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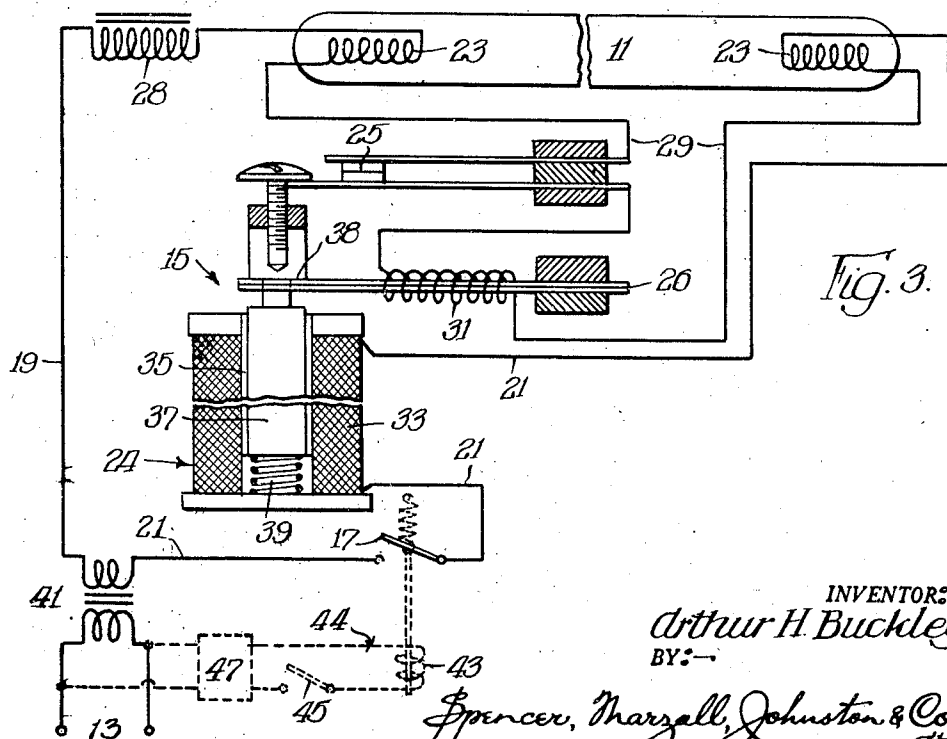
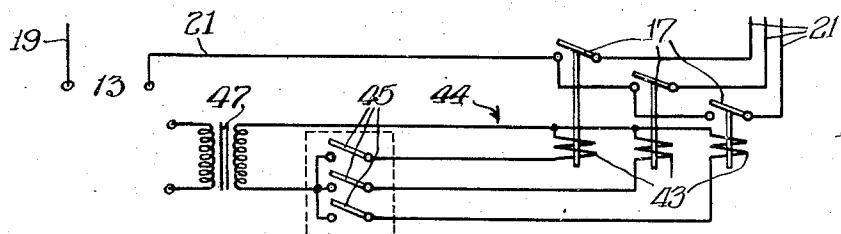
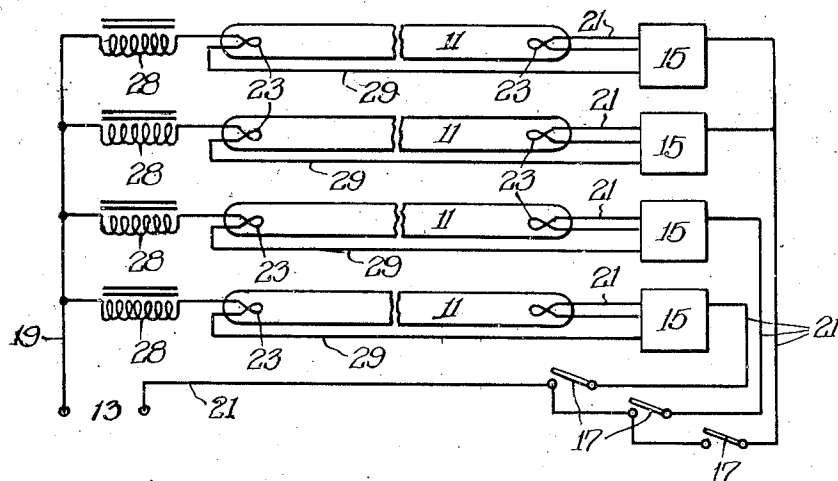
A. H. BUCKLEY

2,410,198

CONTROL SYSTEM

Filed Nov. 9, 1942

2 Sheets-Sheet 1



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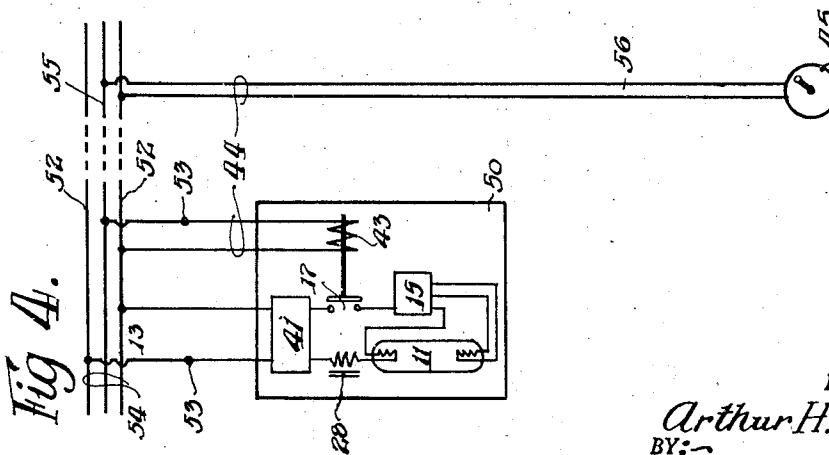
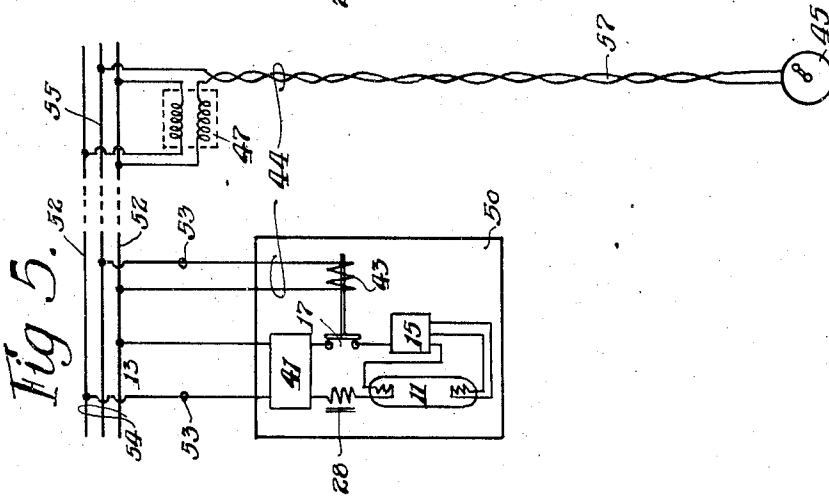
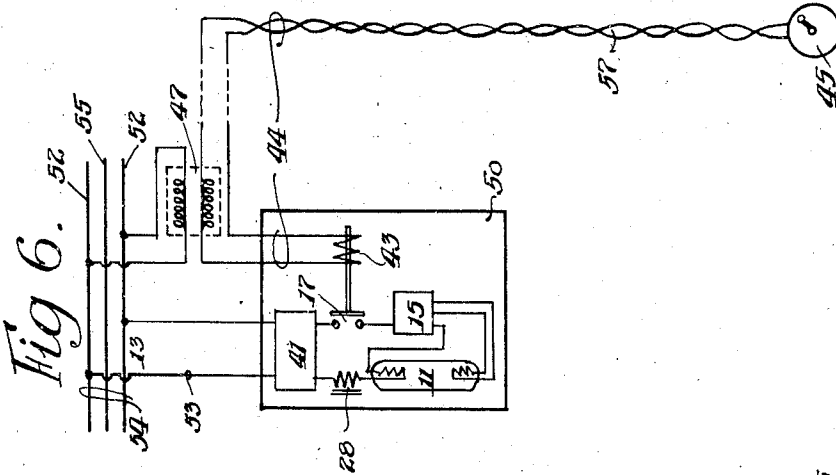
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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

2,410,198

CONTROL SYSTEM

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Application November 9, 1942, Serial No. 465,009

6 Claims. (Cl. 175—335)

1

My invention relates in general to electrical controls, and has more particular reference to improved switch means particularly well suited for use in controlling gaseous conduction lamps.

An important object of the present invention is to provide simple and inexpensive switch means for controlling, from a remote switching station, the delivery of electrical energy to electrical devices, such as gaseous conduction lamps, which, in addition to normal load energy, require the delivery of additional power to starting means for setting the devices in operation, such starting means being inactive during the operation of the devices following the starting period.

A further object is to provide switch means for automatically interrupting an electric circuit following a definite time interval after current has commenced to flow therein.

Another object is to provide simple, inexpensive and automatic means for conditioning an electrical circuit embracing a gaseous conduction lamp for operation, whereby the circuit may be controlled by an ordinary switch and without the delayed operation inherent to thermostatic switches, and without the lamp flicker associated with electromagnetic switches as presently used and applied in the control of gaseous conduction lamp circuits.

Another important object is to utilize a main control switch of standard construction in combination with a relay switch mechanism, whereby normal load energy together with additional starting energy may be delivered to the device upon the closure of the main switch, so that the device may go into operation instantaneously upon the closure of the main switch, the relay being operable to discontinue the delivery of starting energy as soon as the starting period has terminated.

Another important object is to utilize, in a switching system of the character mentioned, an electromagnetic relay incorporating a normally closed switch, the relay, when energized, tending to open the normally closed switch and being provided with blocking means operable initially to delay the opening of said switch, the blocking means being rendered inactive after a predetermined interval by the continued flow of current through said relay; a further object being to utilize a thermostatic blocking element and to provide means for rendering the same inoperative by heat generated by current flow in the circuit during the starting period only.

Among the other important objects and ad-

2

vantages of the invention is to provide for an extremely simple, inexpensive relay of the character and for the purpose mentioned, the utilization of a heat responsive element as blocking means for preventing opening of the starting switch during the starting period, including the means for utilizing starting current for disabling the blocking means at the conclusion of the starting period, after which the blocking element is not heated, the solenoid being arranged to maintain the starting switch in open position, once the same has been opened, against the contrary influence of the blocking element, and to maintain such switch in open condition until the solenoid itself has been de-energized by the opening of the main switch.

These and numerous other important objects, advantages, and inherent functions of the invention will be fully understood from the following description, which, taken in connection with the accompanying drawings, discloses a preferred embodiment of the invention.

Referring to the drawings:

Figure 1 is a diagrammatic view of electrical circuits for controlling electrical devices such as gaseous conduction lamps, in accordance with my present invention;

Figure 2 is a diagrammatic view of a modified circuit arrangement embodying my present invention;

Figure 3 is a diagrammatic view showing a single circuit embodying the invention; and

Figures 4, 5 and 6 are typical wiring diagrams illustrating the connection of high voltage lamps and associated control means in previously existing power delivery circuits.

To illustrate the invention I have shown on the drawings electrical devices 11 adapted to be electrically energized from a suitable power source 13 through control means 15 embodying my present invention. The control means 15 includes, for each lamp, a main switch 17 and a solenoid 24 embodying a normally closed switch 25 and a switch blocking element 26. The devices 11 each comprise starting means 23 requiring to be energized in order to condition the devices 11 for operation. In the illustrated embodiment, the devices 11 comprise gaseous conduction lamps, and the starting means 23 comprise filaments, adapted, when energized, to render the gaseous medium in the lamps 11 electrically conductive. As shown, each lamp has a pair of spaced apart electrodes 23, said electrodes preferably comprising filaments.

In gaseous lamps of the character mentioned,

3

application of operating potential between the spaced filaments 23 will not necessarily start the lamps in operation unless the gaseous medium is simultaneously rendered sufficiently conductive to allow current flow therethrough between the spaced electrodes 23 at the potential supplied from the source 13. The filaments 23, when energized, function to ionize the gaseous contents of the lamp to render the same conducting and thus condition the lamp for operation at the potential supplied from the source.

In order to provide for the delivery of operating potential between the electrodes 23 and also to provide for energizing said electrodes to render the gaseous contents of the lamps conductive, the electrodes of each lamp are connected, respectively, by conductors 19 and 21 with the power source 13, a reactance, preferably in the form of a choke coil 28, being interposed in the conductor 19. The filaments 23 also are connected in a starting circuit 29, including in series therein the starting switch 25 and a heating coil 31 operatively associated with the blocking element 26.

The solenoid 24 comprises a coil 33 connected in a series with the power source through the control switch 17, said coil and switch being preferably connected in the conductor 21. The solenoid 24, of course, comprises a suitable frame upon which the coil 33, the switch 25 and the blocking element 26 are mounted and supported, said frame providing a channel 35 within said coil for the reception of a solenoid plunger or armature 37, which is normally maintained in projected position on the frame by means of a spring 39. The plunger 37 carries means in position to engage and open the switch 25 when the plunger is drawn into the channel 35 against the influence of the spring 39, when the coil 33 is energized.

The blocking element 26 preferably comprises a bimetallic strip engaging the projecting end of the plunger 37, said strip normally having sufficient stiffness and being mounted on the frame of the solenoid in position to prevent retraction of the plunger in the cavity 35 when the coil 33 is initially energized. To this end the plunger is preferably formed with a neck of restricted dimension providing a shoulder 38, and the end of the strip 26 is notched to receive the neck, thereby affording a seat for said shoulder 38 on the strip 26 on opposite sides of the notch. The heating element 31 is thermally associated with the element 26 between the plunger connected and frame mounted ends thereof.

Upon the closure of the switch 17, electrical energy is delivered through the coil 33, a filament 23, thence through the heating coil 31, the switch 25, the other filament 23 and the reactance 28. Immediately the electromagnetic action of the coil 33 seeks to draw the plunger 37 in a direction to open the switch 25. Movement of the plunger, however, is blocked by the resilient resistance of the element 26. Consequently during a preliminary starting period, the switch 25 will remain closed so that all of the current delivered from the power source will pass through the filaments 23, thereby ionizing the gaseous contents of the lamp 11 and conditioning the same for operation. During this initial or starting period, the heater 31 will be energized, thereby heating the bimetallic blocking member 26. This member 26 comprises a bimetallic strip which, when heated, bends in a direction allowing the plunger 37 to enter the cavity 35, thereby opening the switch 25. After the plunger has entered the cavity and

4

opened the switch 25, it will be seen that the starting circuit 29 will be interrupted at the switch 25, thereby disabling the heating coil 31 and the filaments 23. The rate of heating and the bimetallic strip are selected to thus permit the relay to open the switch 25 after a short delay sufficient only to allow the energized filaments to ionize the gaseous contents of the lamp, which is a matter of one second or less; and the action of the blocking strip may be adjusted by altering its length, by altering the length of the heating coil 31 or by adjusting the tension of the spring 39.

As soon as the switch 25 is thus opened by the operation of the relay 24, the heating coil 31 will be disabled and the strip 26 will cool off and exert pressure upon the plunger 37 in a direction urging retraction of the same outwardly of the coil 33. The electromagnetic strength of the coil 33, however, as long as the same remains energized during the normal operation of the lamp 11, is sufficient to prevent retraction of the plunger under the combined influence of the spring 39 and the cooled member 26. Consequently the switch 25 will be retained in open position once the lamp 11 has gone into normal operation until the switch 17 is opened to turn off the lamp. At such time, the coil 33 being de-energized, the spring 39, aided by the flexed strip 26, will retract the plunger 37 and allow the switch 25 to close, thus returning the control system to stand-by position, ready to repeat the starting and operating cycle upon re-closure of the switch 17.

As shown in Figure 1 more particularly, a plurality of lamps 11, each with its associated relay 24 and control switch 17, may be connected in parallel for operation from the power source 13. When so arranged, each switch 17 may be connected to control a single lamp, or a switch 17 may be arranged to control two or more lamps, each with its associated relay 24, as illustrated at the top of Figure 1.

It will be obvious, of course, that the control switches 17 may be disposed remotely from the lamps 11 and that the control units 15 also, if desired, may be located at any convenient position adjacent to or remote from the lamps to facilitate access thereto for repair or replacement. To simplify the electrical connections, however, it is preferable to dispose the control units 15 each as near as possible to its associated lamp, as for example in the lamp housing or fixture in which the lamp is mounted for service; the reactances 28 also being ordinarily mounted each as close as possible to its associated lamp 11.

Gaseous conduction lamps normally operate at relatively high voltage, and where the power source 13 comprises the usual 110 volt house lighting system, it is ordinarily necessary to provide step-up transformer means 41 in circuit between the power source and the lamps to supply power at the required voltage for lamp operation. While manual operation of the main switches 17 is entirely feasible, as indicated in Figure 1, it is ordinarily undesirable, in the interests of safety, to permit manual operation of switches carrying the high voltage necessary for the operation of the lamps. Consequently I prefer, as shown in solid lines in Figure 2, and in dotted lines in Figure 3, to utilize remotely controlled solenoid switch means for the control of the lamp circuits. To this end, the switch means 17 may comprise each a switch held normally open as by means of a suitable biasing spring.

5

Associated with each such normally open switch is a co-operating coil 43 connected in a suitable low voltage remote control circuit 44, including manually operable switch means 45.

The low voltage remote control circuit 44 may be energized through a step-down transformer 47 connected either to the high voltage conductors 19 and 21 or to the low voltage source as shown in Figure 3; or the low voltage remote control circuit may be energized directly from the low voltage source. The arrangement shown in Figure 3, however, in which the remote control circuit 44 is energized from the low voltage power source through a transformer, has the advantage that the transformer may comprise an inexpensive "bell-ringing" transformer, and the remote control circuit from the transformer through the switch 45 and coil 43 may comprise ordinary bell wire, that is to say, the circuit does not require careful insulation. Furthermore, such an arrangement allows installation of high voltage lamps to be made in an exceedingly low voltage lighting system without appreciable change in the existing system.

In Figure 4 an existing system is shown in heavy lines, comprising a main cable 54 including a pair of power bus conductors 52 and a connection conductor 55. In such a system, a low voltage lamp may be electrically connected between leads 53, respectively connected to the conductor 55 and one of the conductors 52, operation of the low voltage lamp being controlled by a switch electrically connected by switch wires 56 between the connection conductor 55 and the other power conductor 52. A high voltage lamp and control mechanism embodying the present invention may be installed in the existing system by providing a fixture 50 for receiving the high voltage lamp 11, the choke coil 28, the control 15, the switch means 17 including the coil 43, the transformer 41, and the interconnected conductors, being mounted either in or adjacent the high voltage lamp fixture 50.

To connect the high voltage lamp and its associated equipment in the existing system, the low voltage side of the transformer 41 may be connected to one of the existing power conductors 52 by one of the existing conductors 53 and to the other power conductor by a new wire. The coil 43 may then be connected to the switch conductors 56 through the other existing conductor 53 and the cable conductor 55, and one of the power conductors 52, to which the coil 43 may be attached by means of an added wire. The existing control switch connected between the conductors 56 may thus be utilized as the remote control switch 45 in the reconditioned system. If necessary to provide new conductors for the remote control circuit, easily applied bell cord 57 may be used, as indicated in Figures 5 and 6, by connecting a bell ringing transformer 47 with its primary between the power conductors 52 and its secondary in the remote control circuit 44 between the coil 43 and the switch 45. In Figure 5, the remote control circuit in part comprises the conductor 55 and one of the power conductors 52, whereas in Figure 6, the entire circuit 44 comprises newly added bell wire.

Upon the closure of any of the switches 45, the corresponding solenoid 43 connected therewith will be energized from the low voltage side of the transformer 47 to thereby close the associated switch 17 and place the corresponding lamp or lamps 11 in operation as previously described herein.

6

It is thought that the invention and its numerous attendant advantages will be fully understood from the foregoing description, and it is obvious that numerous changes may be made in the form, construction and arrangement of the several parts without departing from the spirit or scope of the invention, or sacrificing any of its attendant advantages, the form herein disclosed being a preferred embodiment for the purpose of illustrating the invention.

The invention is hereby claimed as follows:

1. A control member comprising a coil, a movable armature magnetically associated with said coil whereby the armature is urged for movement in one direction from stand-by position when the coil is electrically energized, a bimetallic member operatively associated with said armature to yieldingly urge and hold the same against such movement, heating means operable to heat said bimetallic member when said coil is energized whereby, after a definite time interval, to disable said bimetallic member and allow armature movement to a shifted position, and means operable to disable the heating means in response to armature movement whereby to allow the bimetallic member to cool and reexert its urge on the armature, the urge of said bimetallic member, when cool, being insufficient to return the armature to stand-by position, against the contrary influence of the coil when energized.

2. A control member comprising a coil, a movable armature magnetically associated with said coil whereby the armature is urged for movement in one direction from stand-by position when the coil is electrically energized, a bimetallic member operatively associated with said armature to yieldingly urge and hold the same against such movement, heating means operable to heat said bimetallic member when said coil is energized whereby, after a definite time interval, to disable said bimetallic member and allow armature movement to a shifted position, and a normally closed switch operatively associated with said armature to be thrown to open position by the movement thereof to said shifted position.

3. A control relay comprising a coil, a movable armature magnetically coupled with said coil and movable thereby in one direction from stand-by position when the coil is energized, heat disabled movement resisting means associated with said armature to urge the same toward and hold the armature in stand-by position, heating means to heat said movement resisting means whereby to disable the same and allow armature movement to a shifted position, and means operable to disable the heating means in response to movement of the armature to said shifted position whereby to allow the movement resisting means to reexert its urge on the armature, the urge of said movement resisting means being insufficient to return the armature from shifted to stand-by position as long as the coil remains energized.

4. A control relay comprising a coil, a movable armature magnetically coupled with said coil and movable thereby in one direction from stand-by position when the coil is energized, heat disabled movement resisting means associated with said armature to urge the same toward and hold the armature in stand-by position, heating means to heat said movement resisting means whereby to disable the same and allow armature movement to a shifted position, means operable to disable the heating means in response to movement of the armature to said shifted position whereby to

7

allow the movement resisting means to reexert its urge on the armature, the urge of said movement resisting means being insufficient to return the armature from shifted to stand-by position, as long as the coil remains energized, and a control switch for controlling the supply of electrical energy to said coil.

5. A control relay comprising a coil, a movable armature magnetically coupled with said coil and movable thereby in one direction from stand-by position when the coil is energized, heat disabled movement resisting means associated with said armature to urge the same toward and hold the armature in stand-by position, heating means to heat said movement resisting means whereby to disable the same and allow armature movement to a shifted position, means operable to disable the heating means in response to movement of the armature to said shifted position whereby to allow the movement resisting means to reexert its urge on the armature, the urge of said movement resisting means being insufficient to return the armature from shifted to stand-by position, as long as the coil remains energized, switch means actuated by said armature, and a main switch for controlling the supply of energy to said coil.

8

6. A control relay comprising a coil, a movable armature magnetically coupled with said coil and movable thereby in one direction from stand-by position when the coil is energized, heat disabled movement resisting means associated with said armature to urge the same toward and hold the armature in stand-by position, heating means to heat said movement resisting means whereby to disable the same and allow armature movement to a shifted position, means operable to disable the heating means in response to movement of the armature to said shifted position whereby to allow the movement resisting means to re-exert its urge on the armature, the urge of said movement resisting means being insufficient to return the armature from shifted to stand-by position as long as the coil remains energized, switch means actuated by said armature, a main switch for controlling the supply of energy to said coil, bias means normally urging the main switch toward open position, and remote control means, including a control switch and a coil operatively associated with said main switch to close the same against the influence of said bias means when said control switch is closed.

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