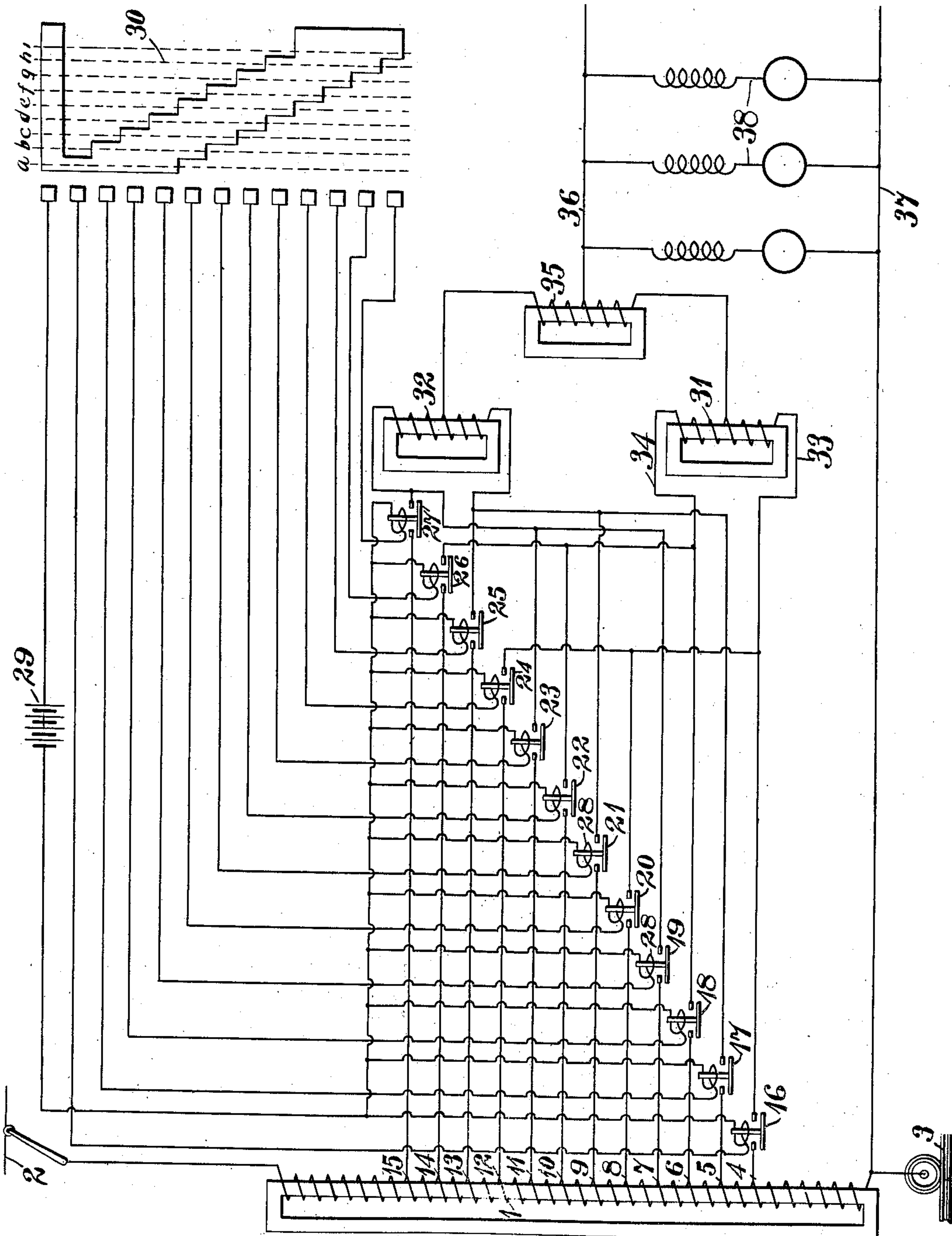


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R. P. JACKSON.
VOLTAGE REGULATOR.

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WITNESSES:

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VOLTAGE-REGULATOR.

No. 834,525.

Specification of Letters Patent.

Patented Oct. 30, 1906.

Application filed June 12, 1905. Renewed April 28, 1906. Serial No. 314,290.

To all whom it may concern:

Be it known that I, RAY P. JACKSON, a citizen of the United States, and a resident of Wilkinsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Voltage-Regulators, of which the following is a specification.

My invention relates to voltage-regulators, and particularly to those in which the voltage applied to translating devices or to a distributing-circuit may be varied by varying the active length of a transformer-winding.

The object of my invention is to provide means whereby large amounts of current may be conducted by circuit-controlling devices without injurious arcing between the circuit making and breaking terminals.

When large amounts of current are to be delivered through switch devices to distributing-circuits, it is frequently desirable that a plurality of switches be connected in parallel circuit for the purpose of reducing the amount of current that traverses the individual circuits in which the switches are located and which must be interrupted thereby when making changes in the circuit connections.

My invention consists in providing a plurality of inductive windings that are so arranged in circuit that a plurality of spaced leads from a main transformer may be utilized simultaneously and the current conducted to the distributing-circuit through a plurality of switch devices without injurious sparking between the switch-contacts when changes in the circuit conditions are effected.

The single figure of the accompanying drawing illustrates a system of electrical distribution embodying my invention.

A main transformer-winding 1, that may be supplied with energy from a trolley-conductor 2 and a track-rail 3 or from any other suitable source, has a plurality of spaced leads 4 to 15, inclusive, which are respectively provided with switches 16 to 27, inclusive. The switches 16 to 27 are severally adapted to be operated by magnet-windings 28, which may be energized by current from a battery 29 or from any other suitable source and which may be controlled by means of a

master-switch 30. The switches 16 to 27 serve to connect the inductive windings 31 and 32 between different alternate leads from the transformer-winding 1, the circuits being so arranged that corresponding terminals of the inductive windings 31 and 32 will be connected to consecutive transformer-leads. For example, inductive winding 31 may be connected between transformer-leads 4 and 6, 6 and 8, 8 and 10, 10 and 12, or 12 and 14, and terminal 33 thereof may be connected to transformer-lead 4, 8, or 12, while terminal 34 may be connected to transformer-lead 6, 10, or 14. The inductive winding 32 may be similarly connected between leads 5 and 7, 7 and 9, 9 and 11, 11 and 13, or 13 and 15.

A third inductive winding 35 is connected between points intermediate the terminals of the windings 31 and 32, which, as here shown, are and preferably will be the middle points thereof. A point intermediate the terminals of the winding 35, which, as here shown, is the middle point, is connected to a distributing-conductor 36, between which and another distributing-conductor 37, that may be connected to one terminal of the transformer-winding 1 or to any other suitable point in the circuit, are motors 38, for which of course other translating devices may be substituted.

If the master-switch 30 is moved to position *a*, switches 16, 17, 18, and 19 will be closed and inductive winding 31 will be connected between transformer-leads 4 and 6 and inductive winding 32 will be connected between transformer-leads 5 and 7. Since the currents which are supplied to each of the inductive windings from the transformer-leads traverse the circuits in opposite directions toward the point of connection therewith of the terminal of the winding 35, the voltages existing between the terminals of the winding 35 and the conductor 37 will be approximately equal to the differences of potential between lead 5 and conductor 37 and lead 6 and conductor 37, respectively.

The inductive winding 35 in a similar manner serves to equalize the voltages supplied thereto from the inductive windings 31 and 32, and the voltage applied to the distributing-circuit or that existing between the con-

ductors 36 and 37 will be approximately equal to the difference of potential existing between a point in the transformer-winding 1 midway between conductors 5 and 6 and the conductor 37.

If it is desired to raise the voltage applied to the motors 38, the master-switch 30 should be moved to position *b*, when the switch 20 will be closed and the switch 16 opened, these operations resulting in connecting the inductive winding 31 between transformer-leads 6 and 8. If the circuits are followed in a manner similar to what has just been described, it will be found that the voltage existing between the conductors 36 and 37 will be approximately that between a point in the transformer-winding 1 midway between the leads 6 and 7 and the conductor 37. The voltage of the distributing-circuit may be further varied by moving the master-switch 30 to its succeeding positions or by returning it to its first position.

The inductive windings 31 and 32 will ordinarily be constructed to operate at voltages equal to those existing between alternate transformer-leads, and their current capacities will be equal to approximately half the current capacity of the motors 38. Since the function of the winding 35 is to equalize the voltages applied to its terminals or approximately the difference of potential existing between successive transformer-leads, it will ordinarily be constructed for normal operation upon a voltage equal to such difference of potential, and its current capacity will be equal to the aggregate current capacity of the inductive windings 31 and 32.

While I have shown a specific form of transformer, it is to be understood that a two-winding transformer may, if desired, be employed instead of that shown or that the leads 4 to 15, inclusive, may be connected to any other suitable source of multivoltages.

It will also be readily understood that any other form of controlling means, such as a drum type of controller, may be employed instead of the independently-operated switches, as here shown, and if independently-operated switches are employed they may be operated otherwise than by means of electromagnets.

I claim as my invention—

1. The combination, in a distributing-circuit, of a transformer having leads extending from several points thereof, two inductive windings, means for connecting said windings between different alternate transformer-leads and a third inductive winding having its terminals connected to points intermediate the terminals of the other two windings and having a point intermediate its terminals connected to the distributing-circuit.

2. The combination with a distributing-circuit, of a transformer having leads extending from several points thereof, two induct-

ive windings, means for connecting said windings between different alternate transformer-leads so that corresponding terminals of the two windings shall be connected to consecutive transformer-leads, and a third inductive winding having its terminals connected to points intermediate the terminals of the other two windings and having a point intermediate its terminals connected to the distributing-circuit.

3. The combination with a distributing-circuit, of a transformer having leads extending from several points thereof, two inductive windings, means for connecting said windings between different alternate transformer-leads so that corresponding terminals of the two windings shall be connected to consecutive transformer-leads, and a third inductive winding having its terminals connected to the middle points of the other two windings and having its middle point connected to the distributing-circuit.

4. The combination with a distributing-circuit, of a transformer having leads extending from several points thereof, a plurality of inductive windings, means for connecting said windings between different alternate transformer-leads and another inductive winding having connections with points intermediate the terminals of the other inductive windings and having a point intermediate its terminals connected to the distributing-circuit.

5. The combination with a distributing-circuit, of a transformer having leads extending from several points thereof, a plurality of inductive windings, means for connecting said windings between different alternate transformer-leads so that corresponding terminals of different windings shall be connected to consecutive leads, and another inductive winding having connection with points intermediate the terminals of the other windings and having a point intermediate its terminals connected to the distributing-circuit.

6. The combination with a distributing-circuit, of a transformer-winding having leads extending from several points thereof, two inductive windings, means for connecting said windings between different alternate transformer-leads and a third inductive winding having its terminals connected to points intermediate the terminals of the other two windings and having a point intermediate its terminals connected to the distributing-circuit.

7. The combination with a distributing-circuit, of a transformer-winding having leads extending from several points thereof, two inductive windings, means for connecting said windings respectively between different alternate transformer-leads, and a third inductive winding having its terminals connected to the middle points of the other

two windings and having its middle point connected to the distributing-circuit.

8. The combination with a series of conductors that are supplied with different voltages, of a plurality of inductive windings, means for connecting said windings to different, alternate conductors of said series and an auxiliary inductive winding an intermediate point of which is connected to a distributing-circuit and the terminals of which are connected to intermediate points in the first-named inductive windings.

9. The combination with a series of conductors supplied with progressively-differing voltages, of a plurality of inductive windings, means for connecting the terminals of said windings to different alternate conductors of said series and an auxiliary inductive winding connected between intermediate points in the first-named windings and having an intermediate point connected to a distributing-circuit.

10. The combination, in a distributing-circuit, of a transformer having leads extending from several points thereof, two inductive windings, means for connecting said windings between different transformer-leads, and a third inductive winding having its terminals connected to points intermediate the terminals of the other two windings and having a point intermediate its terminals connected to the distributing-circuit.

11. The combination with a distributing-circuit, of a transformer having leads extending from several points thereof, a plurality of inductive windings, means for connecting said windings between different transformer-leads and another inductive winding having connections with points intermediate the terminals of the other inductive windings and having a point intermediate its terminals connected to the distributing-circuit.

12. The combination with a distributing-circuit, of a transformer-winding having leads extending from several points thereof, two inductive windings, means for connecting said windings between different transformer-leads and a third inductive winding having its terminals connected to points intermediate the terminals of the other two windings

and having a point intermediate its terminals connected to the distributing-circuit.

13. The combination with a distributing-circuit, of a transformer-winding having leads extending from several points thereof, two inductive windings, means for connecting said windings respectively between different transformer-leads, and a third inductive winding having its terminals connected to the middle points of the other two windings and having its middle point connected to the distributing-circuit.

14. The combination with a series of conductors that are supplied with different voltages, of a plurality of inductive windings, means for connecting said windings to different conductors of said series and an auxiliary inductive winding an intermediate point of which is connected to a distributing-circuit and the terminals of which are connected to intermediate points in the first-named inductive windings.

15. The combination with a series of conductors supplied with progressively-differing voltages, of a plurality of inductive windings, means for connecting the terminals of said windings to different conductors of said series and an auxiliary inductive winding connected between intermediate points in the first-named windings and having an intermediate point connected to a distributing-circuit.

16. The combination with a series of supply-conductors from which different voltages may be secured, of a plurality of inductive windings, means for connecting the terminals of said windings to different supply-conductors, and an auxiliary inductive winding having an intermediate point connected to a distributing-circuit and its terminals connected to intermediate points in the first-named inductive windings.

In testimony whereof I have hereunto subscribed my name this 9th day of June, 1905.

RAY P. JACKSON.

Witnesses:

S. PACKARD,
BIRNEY HINES.