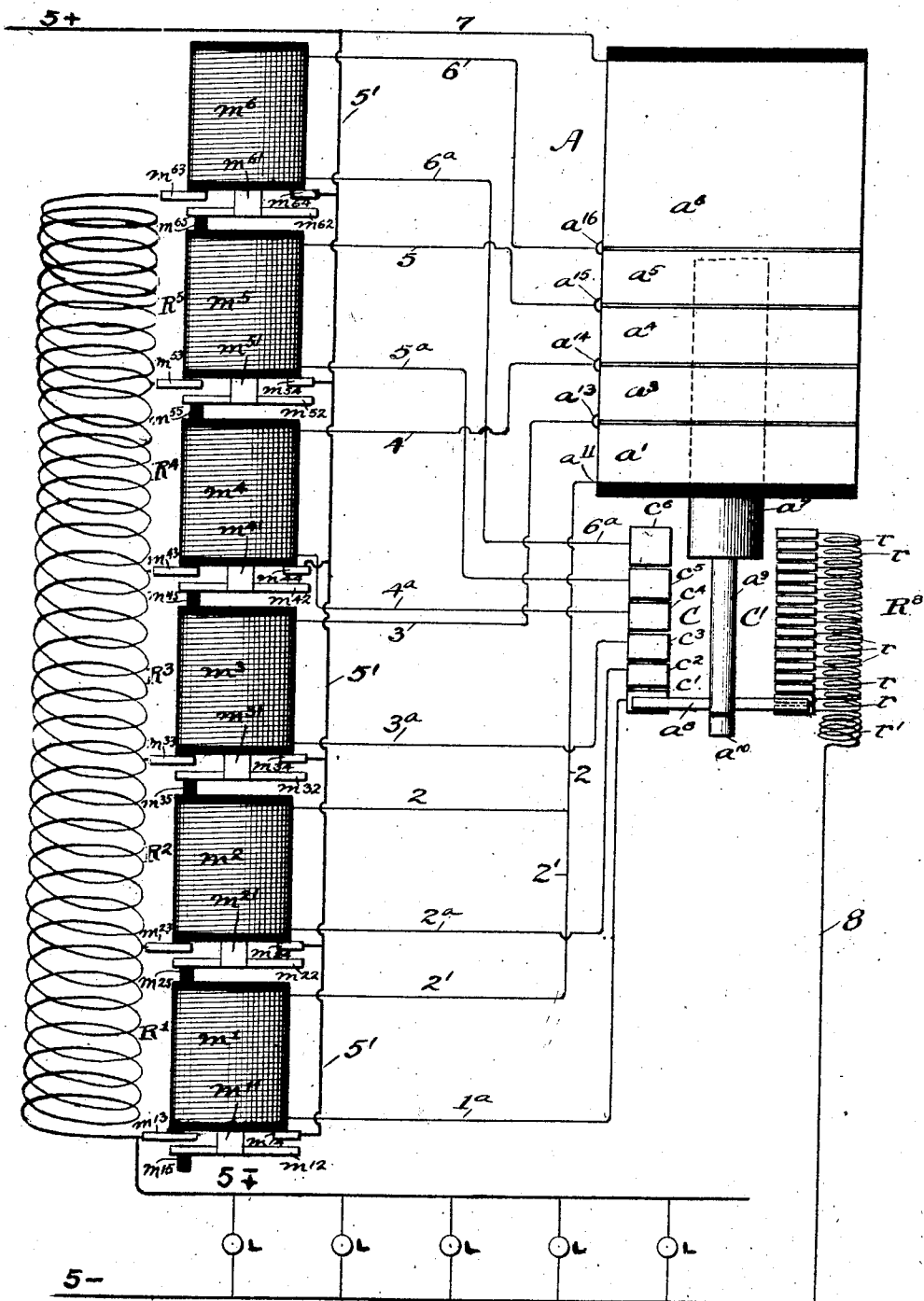


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SYSTEM OF ELECTRICAL DISTRIBUTION.
APPLICATION FILED JULY 1, 1907.

1,006,631.

Patented Oct. 24, 1911.



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To all whom it may concern:

Be it known that I, WILLIAM H. CLARKE, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Systems of Electrical Distribution, of which the following is a specification.

My invention relates to improvements in systems of electrical distribution.

One of the objects of my invention is to provide a system of electrical distribution whereby lamps, or similar translating devices, placed in multiple relation, may be operated and maintained at practically uniform constant potential, in circuits wherein the difference of potential is frequently varied, but in which the decrease never goes below that at which the lamps are operated.

Another object of my invention is to provide a system of the character described, by means of which relatively heavy current may be manipulated without material damage to the mechanism employed for the purpose.

Other and further objects will become apparent to those persons who are skilled in the art from the description hereinafter contained, together with a consideration of the drawing, by which a diagrammatic illustration of my system is shown.

The main line-leads, between which the maximum, and at intervals, varying difference of electrical potential or pressure is impressed are indicated by 5+ and 5-. The subsidiary circuit, between the mains of which, 5± and 5- the lamps L are placed, in parallel or multiple-arc relation, is located between the resistance coils, R¹, R², R³, R⁴ and R⁵, and the main 5-. In other words the resistance coils are adapted to be placed in series relation with the subsidiary circuit in the main circuit. The resistance coils, as shown, being between the subsidiary circuit main 5±, the third main, so to speak, and the main 5+. A means for controlling the resistance coils, R¹-R⁵ inclusive, consists of the magnets m¹, m², m³, m⁴, m⁵ and m⁶ in conjunction with the sectional solenoid A, composed in part of coil sections a¹ a³ a⁴ a⁵ and a⁶, and suitable electrical connections. The controlling solenoid A is provided with a reciprocating armature-core a⁷ having a cross-bar conducting brush a⁸ secured to the lower end of a stem a⁹, which is secured to the lower end of the core a⁷, the brush being

adapted to make electrical connection with the sections of the respective commutators located on either side of a vertical median line of the solenoid. A rest a¹⁰ holds the armature normally in the position shown. The commutator C is composed of a series of sections, c¹, c², c³, c⁴, c⁵ and c⁶, gradually increasing in length as their location approximates the solenoid coil, the reason for which will be hereinafter explained. The sections a¹-a⁵ inclusive, of the solenoid A, are in effect, when they are in circuit, continuations of the large section a⁶. They are joined together in series by means of connections a¹³ a¹⁴ a¹⁵ and a¹⁶. A tap wire 6 electrically joins the connection a¹⁶ with the beginning end of the winding of the solenoid or magnet m⁶. The ending end of the winding of said magnet is joined to the upper contact c⁶ of the commutator C by means of the wire 6^a. In a similar manner the connections a¹⁵, a¹⁴ and a¹³ are made to coils m⁵, m⁴ and m³ by means of wires 5, 4 and 3 respectively, and said magnets are connected to commutator sections c⁵, c⁴ and c³ by wires 5^a, 4^a and 3^a respectively. The terminal a¹¹ of the coil A may be, and is shown connected to two magnets m² and m¹ by means of wire 2 and branch wire 2'. The ending ends of magnets m² and m¹ are electrically connected to commutator sections c² and c¹ by wires 2^a and 1^a respectively. The magnets are each provided with responsive armatures and contacts.

m⁶¹ is the armature core of the magnet m⁶, to the lower end of which is attached an electrical conducting bar m⁶², adapted to make firm and complete electrical connection between the contacts m⁶³ and m⁶⁴. Rests m¹⁵-m⁶⁵ are provided for supporting the armatures in their normal positions.

The corresponding parts, associated with the remaining magnets, are indicated by similar and uniform reference characters. A lead-wire 5' is connected to the main 5+ and has tap connection with contacts m⁶⁴-m¹⁴ inclusive. The resistance coils R¹-R⁵ inclusive, are connected to contacts m¹³-m⁶³ inclusive and respectively. The upper end of the windings of section a⁶ of solenoid A is connected to the main 5+ by means of wire 7. A rheostat R⁸, composed of a series of relatively high resistance coils r-r' is properly connected to the commutator C'. A part of the rheostat R⁸, shown indicated by reference character r' may remain per-

manently in circuit. The lower end of the rheostat is connected to the main 5— by wire 8. The circuit wires, arranged to carry the heavy working current, are indicated by heavy dark lines: Those which carry current of relatively low value are indicated by light lines.

The use and operation of my system of electrical distribution is as follows; The full maximum difference of potential is manifest between the wires 5+ and 5— when the circuit is energized. This difference of potential, or pressure, is presumed to vary at irregular intervals, but at no time will it drop below the difference of potential that is desired to be maintained constant between the wires 5+ and 5— to which the terminals of the lamps L are connected.

When the circuit containing the wires 5+ and 5— is first closed it is completed through the following paths; From main 5+ over wire 7, through coils a^6 a^5 a^4 a^3 and a^1 , or the entire solenoid coil A, over the wire 2, the branch wire 2', through magnet coil m' , over wire 1^a to contact c' over bar a^8 to commutator C' through that portion of the rheostat r' which is left continually in circuit, over wire 8 to the main 5—, thus completing the circuit, energizing solenoid A and magnet m' . As soon as this is done magnet m' attracts its armature bringing contact bar m^{12} into electrical connection with contacts m^{13} and m^{14} , which action completes the electrical path between main 5+, through wire 5', to wire 5+, through the lamps L to the main 5—, putting the maximum difference of potential across the lamp terminals for a very short period of time. Before any damage to the lamps can result from the excessive electrical pressure to which they are thus subjected, owing to the fact that the lamps are much higher resistance when cold than when they are at an incandescing temperature; the armature a' will have been lifted to a greater or less extent by the energized solenoid A, bringing the bar a^8 successively into electrical connection with contacts c^2 c^3 c^4 and so on, until sufficient resistance R^1 R^2 R^3 etc., has thus been cut into circuit, in series with the group of lamps L, to compensate for the excess of electrical pressure to which the lamps were primarily subjected.

The current flowing through the circuit, beginning with wire 7 and ending with wire 8 is maintained practically constant in value by the act of cutting resistance R^8 to a greater or less extent, into the said circuit, as substantially an equivalent amount of resistance is removed from the circuit by cutting out one or more of the sections a^1 a^2 etc., of coil A. The arrangement is such that the core a' will remain stably in the position to which it has been moved so long as the current flowing through the solenoid A, or any portion thereof, is not materially

increased or decreased beyond the point to which adjustment has been made.

Should the core be moved to a given point on the commutator C, in obedience to a given maximum electrical pressure a corresponding resistance R^1 R^2 , etc., would thus be cut into series with the lamps L. Should the electrical pressure between wires 5+ and 5— be subsequently increased the core a' will be moved higher up and more of the rheostat coils R^1 etc., will be cut into series with the lamps. Should the electrical pressure in the main circuit, between wires 5+ and 5— be diminished the core with its cross bar a^8 will fall and resistance coils R^1 etc., will be cut out of circuit. In every instance resistance coils R^1 etc., are cut into circuit in series with the lamps L, or removed therefrom in accordance with the variation of potential or pressure in the main circuit, to compensate to a greater or less degree for the excess of pressure in the main circuit over that obtained in the lamp or subsidiary circuit, in order to maintain the difference of potential in the subsidiary circuit at a constant or invariable potential or pressure.

It is well known that the attraction or "pull" of a solenoid core is not uniform upon approach of the core toward the coil center, so that, if the resistance sections r are to be included in the circuit in proportion to current increase, provision must be made to prevent lessening of strength of the "pull" as the core progresses. To this end, as heretofore described, I provide that each successive step of the commutator shall cut out a portion of the solenoid coil, so in effect raising the coil center and tending to restore the original "pulling" or attractive effect thereof. Such arrangement of reducing the turns of the solenoid coil for uniform solenoid "pull" obviously has the effect to reduce the resistance between the wires 7—8 at each step, but by making the commutator sections c' , c^2 , etc., successively wider, each step of the core or armature brush over said sections is caused to include an increasing number of the resistance sections r in the circuit. If a section of resistance were cut into the circuit of solenoid A exactly equivalent to the resistance of the section of the solenoid cut out, then the current in the solenoid would not remain constant, but would increase, for the cause of the core a' rising within the solenoid A is the increase of voltage between the mains 5+ and 5—. In order to keep the current substantially constant in the solenoid, it is therefore necessary to cut in resistance r that is equal to the section of the solenoid cut out, and enough more to bring the current in the solenoid back to normal value. This result is obtained by making the contacts c' , c^2 , successively wider.

Having thus described my invention, I

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

1. In a system of electrical distribution, a main circuit, a subsidiary circuit containing translating devices in parallel relation, a rheostat composed of a series of resistance sections, means for short circuiting the rheostat and subsequently inserting a greater or less number of said sections after said subsidiary circuit has been initially closed.

2. In a system of electrical distribution, a main circuit, a subsidiary circuit containing translating devices in parallel relation, a rheostat composed of a series of resistance sections, adapted to be connected in series relation with said subsidiary circuit but normally out of circuit, means for short circuiting the rheostat when said subsidiary circuit is initially closed, and cooperating means for substantially including a greater or less number of sections in circuit in series with said subsidiary circuit.

3. In a system of electrical distribution, a main circuit, a subsidiary circuit containing translating devices in parallel relation, a rheostat composed of a series of resistance sections adapted to be connected in series relation with said subsidiary circuit, means for connecting said subsidiary circuit directly to the main circuit, and thereby short circuiting said rheostat and means for subsequently inserting a greater or less number of said resistance sections in series with said subsidiary circuit.

4. In a system of electrical distribution, a main circuit, a subsidiary circuit containing translating devices in parallel relation, a rheostat composed of a series of sections, a separate automatic switch for controlling each of the sections respectively, and means responsive to variations in the main circuit, for controlling said switches to close the main circuit through the subsidiary circuit without the inclusion of the rheostat and to subsequently insert more or less resistance in series therewith.

5. In a system of electrical distribution, a main circuit, a subsidiary circuit containing translating devices in parallel relation, a variable resistance, divided into sections, adapted to be connected in series relation with said subsidiary circuit, a controlling magnet, and a series of magnetic switches arranged to be operated in sequence by said controlling magnet, to first close said main circuit through said subsidiary circuit without the inclusion of the rheostat and to subsequently connect more or less resistance in series with said subsidiary circuit.

6. In a system of electrical distribution,

a circuit, a variable resistance adapted and arranged to be included in said circuit, means for connecting more or less of said resistance in said circuit, a controlling magnet, for said means, and a means for maintaining the current through said controlling magnet substantially constant.

7. In a system of electrical distribution, a circuit, a variable resistance adapted and arranged to be included in said circuit, means for connecting more or less of said resistance in said circuit, a controlling magnet for said means, and means operated by said controlling magnet for maintaining the current through said magnet substantially constant regardless of the variation of potential of the circuit in which said controlling magnet is included.

8. In a system of electrical distribution, a controlling magnet, the windings of which are divided into sections, a responsive core, a commutator, to which said sections are connected in order, a variable resistance adapted and arranged to be included in series circuit relation with the windings of said controlling magnet, a second commutator to which the sections of the resistance are connected in order and a means, operated by the movement of said core, for varying the resistance in circuit with said windings, a variable resistance adapted and arranged to be included in parallel circuit relation with the windings of the controlling magnet, means controlled by inclusion of sections of said first commutator in circuit for varying the last said resistance, and circuit connections for said parts.

9. In a system of electrical distribution, a circuit, a rheostat divided into sections, a series of magnets, one for each resistance section, adapted and arranged to operate switches to connect the respective sections of resistance into said circuit, a commutator a controlling magnet divided into a plurality of coils normally connected in series, brush means for the commutator controlled by the controlling magnet, and a tap wire from the point where the adjacent coils are connected together to each of the resistance magnets respectively, the other terminal of said magnets connected to commutator sections of said commutator respectively in regular order.

In testimony whereof I hereunto set my hand in the presence of two witnesses.

WILLIAM H. CLARKE.

In the presence of—

GEO. T. MAY, JR.,

MARY F. ALLEN.