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2 SHEETS—SHEET 1.



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G. A. BURNHAM.
CONTROLLING MEANS FOR ELECTRIC CIRCUITS.
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Patented June 18, 1912.

2 SHEETS-SHEET 2.

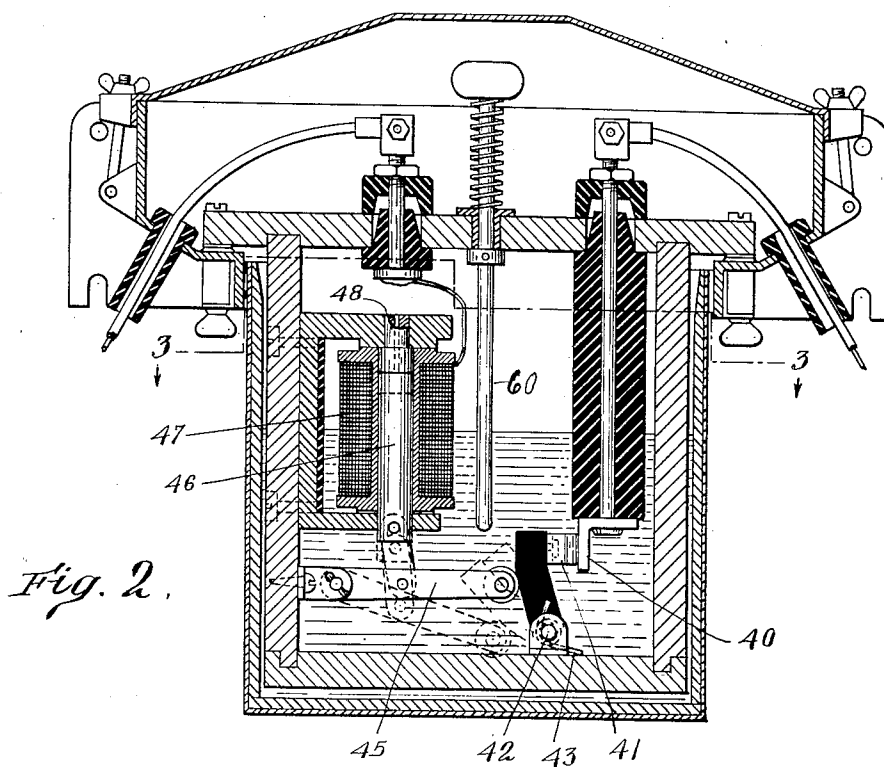


Fig. 2.

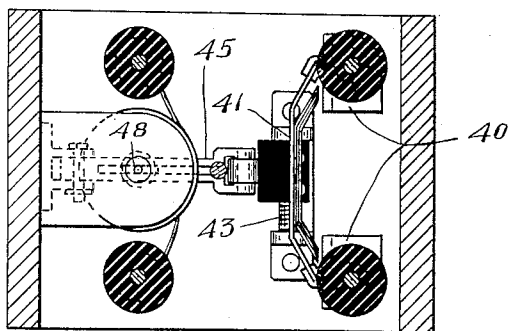


Fig. 3.

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UNITED STATES PATENT OFFICE.

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CONTROLLING MEANS FOR ELECTRIC CIRCUITS.

1,029,974.

Specification of Letters Patent.

Patented June 18, 1912.

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To all whom it may concern:

Be it known that I, GEORGE A. BURNHAM, a citizen of the United States, residing at Saugus, in the county of Essex and State of Massachusetts, have invented an Improvement in Controlling Means for Electric Circuits, of which the following is a specification.

In many places where arc lamps are employed for street-lighting, there is a demand for incandescent lamps for street-lighting, particularly since the innovation of the tungsten lamp. This demand is usually local. To satisfy this local demand it has been customary to run circuits from the transformers which happen to be located in the vicinity of the demand, or to install transformers in case there are none in the vicinity, thus to supply current to the lamps from a distributing or other station. Much trouble and expense is involved in controlling these local lamp-circuits as some means must be provided for closing and opening them at the proper times to turn on and off the lamps. Time-switches have been employed for this purpose, also switches requiring the attendance of a man to operate them, and also remote-control switches which are adapted to be operated from the station but which require additional circuit wires. All of these well known controlling-means are expensive, the cost of installation and maintenance or the cost of the attendance making up a large item of expense which in the aggregate is burdensome.

This invention has for its object the production of controlling-means for electric circuits especially designed to meet this difficulty, which is not expensive to install or maintain, is not liable to get out of order and may be operated from the station.

The arc-lamps are usually arranged in series relation in a constant current circuit or a rectified current circuit, the latter, so far as the present invention is concerned, being considered the equivalent of a constant current circuit, and the incandescent lamps are arranged in multiple relation in a constant potential circuit, and both circuits derive their current from an alternating current circuit. Both lamp circuits are open when not in use, and a switch is provided for closing and opening the constant current circuit for the purpose of turning on and off the lamps which are connected therein.

The controlling-means embodying this invention is especially provided for the constant potential circuit, and is adapted to be operated to close and open said circuit to turn on and off the lamps connected therein; and another object of this invention is the provision of controlling-means for the constant potential circuit, which is connected with the constant current circuit and is adapted to be operated by the constant current to close the constant potential circuit and turn on the lamps, and is adapted to be operated by a current of a different character to open the constant potential circuit to turn off the lamp. As an alternating current is conveniently at hand, this current will be employed as a current of different character, to thus operate the controlling-means to open the constant potential circuit. Employing currents of different character to operate the controlling-means, respectively, to close and open the constant potential circuit, insures positive operation, enables it to be under the control of the attendant at the station at all times, and is of a decided advantage over the employment of a current to operate the controlling-means to close the constant potential circuit, and no current to operate it to open said circuit for the reason that it is not sensitive to the flashing or momentary interruption of the constant current circuit.

Another object of the invention is the construction of the controlling-means having an electro-magnetic operating-device which is operated by a constant current to close the switch, and when thus operated its electro-magnet becomes saturated and will operate to hold its armature in attracted position by residual magnetism for a long period of time or until demagnetized by a current of a different character, whereupon its armature is released and permitted to retract, so that the switch will remain closed even though the controlling-circuit is opened momentarily or for a reasonable length of time and until the controlling-means is operated by a current of a different character.

Another object of the invention is the provision of manual means to open the switch of the controlling-means.

Figure 1 is a diagram of a portion of a system of electrical distribution having lamp circuits and controlling-means embodying this invention. Fig. 2 is a longitudinal ver-

tical section of one form of controlling-means which may be employed. Fig. 3 is a horizontal section of the controlling-means taken on the dotted line 3—3 Fig. 2.

5 Referring to Fig. 1 of the drawing, 10 represents an alternating current generator, 11, 12 and 13 its bus bars, 15 an induction-motor connected with the bus bars 11, 12 and 13. 16 a constant current generator
10 driven by said motor; 17 a lamp-circuit connected with said generator having a main-switch 18 to close and open it to turn on and off the lamps. As here shown are lamps 19 are arranged in series relation in said lamp-circuit, but so far as the present invention
15 is concerned any other form of translating-devices may be arranged therein. The term "lamp-circuit" is herein employed merely as a designated term. According to the
20 spirit of my invention as herein illustrated the arc-lamps are designed for street-lighting purposes. 25 represents another circuit which is of constant potential, it leading from the bus bars, and said constant potential circuit has arranged in it transformers
25 26, 27, any suitable number being employed. Ordinarily the transformers, as 26, are employed for house lighting purposes, being in use at the present time. For the purpose
30 of illustration it is assumed that there is a local demand for incandescent street lamps, such for instance, as tungsten lamps, at two different places, and at one of these places a transformer as 26 is already installed, but
35 at the other place there is no transformer, hence the transformer 27 is installed. The secondaries of both transformers have constant potential lamp-circuits connected with them and herein the transformer 26 has two
40 such circuits as 30 and 31, the circuit 30 presumably being extended throughout a building and the circuit 31 being arranged for street lighting purposes and having lamps 32 arranged in multiple relation therein.
45 Herein the transformer 27 has but one lamp circuit 33 connected with its secondary, said circuit having lamps 34 arranged therein in multiple relation. Controlling-means embodying this invention is arranged in connection with each local lamp-circuit 31 and
50 33, and each controlling-means is connected with the constant current circuit 17, to be controlled by it. Said controlling-means will now be described.

55 Referring particularly to Figs. 2 and 3, 40, 40, represent the stationary members and 41 the movable member of a switch which is provided for closing and opening the constant potential circuit 31 or 33, but
60 it is obvious that in lieu thereof, so far as this invention is concerned, any suitable form of switch may be employed. 45 represents a pivoted actuating-lever for the movable member of said switch, adapted for
65 movement up and down to move the switch-

member forward on its pivot 42, and permit movement of said member in the opposite direction by means of a spring 43. Said actuating-lever is connected with the core or armature 46 of a solenoid or other form of
70 electro-magnet 47, which is adapted to be connected in the constant current circuit 17. Said solenoid or magnet has at its upper end a soft iron or other magnetizable plug 48, which closes the upper end of its tubular
75 bore, preferably projecting a short distance thereinto, so that the core 46, when attracted will be moved into engagement with it. Said plug may have a vent hole through it.

In operation when the constant current 80 circuit 17 is closed by switch 18, and the lamps therein turned on, the current passes through the solenoid and its core is attracted to the position shown in Fig. 2, and the switch-member 41 is moved to engage the
85 members 40, thus to close the constant potential circuit. The constant current acts to magnetically saturate the solenoid and core, so that, even though the switch 18 of the constant current circuit is opened said
90 core will remain in attracted position, being held by residual magnetism, and the switch 40, 41, will remain closed. This capability of the solenoid to hold its core for a period
95 of time and thus to hold the switch 40, 41, closed in case the constant current circuit is opened, is of vital importance, as while thus held it is not responsive to flashings or other momentary or reasonable interruptions
100 of the constant current circuit, as a result of which the continuity of the constant potential circuit is maintained regardless of interruptions in the constant current circuit. The ordinary solenoid of commerce
105 does not possess this capability. When it is desired to open the constant potential circuit to turn off the lamps a current of a different character is passed through the solenoid which acts to demagnetize it, to permit its
110 core or armature to retract. For this purpose, as here shown, the alternating current at the station is employed, it being conveniently at hand, and, as shown in Fig. 1, a transformer 50 is connected with the alternating current circuit, from the secondary of
115 which a pair of leads 51, 51, extend, having contacts 52, 52 at their ends suitably supported in insulating hand-pieces, and the attendant at the station places these contacts in engagement with the opposite sides of the
120 switch 18, or other terminals of the circuit 17, and the alternating current then passes over the circuit 17, and the solenoid connected therein is immediately demagnetized, resulting in the switch-member 41 being permitted
125 to move away from the switch-member 40 to open the constant potential circuit. It will thus be observed that the controlling-means for the constant potential circuit is operated by the closing of the switch 18 to 130

close the constant potential circuit, thereby to turn on the lamps or other translating devices therein, a constant current being employed for this purpose, and is operated by the engagement of the contacts 52, 52, with terminals of the circuit 17 to open the constant potential circuit, thereby to turn off the lamps or other translating devices therein, a current of a different character being employed for this purpose.

In case the lamps were omitted from the circuit 17, said circuit would still serve as a control circuit for the controlling-means, and the operation of the controlling-means in such case would be as above described.

Manual means are also provided for moving the actuating-lever 45 to open the switch which may be employed if desired, and herein a vertically disposed rod 60 is arranged to slide in bearings provided for it in the top of the case containing the controlling-means, the lower end of which terminates above the actuating-lever 45 and upon depression of said rod its lower end will engage the actuating-lever and move it in a direction to permit the switch to open. As the actuating-lever 45 is connected with the core of the solenoid it will be understood that considerable force is required to depress it against the pull of the residual magnetism by which it is held.

The switch and electro-magnetic operating means therefor, herein disclosed, form the subject-matter of a divisional application Serial No. 690,706 filed April 15, 1912.

I claim:—

1. The combination of two circuits, a switch to control one of said circuits, electro-magnetic means arranged in the other circuit and responsive to a current of one character to close the switch and responsive to a current of another character to open the switch, substantially as described.

2. The combination of two circuits, a switch to control one of said circuits, electro-magnetic means arranged in the other circuit and responsive to a current of one character to close the switch and to hold said switch closed after said current is removed and responsive to a current of another character to open said switch, substantially as described.

3. The combination of a constant current circuit and a constant potential circuit, a switch to control said constant potential circuit, electro-magnetic means arranged in the constant current circuit and responsive to a current of one character to close the switch and to a current of another character to open the switch, substantially as described.

4. The combination of two circuits, a switch to control one of said circuits and an electro-magnetic operating-device for said switch controlled by the other circuit and energized by a current of one character to

close the switch and to hold the switch closed in case its controlling-circuit is interrupted; thereby to maintain the continuity of the controlled-circuit during periods of interruption of the controlling-circuit, and deenergized by a current of another character to open the switch, substantially as described.

5. The combination of two circuits, a switch to control one of said circuits, an electro-magnetic operating-device for said switch controlled by the other circuit and energized by a current of one character to close the switch and deenergized by a current of another character to open the switch, said device having means whereby its magnetic-circuit remains closed in case the controlling-circuit is interrupted, thus maintaining the continuity of the controlled-circuit, substantially as described.

6. The combination of two circuits, a switch to control one of said circuits and an electro-magnetic operating-device for said switch controlled by the other circuit and energized by a current of one character to close the switch and to hold the switch closed in case its controlling-circuit is interrupted, thereby to maintain the continuity of the controlled-circuit during periods of interruption of the controlling-circuit, and deenergized by a current of another character to open the switch, and also having manual means to restore it and open the switch, substantially as described.

7. The combination of a constant current circuit and a constant potential circuit, a switch to control said constant potential circuit, electro-magnetic means controlled by the constant current circuit and operated by the constant current to close said switch and operated by a current of a different character to open said switch, substantially as described.

8. The combination of a constant current circuit and a constant potential circuit, a switch to control said constant potential circuit, an electro-magnetic operating-device for said switch connected with the constant current circuit whereby it is operated by a constant current to close the switch, and means to circulate a current of a different character over said circuit to operate the switch to open the circuit, substantially as described.

9. The combination of a constant current circuit and a constant potential circuit, a switch to control said constant potential circuit, an electro-magnetic operating-device for said switch connected with the constant current circuit whereby it is operated by a constant current to close the switch, and means to circulate an alternating current over said circuit to operate said device to open the switch, substantially as described.

10. The combination of a lamp-circuit

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containing lamps arranged in series relation and another lamp-circuit containing lamps arranged in multiple relation, a switch to close said last named circuit, an
5 electro-magnetic controller for said switch arranged in the first named circuit and adapted to be operated to close the switch by the current employed to operate the lamps therein and adapted to be operated
10 to open the switch by a current of a different character, substantially as described.

11. The combination of a lamp-circuit containing lamps arranged in series relation and another lamp-circuit containing
15 lamps arranged in multiple relation, a switch to close said last named circuit, an electro-magnetic controller for said switch arranged in the first named circuit and adapted to be operated to close the switch
20 by the current employed to operate the lamps therein, and means to disconnect said first named circuit from its supply and to connect it with a circuit having a current of
25 a different character, thereby to operate said switch-controller to open the switch, substantially as described.

12. The combination of a lamp-circuit containing lamps arranged in series relation and another lamp-circuit containing lamps
30 arranged in multiple relation, a switch to close said last named circuit, an electro-magnetic controller for said switch arranged in the first named circuit and adapted to be operated to close the switch by the
35 current employed to operate the lamps therein and adapted to be operated to open the switch by a current of a different charac-

ter, said switch-controller holding the switch closed in case the first named circuit is interrupted, thereby to maintain the continuity of the last named circuit during
40 periods of interruption of the first named circuit, substantially as described.

13. The combination of a constant current circuit and a constant potential circuit, a
45 switch to control said constant potential circuit, electro-magnetic means controlled by the constant current circuit to close the switch and to hold said switch closed by
50 residual magnetism, regardless of interruptions in said constant current circuit, and means to restore said electro-magnetic means and open the switch, substantially as described.

14. The combination of a constant current
55 circuit and a constant potential circuit, a switch to control said constant potential circuit, electro-magnetic means controlled by the constant current circuit to close the
60 switch and to hold the switch closed by residual magnetism, regardless of interruptions in said constant potential circuit, means to deenergize said electro-magnetic
65 means to restore it and open the switch, and manual means to also restore said electro-magnetic means and open the switch, substantially as described.

In testimony whereof, I have signed my name to this specification, in the presence of two subscribing witnesses.

GEORGE A. BURNHAM.

Witnesses:

B. J. NOYES,
H. B. DAVIS.