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ILLUMINATION CONTROL

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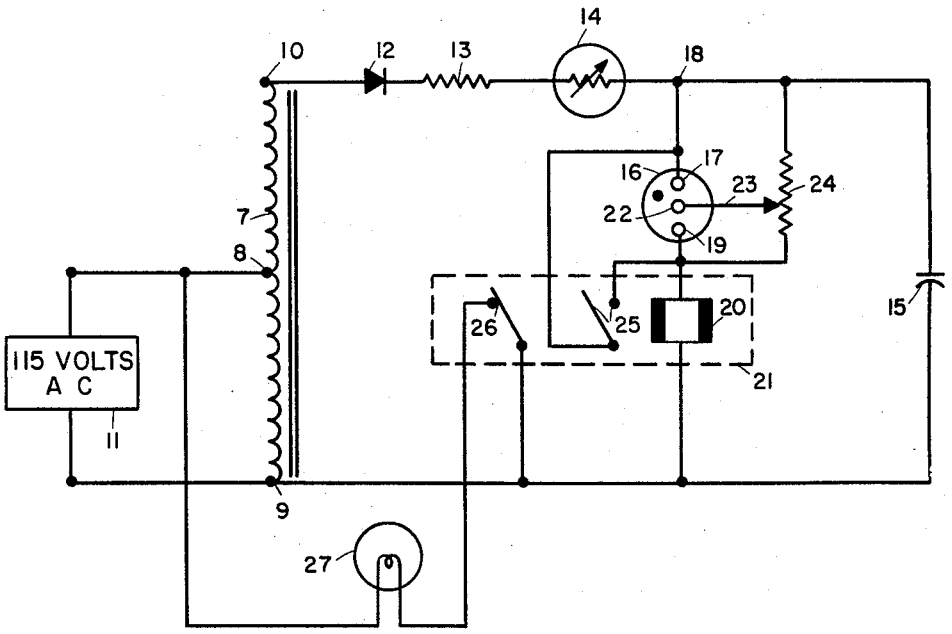

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ILLUMINATION CONTROL

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This invention relates to photoelectric control circuits.

One application of photoelectric control circuits lies in the control of the illumination of street lamps. In such an application each lamp is usually equipped with its own individual control which turns the lamp on when the ambient illumination falls below a certain level and turns it off when the ambient illumination rises above a certain level. Illumination controls differ from some other types of photoelectric controls in that they normally operate only twice a day, and in that in order to be practical they must require very little servicing.

It is the principal object of this invention to provide a photoelectric control circuit particularly suitable for illumination control, which requires very little servicing and which can be built at very low cost.

Other and incidental objects of this invention will be apparent to those skilled in the art from a reading of the following specification and an inspection of the accompanying drawing which shows a circuit diagram of an illumination control in accordance with this invention.

Referring now to the drawing we have an autotransformer 7 having a primary winding between terminals 8 and 9 and a secondary winding between terminals 9 and 10. The terminals 9 and 8 are connected across a source 11 of alternating current. The turns ratio of the transformer 7 is such that when its primary winding is connected across a 115 volt line the voltage across its secondary winding is approximately 170 volts. A selenium rectifier 12, a series limiting resistor 13, a cadmium selenide photoconductive cell 14 and an electrolytic capacitor 15 are connected in series across the secondary terminals 9 and 10. A three-element glow discharge trigger tube such as neon lamp 16 has one of its main electrodes 17 connected to the junction 18 of the photoconductive cell 14 and the condenser 15, while its other main electrode 19 is connected to the terminal 9 through the coil 20 of a double-pole single-throw relay 21. The starter electrode 22 of the neon lamp 16 is connected to the sliding contact 23 of a potentiometer 24 connected in shunt with the main electrodes 17 and 19 of the neon lamp 16. The relay 21 comprises a pair of contacts 25 which when closed short-circuit the main electrodes of neon lamp 16, and a pair of contacts 26 which when closed connect the lamp 27 across the primary terminals 8 and 9. The lamp 27 is the load to be controlled such as a street lamp.

The operation of a photoelectric control circuit shown in the drawing is as follows: the rectifier 12 supplies direct current to the circuit, the junction of rectifier 12 and resistor 13 may be regarded as the positive power supply terminal and the terminal 9 as the negative power supply terminal. The relay 21 pulls in when the current through the coil 20 exceeds approximately 6 milliamperes and drops out when the current through the coil 20 drops below approximately 2 milliamperes. When the relay 21 is pulled in the contacts 25 are closed and the contacts 26 are open, while when the relay 21 has dropped out the contacts 25 are opened and the contacts

26 are closed. Let us first assume that there is little or no illumination impinging on the photocell 14: the neon lamp 16 is in series with the relay coil 20 since the contacts 25 are opened, and the lamp 27 is lit since the contacts 26 are closed. As the illumination level on the photocell 14 reaches one foot-candle the rectified current passed through the rectifier 12 charges the capacitor 15 to approximately 180 volts. The neon lamp 16 is ready to fire if the potential of the starter electrode 23 reaches the firing potential. As the level of illumination goes up further the photocell 14 conducts more current, the capacitor 15 charges to a higher voltage and eventually the firing potential on the starter electrode is reached and the neon lamp 16 fires. The illumination level at which the neon lamp 16 fires is controlled by the position of the sliding contact 23 on the potentiometer 24. The neon lamp 16 provides a low impedance discharge path for the charge accumulated across the capacitor 15 and the current pulse due to the sudden discharge of this capacitor through the neon lamp 16 and the relay coil 20 actuates the relay 21. The contact 26 opens thus deenergizing the lamp 27, and the contacts 25 close thus putting the coil 20 directly in series with the cell 14. As long as the illumination of the photocell 14 is sufficient to pass two milliamperes through the coil 20 the lamp 27 remains deenergized. When the current through the relay coil 20 drops below two milliamperes the contacts 25 open and the contacts 26 close thus energizing the lamp 27. The operating cycle is thus ready to be repeated.

The advantages of the illumination control of the present invention over other controls are as follows:

(1) The neon lamp 16 provides an amplification factor of three or better without the use of an amplifier having a heated cathode. Service free operation over a period of five to ten years is thus possible.

(2) The neon lamp 16 is fired and immediately extinguished only once a day. This prolongs its life almost indefinitely.

(3) The cadmium sulfide photocell is slow acting. This factor, together with the fact that the capacitor 15 may be made quite large, renders the system immune to fast light transients.

(4) As the cadmium selenide is desensitized by high levels of illumination during the day the circuit turns the street lamp on at night at a higher level of illumination than that at which it turns it off in the morning. This is desirable as traffic in the streets is usually much more dense at dusk than at dawn.

I claim:

1. An illumination control circuit for a lamp comprising a glow discharge trigger tube having two main electrodes and a starter electrode, means including a photoelectric cell to connect one of said main electrodes to a positive power supply terminal, means including a relay coil to connect the other of said main electrodes to a negative power supply terminal, a potentiometer having a resistor and a sliding contact thereon, means to connect said resistor in shunt with the main electrodes of said tube, means to connect said starter electrode to said sliding contact, a capacitor having two terminals, means to connect one terminal of said capacitor to the positive power supply terminal through said photoelectric cell, means to connect the other terminal of said capacitor to said negative power supply terminal, a pair of normally open relay contacts in shunt with the main electrodes of said tube and a pair of normally closed relay contacts to energize said lamp.

2. An illumination control circuit for a lamp comprising a glow discharge trigger tube having two main electrodes and a starter electrode, means including a photo-

electric cell to connect one of said main electrodes to a positive power supply terminal, means including a relay coil to connect the other of said main electrodes to a negative supply terminal, a resistor in shunt with the main electrodes of said tube, means to connect said starter electrode to a point on said resistor, a capacitor having two terminals, means to connect one terminal of said capacitor to the positive power supply terminal through said photoelectric cell, means to connect the other terminal of said capacitor to said negative power supply terminal, a pair of normally open relay contacts in shunt with the main electrodes of said tube and a pair of normally closed relay contacts to energize said lamp.

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