

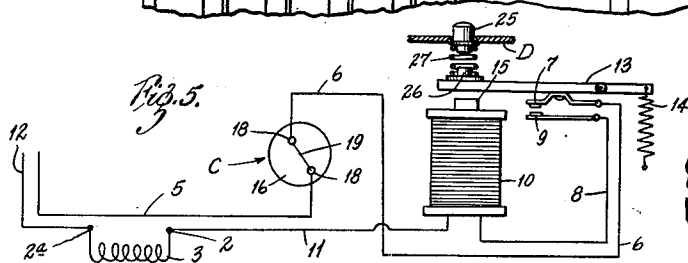
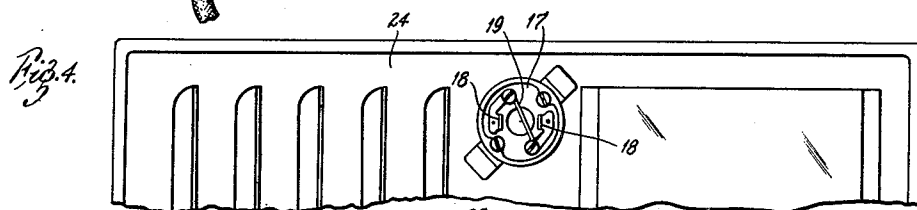
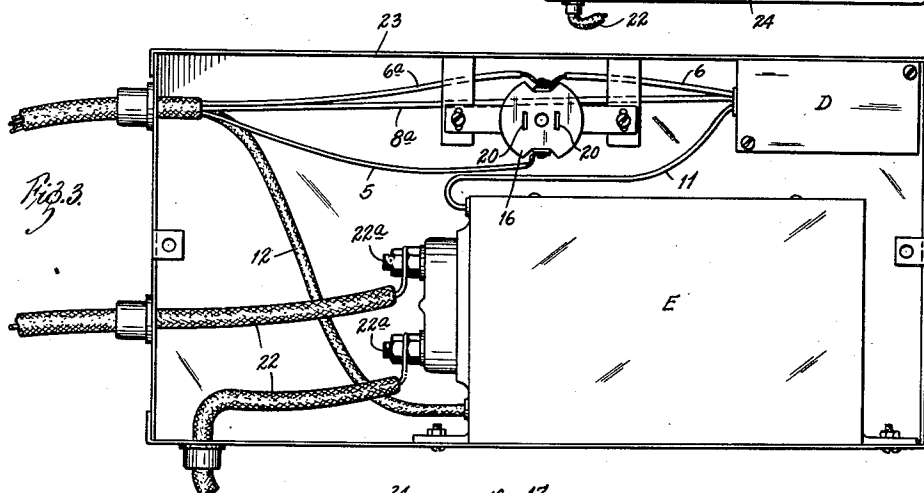
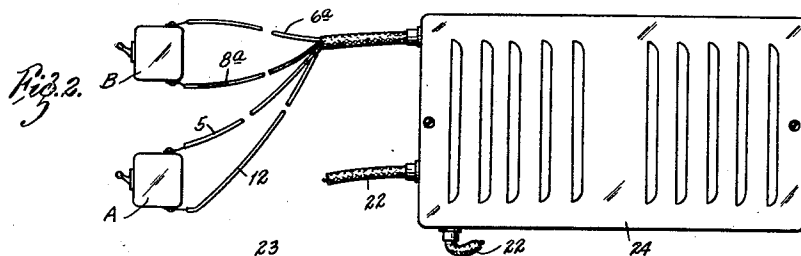
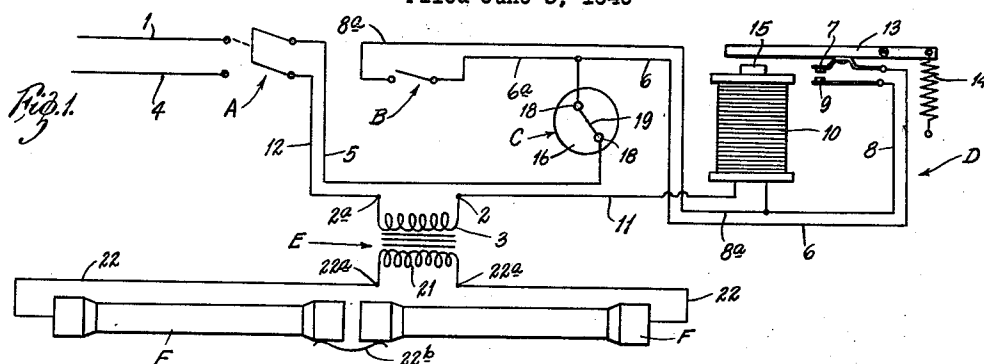
Jan. 19, 1943.

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2,308,987

ELECTRIC LIGHTING SYSTEM

Filed June 3, 1940



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UNITED STATES PATENT OFFICE

2,308,987

ELECTRIC LIGHTING SYSTEM

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Application June 3, 1940, Serial No. 338,666

4 Claims. (Cl. 176—124)

This invention relates to lighting systems, particularly electric lighting systems including gas or vapor lamps of the electric discharge type and a step-up transformer for changing the ordinary low voltage service current to a current of sufficiently high voltage to operate said lamps. The principal object of the present invention is to provide in the low voltage circuit of an electric lighting system of the above type a relay which will automatically open said circuit upon any interruption of the high voltage circuit; to provide for electrically or mechanically operating the relay thus opened to again close such automatically low voltage circuit when the high voltage circuit is interrupted by a defective lamp to thereby cause the sound lamps to glow faintly and thus indicate the particular lamp that requires replacement; to provide for the compact mounting of said transformer, relay and either the mechanical or electric relay closer in a housing having an access opening and a cover therefor; and to provide means whereby the low voltage circuit is opened by the removal of said cover so as to enable inspection, repair and replacement of the parts in the housing to be made with safety. The invention consists in the electric lighting system hereinafter described and claimed.

In the accompanying drawing, wherein like symbols refer to like parts wherever they occur, 30
Fig. 1 is a diagram illustrating my system.

Fig. 2 is a front elevation of the housing which encloses the transformer, the safety relay in the low voltage or primary circuit and the safety switch which opens said circuit when the cover 35 for said housing is removed.

Fig. 3 is an enlarged view of said housing with the cover removed.

Fig. 4 is a fragmentary interior face view of the housing cover, showing the plug of the safety 40 switch mounted thereon; and

Fig. 5 is a diagram illustrating a modified form of lighting system wherein the relay is closed by a mechanical device mounted in the housing.

The electric lighting system illustrated in the accompanying drawing comprises a normally closed double pole toggle switch A, a spring-opened momentary toggle switch B, a normally closed plug switch C, a normally open electromagnetic switch or relay D, a step-up transformer E and one or more tubular lamps F of the fluorescent type in which light is produced by an electric discharge through a gas or vapor in said tubes. The step-up transformer E is supplied with the ordinary low voltage service current 55

through a low voltage circuit that leads from one of the service or line wires 1 to one terminal 2 of the primary winding 3 of said transformer and thence from the other terminal 2a thereof to the other service or line wire 4, said service or line wires being connected to said low voltage circuit through the normally closed double pole control switch A. This low voltage or primary circuit comprises a wire 5 leading from one terminal of the control switch A to one terminal of the plug switch C, a wire 6 leading from the other terminal of said plug switch to a movable contact 7 of the relay D, a wire 8 leading from a stationary contact 9 of said relay to the winding 10 thereof, a wire 11 leading from said winding to the terminal 2 of the primary winding 3 of the transformer E and a wire 12 leading from the other terminal 2a of said primary winding to the other terminal of said control switch. Said low voltage circuit also includes an auxiliary circuit or shunt for energizing the relay winding 10 including a wire 6a leading from the terminal for the wire 6 on the plug switch C to one of the terminals of the momentary contact switch B, and a wire 8a leading from the other terminal of said momentary contact switch to the winding of the relay D.

As shown in the drawing, the movable contact 7 of the switch element of the relay D is secured to one arm of a pivoted lever 13 whose other upper arm has a coil tension spring 14 attached thereto which normally serves to hold said contact 7 out of engagement with the stationary contact 9 of said relay. The contact carrying lever 13 of the self-opening or retracting switch element of the relay D has its contact supporting end disposed opposite to the core 15 of the coil or winding 10 of the electromagnet of said relay D, whereby said coil when energized causes said lever to swing into engagement with said core and thus cause the movable contact 7 to engage the stationary contact 9. The plug switch comprises a receptacle 16 having the terminals thereon for the wires 5, 6 and 6a and a plug 17 having two prong contacts 18 that are permanently connected by a cross wire 19 and are adapted to enter openings 20 provided therefor in said receptacle and establish an electrical connection between the two terminals of said plug switch. The fluorescent lamps F are supplied with high voltage current from the secondary or high voltage winding 21 of the step-up transformer E through a high voltage or secondary circuit including wires 22 leading from terminals 22a of said secondary winding 21 to the electrodes of the

respective lamps at remote ends thereof, the lamps being connected in series by a suitable bridge conductor 22b between the electrodes at adjacent ends of said lamps.

To energize the lamps F, the control switch A is manually closed to connect the system with the low voltage service current and the momentary switch B is manually closed so that the current will flow through wire 5, plug switch C, wire 6a, said momentary switch and wire 8a to the winding 10 of the relay D to thereby energize said winding and cause the lever 13 to be drawn into engagement with the core 15 of said winding and thus engage the movable contact 7 with the stationary contact 9 and close the low voltage circuit. After the low voltage circuit is thus closed, the momentary contact switch B is released, the relay D still remaining closed. With the low voltage circuit thus completed, the low voltage service current flows through control switch A, wire 5, plug switch C, wire 6, closed relay contacts 7 and 9, wire 8, relay winding 10, wire 11 to terminal 2 of primary winding of transformer E and thence from the other terminal 2a of said primary winding to said control switch through the wire 12. At the same time, the step-up transformer E causes a change from low to high voltage and this high voltage is supplied from the secondary or high voltage winding 21 of the transformer E to the lamps F through the high voltage circuit including the wires 22 leading from the respective terminals 22a of said winding to the electrodes at the remote ends of said lamps. In the event that the high voltage circuit is interrupted by a defective lamp or any other cause, such interruption causes the relay in the low voltage circuit to become de-energized and the contacts 7 and 9 thereof to separate, thereby opening the primary circuit and thus permitting inspection and repair of the lighting circuit between the closed control switch A and the lamps and the removal and replacement of said lamps with safety. In the event that the high voltage circuit is interrupted, due to a defective lamp, the momentary contact switch B may be momentarily closed, thus energizing the coil 10 of the relay D and causing the contacts 7 and 9 thereof to close and close the lower voltage circuit. So long as the momentary contact switch B is held closed, the low voltage circuit is also closed and there will be sufficient current produced by the transformer in the high voltage circuit to cause the good lamp or lamps to glow faintly and thus enable the defective lamp to be readily detected. After the defective lamp is thus located, the momentary contact switch is released thus permitting the relay contacts 7 and 9 to separate and open the low voltage circuit, whereby the defective lamp may be removed with safety.

As shown in the drawing, the transformer E, relay D and plug switch C are all enclosed with a single housing 23 having a removable cover 24 providing access to the interior of said housing for inspection and repair of the parts therein. The receptacle 16 of the plug switch C is rigidly secured within the housing 23 with its prong receiving openings 20 facing the cover 24 of said housing; and the plug 17 of said switch is rigidly secured to said cover for attachment to and removal from the housing with said cover as a unit. The plug 17 is positioned on the cover 24 so that, when said cover is applied to the housing 23, the prongs 18 of said plug will enter the openings 20 in the receptacle 16 and thus close the primary circuit. When, however, the cover 24 is removed

from the housing 23, the plug 17 of the plug switch C is disconnected with the receptacle 16 thereof, thus opening the low voltage circuit of the lighting system and permitting the parts in the housing to be inspected with safety. If desired, the control switch A and the momentary contact switch B may also be mounted in the housing 23.

The modified electric lighting system shown in Fig. 5 is similar to the system hereinbefore described except that the system shown in Fig. 5 dispenses with the momentary contact switch B for electrically closing the relay D and substitutes therefor a mechanical device for closing said relay. This device for mechanically closing the spring opened relay D comprises an operating push button 25 slidable in openings provided therefor in the cover of the housing of the relay D and in the cover of the housing 23, an insulator button 26 cooperating with the contact carrying, core engaging arm of the lever 13 and a coil spring 27 interposed between said buttons and adapted to transmit movement of the operating button 25 to the insulator button 26 to thereby actuate said lever against the pull of the spring 14 and engage the contact 7 with the contact 9 and thus close the low voltage circuit. In this modification, the coil 10 of the relay is energized and the contacts of the relay remain closed after operating the push button 25 so long as the control switch remains closed and the low and high voltage circuits are not interrupted. If either of these circuits is broken the relay coil 10 is de-energized, thus permitting the spring 14 to pull the contact 7 away from the contact 9.

Obviously, the systems hereinbefore described admit of considerable modification without departing from my invention. Therefore, I do not wish to be limited to the precise arrangements shown and described.

Reference is hereby made to my copending application Serial No. 464,969 filed November 9, 1942, for subject matter divided out of the present application.

What I claim is:

1. A lighting system comprising a step-up transformer having a low voltage winding and a high voltage winding adapted to receive energy by induction from said low voltage winding, a self-opening switch, an electromagnet for closing said switch, a gas or vapor lamp of the electric discharge type, a low voltage supply circuit including said low voltage winding, said self-opening switch, and said electro-magnet, and a high voltage delivery circuit including said high voltage winding and said lamp, said low voltage circuit including an electrical conductor leading from a source of electrical energy to one contact element of said self-opening switch, an electrical conductor leading from the other contact element of said self-opening switch to one terminal of said electromagnet, an electrical conductor leading from the other terminal of said electromagnet to one terminal of said low voltage winding, and an electrical conductor leading from the other terminal of said low voltage winding to said source of electrical energy, said high voltage circuit including electrical conductors leading from the terminals of said high voltage winding to the terminals of said lamp, and a self-opening momentary contact switch in circuit with said low voltage circuit through an electrical conductor leading from said first mentioned conductor of said low voltage circuit to one of the contact elements of said momentary contact

switch, and an electrical conductor leading from the other contact element of said last mentioned switch to said first mentioned terminal of said electromagnet.

2. A lighting system comprising a step-up transformer having a low voltage winding and a high voltage winding adapted to receive energy by induction from said low voltage winding, a self-opening switch, a normally closed plug switch, an electromagnet for closing said self-opening switch, and a plurality of series connected gas or vapor lamps of the electric discharge type, a low voltage supply circuit including said low voltage winding, said self-opening switch, said plug switch and said electromagnet, and a high voltage delivery circuit including said high voltage winding and said lamps, said low voltage circuit including an electrical conductor leading from a source of electrical energy to one contact element of said plug switch, an electrical conductor leading from the other contact element of said plug switch to one contact element of said self-opening switch, an electrical conductor leading from the other contact element of said self-opening switch to one terminal of said electromagnet, an electrical conductor leading from the other terminal of said electromagnet to one terminal of said low voltage winding, and an electrical conductor leading from the other terminal of said low voltage winding to said source of electrical energy, said high voltage circuit including electrical conductors leading from opposite terminals of said high voltage winding to terminals of said lamps, a self-opening momentary contact switch in circuit with said low voltage circuit through an electrical conductor leading from said other contact element of said plug switch to one contact element of said momentary contact switch, and an electrical conductor leading from the other contact element of said last mentioned switch to said first mentioned terminal of said electromagnet, said transformer, self-opening switch, plug switch and electromagnet being all mounted in a single housing having a cover, one element of said plug switch being mounted in and removable with said cover.

3. A lighting system comprising a step-up transformer having a primary winding and a secondary winding, a high voltage circuit including said secondary winding and an electric discharge lamp, a low voltage circuit including

said primary winding, a self-retracting switch, and an electromagnet in operative relation to said switch to close the same when energized, and a normally open momentary contact switch in the circuit of said electromagnet but in a shunt around said self-retracting switch, whereby the closing of said momentary contact switch establishes a current flow through said shunt to said electromagnet to thereby energize the same and thus close said self-retracting switch, the opening of said momentary contact switch shifts the current from said shunt to said low voltage circuit to energize said electromagnet and thereby hold said self-retracting switch closed during the normal current flow through said low voltage circuit, and a decreased current flow in said low voltage circuit brought about by any interruption of the current in said high voltage circuit weakens said electromagnet and permits said self-retracting switch to open.

4. A lighting system comprising a step-up transformer having a primary winding and a secondary winding, a high voltage circuit including said secondary winding and a plurality of series connected electric discharge lamps, a low voltage circuit including said primary winding, a self-retracting switch, and an electromagnet in operative relation to said switch to close the same when energized, and a normally open momentary contact switch in the circuit of said electromagnet but in a shunt around said self-retracting switch, whereby the closing of said momentary contact switch establishes a current flow through said shunt to said electromagnet to thereby energize the same and thus close said self-retracting switch, the opening of said momentary contact switch shifts the current from said shunt to said low voltage circuit to energize said electromagnet and thereby hold said self-retracting switch closed during the normal current flow through said low voltage circuit, and a decreased current flow in said low voltage circuit brought about by any interruption of the current in said high voltage circuit weakens said electromagnet and permits said self-retracting switch to open, a housing enclosing said transformer, said self-opening switch and said electromagnet, a cover for said housing, and a normally closed switch in said low voltage circuit adapted to be opened by the opening of said cover.

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