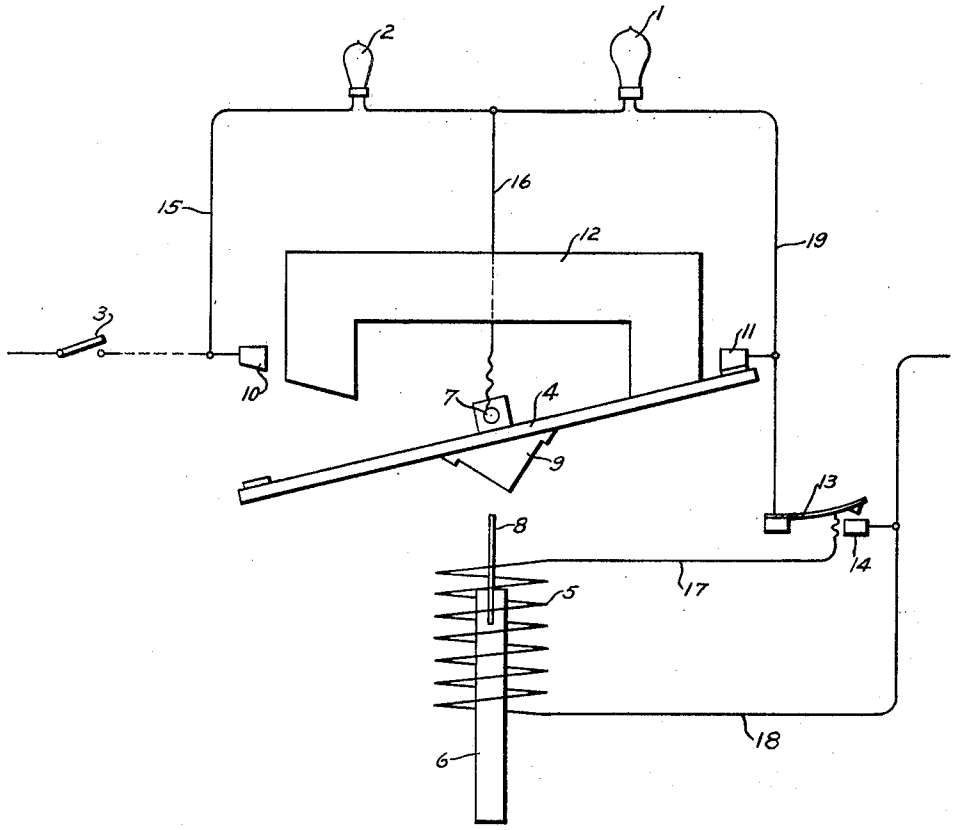
Feb. 5, 1929. 1,701,357

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CIRCUIT CONTROLLING DEVICE

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UNITED STATES PATENT OFFICE.

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CIRCUIT-CONTROLLING DEVICE.

Application filed February 1, 1924. Serial No. 690,086.

My invention relates to improvements in circuit controlling devices and more particularly to circuit controlling devices for the remote control of electric circuits.

Street lighting systems in which each lighting unit comprises two lamps of relatively high and low candle-power respectively are arranged to be operated with the high candle-power lamps lighted during the earlier part of the night period of darkness when more people are liable to be using the streets and during the later part of the night when such a high intensity of illumination is not necessary, with the low candle-power lighted as a matter of economy. There would, however, be little or no economy, if it were necessary to perform the switching operation of changing from the high to the low candle-power lamps of vice-versa at each lighting unit manually. Automatic circuit controlling devices are, therefore, employed so that by a simple switching operation at some distant point, such as the supply station, all the lamps can be switched over simultaneously. One of these circuit controlling devices is usually associated with each lighting unit and, as the lamps are generally arranged in a constant current series circuit, it is customary to place the winding of the operating element of the device in series in the lighting circuit so as to avoid auxiliary control circuits and the like. However, due to the number of circuit controlling devices employed dependent of course on the number of lighting units, the load of these devices becomes an appreciable factor and moreover it is necessary to design the devices for a continuous rating to guard against over heating and the like. It is, therefore, desirable to have a circuit controlling device which will operate automatically not only to switch over the lamps when the required switching operation is performed at the supply station but also to reduce the load which it imposes on the lighting circuit.

An object of my invention is, therefore, to provide an improved circuit controlling device which is remotely controllable automatically to perform a desired sequence of switching operations and at the expiration of each switching operation to reduce the load it imposes on the circuit and which is of particular use in the relation of utility set forth although its application is not so limited.

My invention will be better understood from the following description taken in connection with the accompanying drawing and its scope will be pointed out in the appended claims.

The single figure of the accompanying drawing illustrates diagrammatically a circuit controlling device embodying my invention and arranged to control the operation of translating devices such as lamps 1 and 2 of relatively high and low candle-power respectively, connected in series in a lighting circuit which may comprise a plurality of similar lighting units. The lighting circuit may be controlled by a switch 3 located at some distant point such as the supply station.

For controlling the lighting of the lamps 1 and 2 of each lighting unit automatically in response to the operation of the distant switch 3, I provide a circuit controlling device comprising a movable circuit controlling member 4 arranged to be actuated by an electromagnet comprising a winding 5 and a movable member or armature 6. The circuit controlling member 4 is movable to a plurality of circuit controlling positions in one of which the lamp 1 is short-circuited and in another of which the lamp 2 is short-circuited. For moving the member 4 to these positions in response to the energization of the electromagnet, the member 4 may be pivotally mounted at 7 substantially in line with the path of movement of a preferably flexible member 8 carried by the armature 6. In order that the member 4 may be moved to each of its circuit controlling positions in a definite sequence, it is provided with a wedge-shaped portion or cam 9, the point or nose of which is arranged, irrespective of the position of the member 4, to lie on one side or the other of the path of movement of the flexible member 8, so that upon successive energizations of the electromagnet, the flexible member 8 will engage the cam 9 first on one face and then on the other whereby to move the member 4 from one circuit controlling position to another alternately. For holding the member 4 firmly in circuit controlling position and providing a snap action when the circuit is broken at contact points 10 and 11, the member 4 may be of magnetic material or comprise a magnetic portion arranged in either circuit controlling position to abut one of the poles of a permanent magnet 12.

In order that the winding 5 of the electromagnet may not be a continuous load on the lighting circuit while energized, I provide

thermal responsive means arranged to be heated in accordance with the current in the circuit and to control the duration of the energization of the winding 5 so as to short circuit the same subsequently to the actuation of the circuit controlling member 4 and to maintain the winding short-circuited and the lighting circuit closed until the switch 3 is opened. This thermal responsive means may comprise for example a bimetallic thermal element or strip 13 connected in series in the lighting circuit with the winding 5 and arranged when heated to maintain the lighting circuit through a path in parallel to the winding 5, this path comprising a portion of the thermal element 13 and a contact 14 controlled thereby.

Assuming the parts positioned as shown in the drawing, then the circuit controlling member 4 short-circuits lamp 1. This is the way the lighting circuit would be upon opening the switch 3 at dawn and after the time lag necessary for the thermal element 13 to cool. Now in the evening, when it is desired to light the lamps of the system, the switch 3 is closed and the winding 5 is energized. The circuit at each lighting unit is momentarily conductor 15, lamp 2, conductor 16, member 4, contact 11, thermal element 13, conductor 17, winding 5 and conductor 18. The electromagnet is energized and armature 6 moves up causing flexible member 8 to move over the left face or edge of cam 9 and finally engage a notch therein and move the member 4 clockwise to engage contact 10. This completes a short-circuit across lamp 2, as follows:—contact 10, member 4 and conductor 16, while the short-circuit across lamp 1 is removed. Lamp 1 is now in circuit, as follows;—contact 10, member 4, conductor 16, lamp 1, conductor 19, thermal element 13, conductor 17, winding 5, and conductor 18. Very quickly, however, the thermal element 13 will become heated and close on contact 14, thus short-circuiting the winding 5. Moreover as line current continues to flow through the thermal element 13, it will maintain the line circuit through the path in parallel to the winding 5 so long as the switch 3 is closed. Later in the evening, when it is desired to switch over to lamp 2, the low candle power lamp, the switch 3 is opened and allowed to remain open for an interval equal to the time lag of the thermal element 13 which in cooling opens the parallel path or circuit across the terminals of winding 5. Switch 3 is then closed and the winding 5 is energized the circuit being, contact 10, member 4, conductor 16, lamp 1, conductor 19, thermal element 13, conductor 17, winding 5 and conductor 18. The armature 6 moves up causing flexible member 8 to move over the right face or edge of cam 9 and finally engage the notch therein and move the member 4 counter clockwise. Lamp 1 is now short-circuited as shown in the drawing, the short circuit being conductor 16, member 4 and contact 11. In the meantime thermal element 13 is becoming heated and short-circuits the winding 5 subsequently to the actuation of the member 4 by the electromagnet. When it is desired to put out all lights in the morning, the switch 3 is opened and the thermal element 13 in cooling returns to the position shown in the drawing with everything in readiness to repeat the cycle of operation outlined.

While I have shown and described only one embodiment of my invention, I do not desire to be limited to the exact arrangement shown and described but seek to cover in the appended claims all those modifications that fall within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States, is:

1. In a device of the class described, a movable circuit controlling member, means comprising an electro-magnet having an armature arranged on movement to the attracted position to move said member to circuit controlling position, and means for effecting the movement of the armature to the unattracted position after the energization of said electromagnet comprising a thermal responsive element arranged upon energization of the electromagnet to be heated in accordance with the current in the winding thereof and subsequently to the energization of the electromagnet to complete a circuit in shunt with the winding of said electromagnet and maintain said shunt circuit while the circuit controlled by said member remains energized.

2. In a device of the class described, a circuit controlling member movable to a plurality of circuit controlling positions, means comprising an electromagnet arranged upon a plurality of energizations to move said member to each of said positions in a definite sequence, and means for controlling the duration of each energization of said electromagnet comprising a thermal responsive element arranged upon energization of the electromagnet to be heated in accordance with the current in the winding of the electromagnet and subsequently to the energization of the electromagnet to complete a circuit in shunt with the winding of said electromagnet and maintain said shunt circuit while the circuit controlled by said member remains energized.

3. In a device of the class described, a movable circuit controlling member, means comprising an electromagnet having an armature arranged on movement to the attracted position to move said member to circuit controlling position, and thermal responsive means for effecting the movement of the armature to the unattracted position arranged upon energization of the electromagnet to be heated in accordance with the current in the winding thereof and subsequently to the

energization of the electromagnet to short-circuit the winding thereof and maintain the same short-circuited while the circuit controlled by said member remains energized.

4. In a device of the class described, a circuit controlling member movable to a plurality of circuit controlling positions, means comprising an electromagnet arranged upon a plurality of energizations to move said member to each of said positions in a definite sequence, and thermal responsive means arranged upon energization of the electromagnet to be heated in accordance with the current in the winding thereof and subsequently to the energization of the electromagnet to short circuit the winding thereof and maintain the same short-circuited while the circuit controlled by said member remains energized.

5. In a device of the class described, a movable circuit controlling member, means comprising an electromagnet having an armature arranged on movement to the attracted position to move said member to circuit controlling position, and means for effecting the movement of the armature to the unattracted position comprising a thermal responsive element connected in series with the winding of said electromagnet and arranged subsequently to the energization of the electromagnet to short-circuit the winding thereof and maintain the same short-circuited while the circuit controlled by said member remains energized.

6. In a device of the class described, a circuit controlling member movable to a plurality of circuit controlling positions, means comprising an electromagnet arranged upon a plurality of energizations to move said member to each of said positions in a definite sequence, and means comprising a thermal responsive element connected in series with the winding of said electromagnet and arranged subsequently to the energization thereof and irrespective of the circuit controlling position of said member to short-circuit the winding of the electromagnet and maintain the same short-circuited while the circuit controlled by the member remains energized.

7. In a circuit controlling system wherein a circuit comprises two translating devices connected in series and wherein the translating devices are to be operated alternately, a movable circuit controlling member arranged in one circuit controlling position to short-circuit one of said translating devices and in another circuit controlling position to short-circuit the other of said translating devices, means for actuating said member comprising an electromagnet arranged upon successive energizations to move said member to its respective circuit controlling positions, the winding of said electromagnet being connected in series in said circuit and means for controlling the duration of energization of said winding comprising a thermal responsive element arranged upon energization of said winding to be heated in accordance with the current in said circuit and subsequently to the energization of the winding to short-circuit the winding and maintain the same short-circuited while the circuit controlled by said member remains energized.

8. In a circuit controlling system wherein a circuit comprises two translating devices connected in series and wherein the translating devices are to be operated alternately, a movable circuit controlling member arranged in one circuit controlling position to short-circuit one of said translating devices and in another circuit controlling position to short-circuit the other of said translating devices, means for actuating said member comprising an electromagnet arranged upon successive energizations to move said member to its respective circuit controlling positions, and means for controlling the duration of energization of said electromagnet comprising a thermal responsive element connected in series in said circuit with the energizing winding of said electromagnet and arranged upon energization of the circuit to complete and maintain another path for the current in the circuit in parallel with the winding of the electromagnet subsequently to the operation thereof and upon deenergization of the circuit to open said parallel path.

In witness whereof, I have hereunto set my hand this 31st day of January, 1924.

HENRY E. BUTLER.