supply. That is, the use of an ionizable gas requires less power consumption than the incandescent lamp yet the lamp 46 provides an intense enough illumination to maintain traffic control.

The powerpack 52 further includes the battery charger 102 which maintains the DC battery 104 in a usable condition at all times. The relay 106, by being responsive to the AC to DC converter 100, which is in turn connected to the primary power source, enables the circuit to be automatically switched into operation by the mere failure of the primary power source. Accordingly, service personnel are not required to be routed to each traffic control signal to turn on the secondary powerpack during an emergency.

It should further be noted that the same power source utilized for energizing lamps 44 through conventional switching circuits 112 is utilized to energize the relay coil 118 to maintain its responsive state. Thus, there is no unnecessary drain of the DC battery until it is utilized for operating the lamp 46.

The AC to DC converter 100 is best seen in FIG. 3. As seen therein, the converter basically comprises a power transformer 150 having its primary winding connected to the 117-volts AC primary power source and its secondary winding connected across a full-wave rectifier circuit 152 comprised of 4 diodes 154, 156, 158 and 160. One end of the secondary winding of transformer 150 is connected to the junction between diodes 154 and 156 and the other end of the secondary winding is connected to the junction between diodes 160 and 158. The output lines 114 and 116 are connected between the junctions of diodes 158 and 156 and the junction of diodes 154 and 160.

The charger circuit 102 is best seen in FIG. 5. The charger circuit includes a switch comprised of a pair of PNP transistors 170 and 172 and a pair of NPN-transistors 174 and 176 which are connected as a trigger circuit. Line 114 is connected to a current-limiting resistor 178 and to a diode 180. Resistor 178 is connected at its other end to the emitter of transistor 170. The collector of transistor 170 is connected to the collector of transistor 172 and to a positive terminal 182 which is in turn connected to output line 122 of the battery charger 102.

The collectors of transistors 170 and 172 are also connected to resistor 184 of a potentiometer 186. The wiper arm 188 of potentiometer 186 is connected to the base of transistor 174. The other end of resistor 184 is connected to a common line 190 which is connected to negative output terminal 192 which is in turn connected to output line 120 of the battery charger 102.

Diode 180 is connected at its other side to resistor 194 and Zener diode 196. Resistor 194 is connected at its other side to the collector of transistor 174. Zener diode 196 is connected at its other side to the base of transistor 172 and to the collector of transistor 176 via a resistor 197. The collector of transistor 174 is connected to the base of transistor 176 via resistor 198. The base of transistor 176 is connected to line 190 via resistor 200. The emitter of transistor 176 is connected via resistor 202 to line 190. An electrolytic capacitor 204 is connected to line 190 and at its other end to diode 180, resistor 194 and Zener diode 196.

In operation, the charger circuit provides a charging current via the positive terminal 182 and negative terminal 192 to the battery 104 whenever the voltage across terminals 182 and 192 falls below 10 volts. The charging current continues to the terminal 182 until the voltage across terminals 182 and 192 reaches 14 volts at which time the circuit is turned off until such time as the voltage across terminals 182 and 192 again falls to 10 volts or lower.
The transistors 170 and 172 are connected together to form a Darlington switch. Transistors 174 and 176 are connected together to form a trigger circuit.

In operation, when 14 volts are provided across terminals 182 and 192, the potentiometer 186 is so set that the transistor 174 has its base emitter junction forward-biased thereby causing the transistor 174 to conduct. When transistor 174 conducts, it causes the transistor 176 to be cut off due to the low voltage at the base thereof provided by the collector of transistor 174. Consequently, the voltage at the collector of transistor 176 goes high thereby causing the base voltage of transistor 172 to become higher than the emitter voltage thereof, thereby turning off transistor 172.

When transistor 172 is cut off, it causes the voltage at the base of transistor 170 to back-bias the emitter base junction of transistor 170 causing transistor 170 to be cut off. The cutting off of transistors 170 and 172 thus prevents the charging from lines 114 and 116 to terminals 182 and 192 to the DC battery.

When the voltage across terminals 182 and 192 drops below 10 volts, the voltage at the base of transistor 174 is caused by potentiometer 186 to be dropped below the level to maintain conduction of transistor 174. The base emitter junction of transistor 174 is then back-biased cutting off transistor 174 and thereby causing a high voltage from the collector of transistor 174 to turn on transistor 176.

When transistor 176 is turned on and starts to conduct, the voltage level at the base of transistor 172 is then dropped causing the emitter base junction of transistor 172 to be forward-biased thereby turning on transistor 172. As the transistor 172 conducts, the emitter voltage drops and forward-biases the emitter base junction of transistor 170. With transistors 170 and 172 conducting, the resistor 178 acts as a limiting resistor to prevent too quick a charging of the DC battery via transistor 170 and terminals 182 and 192.

The charging through resistor 178 continues until such time as the voltage between terminals 182 and 192 reaches 14 volts and thereby turns on transistor 174 again which thereby terminates the charging of battery 104 until such time as the voltage level between terminals 182 and 192 falls below 10 volts.

The capacitor 204 acts to provide DC stabilization from the trigger circuit. The Zener diode 196 stabilizes the voltage at the base of the transistor by providing approximately 5.6 volts at the base thereof whenever transistor 176 is turned on. The diode 180 prevents feedback from either the trigger circuit comprised of transistors 174 and 176 or through the Zener diode 196 and thus isolates the Darlington switch from the trigger.

The flasher circuit is best seen in FIG. 6. The flasher circuit basically comprises a pair of transistors 210 and 212 which are connected together as a multivibrator. Transistors 210 and 212 are preferably comprised of NPN-transistors. The circuit further includes transistor 214 which is also preferably of the NPN type.

The emitters of transistors 210, 212 and 214 are each connected to common line 216. The base of transistor 210 is connected to the collector of transistor 212 via a capacitor 220. The base of transistor 212 is connected to the collector of transistor 210 via capacitor 222. The base of transistor 210 is connected to line 224 via resistor 226. The base of transistor 212 is connected to line 224 via resistor 228. The collectors of transistors 210 and 212 are connected to line 224 via load resistors 230 and 232, respectively.

A Zener diode 234 is also provided which is connected between lines 216 and 224 in parallel with an electrolytic capacitor 236. The Zener diode 234 acts to maintain the voltage across the circuit at approximately 6.5 volts. The electrolytic capacitor aids in stabilizing the voltage at 6.5 volts across the Zener diode and the remainder of the circuit. The line 224 is connected to the collector of transistor 214 via the coil 238 of a relay 240. The base of transistor 214 is connected to the collector of transistor 212 via a coupling resistor 241.

Relay 240 includes, in addition to coil 238, a switch 242 which includes a pair of terminals 244 and 246 and a wiper 248. The wiper arm 248 is normally urged against terminal 246. When the relay coil 238 is energized, arm 248 is drawn against contact terminal 244.

The wiper arm 248 is connected to output line 144 which is connected to the input of high-voltage oscillator 110. The line 216 is connected to the negative terminal of the DC battery 104 via line 140.

Input line 142 from relay 106 is connected to terminal 244 of relay switch 242 and to line 224 via resistor 250. When voltage is applied on line 142 from the DC battery as a result of the deemphasis of resistor 106, the positive voltage at line 224 applied via resistor 250 causes each of the transistors 210 and 212 to alternately conduct or change state at a rate of 120 times per minute. This causes each transistor to conduct 60 times per minute. The time constant is set by resistors 226 and 228 and capacitors 220 and 222 which sets the oscillation rate of the circuit. Since transistors 210 and 212 are connected as a multivibrator, the transistors are alternately conductive and cut off. The transistor 212 is thus caused to be turned off 60 times per minute. Each time transistor 212 is turned off, the voltage at the collector thereof goes high thereby causing the base emitter junction of transistor 214 to be forward-biased thereby turning on transistor 214. Each time transistor 214 is turned on, it causes conduction through the emitter collector path thereof which enables the relay coil 238 to be energized.

When relay coil 238 is energized, it causes the arm 248 of switch 242 to be drawn against terminal 244 which in turn causes the positive terminal of the battery 104 to be connected directly to the high-voltage oscillator 110 via lines 142 and 144. The resistor 250 acts to isolate the flasher circuitry from the high-voltage oscillator. Thus, the flasher circuit acts to connect the battery to the high-voltage oscillator circuit 60 times a minute for one-half second at a time. Each time the voltage from the battery is connected to the oscillator, the oscillator generates the voltage which is required to illuminate the lamp 46.

The high-voltage oscillator 110 is best seen in FIG. 7. The high-voltage oscillator basically comprises a pair of transistors 260 and 262 which are preferably of the NPN type and which are connected together in push-pull fashion. The high-voltage oscillator also includes a transformer 264 which preferably includes no core separation. The transformer 264 includes a primary winding 266 which is center-tapped at line 268. The transformer also includes a first secondary winding 270 which is center-tapped at line 272 and a second secondary winding 274 which is connected to output lines 146 and 148 which are connected across the lamp 46.

The primary winding 266 preferably includes 60 turns with the line 268 being connected at the halfway point between the windings. Similarly, winding 270 preferably includes 20 turns with the line 272 being connected at the halfway point of the winding. The secondary winding 274 preferably includes 4,500 turns to step up considerably the voltage provided across the primary winding 266. The emitters of transistors 260 and 262 are connected together and are connected via a resistor 276 to the center tap line 272 of winding 270. The collectors of transistors 260 and 262 are connected to the opposite ends of the primary winding 266.

The center tap line 268 of primary winding 266 is connected via a resistor 278 to center tap line 272 of winding 270. The bases of transistors 260 and 262 are connected across the opposite ends of the winding 270.

When the voltage from the battery is applied on lines 144 and 140 to the oscillator 110, it in turn causes oscillations in transistors 260 and 262. The oscillation is made possible by the feedback to the bases of transistors 260 and 262 of the voltage via the secondary winding 270. The voltage from the collectors of the transistors 260 and 262 is fed to the primary winding 266 and transformer winding 274. A high-voltage oscillation is thus applied across lines 146 and 148 to the lamp 46.

The oscillation of the oscillator 110 continues for one-half second at a time and is turned off for ½-second period at a
What is claimed as the invention is:

1. In a traffic control light, a lamp unit comprising a first lamp means and a second lamp means, said second lamp means comprising an elongated bulb wound in a coil and filled with an ionizable gas which is mounted about said first lamp means, said first lamp means being illuminated by a primary power source, a secondary power source, means responsive to a failure of said primary power source for connecting said second lamp means to said secondary source so that said second lamp will be illuminated so that it will act as a control signal to motorists in place of said first lamp.

2. The invention of claim 1 wherein means are provided to operate said second lamp means in a flashing mode.

3. The invention of claim 1 wherein said elongated bulb is filled with xenon.

4. The invention of claim 1 wherein said primary power source comprises a conventional 60 cycle per second alternating current source and said secondary power source comprises a direct current battery, said means responsive to a failure of said primary source comprising a relay, said relay having a coil connected across said primary source.

5. The invention of claim 4 wherein said relay further includes switching means, said switching means being connected between said secondary source and said second lamp means so that failure of said primary power source causes said second lamp means to be connected to said secondary source.

6. The invention of claim 1 wherein said traffic control light further comprises a high-voltage oscillator for energizing said second lamp, said oscillator being connected to said secondary power source for producing an energizing signal for said lamp means.

7. The invention of claim 6 wherein said high-voltage oscillator comprises a push-pull oscillator and a step-up transformer for amplifying the voltage produced at the output of said push-pull oscillator.

8. The invention of claim 6 wherein said traffic control light further includes a switching device for alternately connecting and disconnecting said oscillator to said secondary power source, said switching device acting to cause said lamp to be operated in a flashing mode.

9. The invention of claim 8 wherein said switching device includes a multivibrator which is connected to said secondary source when said failure of said primary source is detected, a switch, said switch being responsive to said multivibrator for connecting and disconnecting said secondary power source to said high-voltage oscillator in accordance with the state of said multivibrator.

10. The invention of claim 1 and further including charging means, said charging means being connected at its input to said primary source of power and at its output to said secondary power source, said switching device being so connected that said secondary power source is maintained between predetermined signal levels so long as said primary power source is operative.

11. The invention of claim 10 wherein said charging means includes a switching device and a triggering circuit, said switching means acting to enable charging of said secondary source by said primary source when said secondary source reaches a predetermined signal level, said triggering circuit being responsive to said signal level of said secondary power source so that when said secondary power source reaches a second predetermined signal level, said triggering circuit causes said switching means to disconnect said primary source from said secondary source.
UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION
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and
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It is certified that errors appear in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

(1) Column 2, Line 51 "provided" should be --provides--.

(2) Column 6, Line 71 after the word "and" insert the following:

--is stepped up considerably by the transformer 264 and--

Signed and sealed this 13th day of June 1972.

(SEAL)
Attest:

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