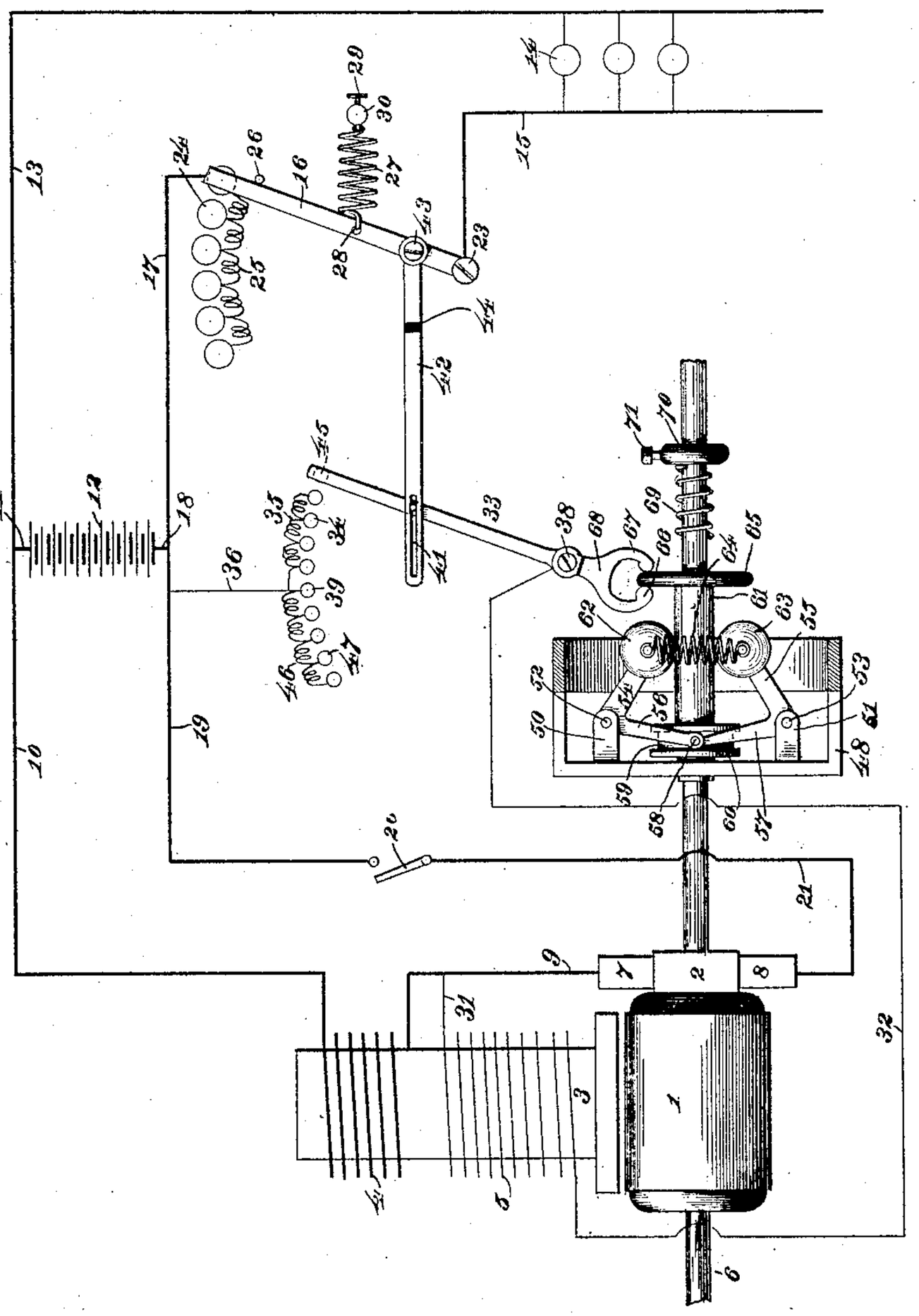
No. 704,863. Patented July 15, 1902.

J. L. CREVELING.

SYSTEM OF ELECTRICAL DISTRIBUTION.

(Application filed Aug. 30, 1900.)

(No Model.)



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UNITED STATES PATENT OFFICE.

JOHN L. CREVELING, OF NEW YORK, N. Y.

SYSTEM OF ELECTRICAL DISTRIBUTION.

SPECIFICATION forming part of Letters Patent No. 704,863, dated July 15, 1902.

Application filed August 30, 1900. Serial No. 28,525. (No model.)

To all whom it may concern:

Be it known that I, JOHN L. CREVELING, of New York, in the county of New York, State of New York, have invented an Improved System of Electrical Distribution, of which the following is a complete specification, reference being had to the accompanying drawing.

My invention relates to improvements in electric-lighting systems in which the speed of the armature driving-shaft is variable, and particularly to electric-lighting systems for railway-cars in which the power is derived from the axle of the car.

The object of my invention is to provide for the maintenance of constant voltage through the mains of the system and for the prevention of excess of current and especially by means dependent for its operation upon the rate of speed of the armature-shaft.

In the accompanying drawing I present a diagrammatic view of a simple, and for that reason preferred, form of embodiment of my invention.

Referring to the numerals on the drawing, 1 indicates the armature, 2 the commutator, and 3 the field-magnet of any suitable type of generator, in this instance the one shown being a differential compound machine having a series differential coil 4 and field exciting-coil 5.

6 indicates the armature driving-shaft, and 7 and 8 the respective brushes of the generator.

9 indicates one of the generator-leads, which, communicating with coil 4, is led by the main 10 to one pole 11 of the storage battery or accumulator 12. From the pole 11 of the battery 12 the main is continued, as indicated by 13, to the translating device or lighting system 14, from which it returns, through the main 15, yielding member or lever 16, main 17, pole 18 of the battery, main 19, switch 20, and main 21, to the brush 8 of the generator. The lever 16, constituting a movable section of the generator-circuit, is pivoted to a fixed point, as indicated at 23, and sweeps successively across the contact-plates 24 of a variable-resistance device or rheostat 25. The office of the lever 16 is to introduce, through successive contacts with the plates 24, a variable resistance into the work or translating circuit. When the lever 16 is in the position shown in the drawing, the resistance of the rheostat is cut out, and the lever rested against a stop-pin 26 is normally held in this position by a spring 27, secured at one end, as indicated at 28, to the lever and at the other to an adjustment-screw 29, working in a fixed stud 30. The field exciting-coil 5 being connected, as by the wire 31, with the main 9 and by the wire 32, vibratory arm 33, and contact-plates 34 of a variable-resistance device 35, and wire 36 with the main 19 is thereby placed across the terminals of the battery and also, when the switch 20 is closed, across the brushes of the generator. The vibratory arm 33 being pivoted, as indicated at 38, to a fixed point is adapted by successively sweeping across the contacts 34 to gradually eliminate the resistance of the rheostat 35 until the contact 39 is reached, when the arm 33 is in direct contact with the wire 36. The lever 33 is provided with a pin 40, which works in a slot 41, longitudinally disposed in a link 42, pivoted, as indicated at 43, to the lever 16, the arm 13 and lever 16 being insulated from each other, as by an insulated section 44 in the link 42. The length of the slot 41 is such as that when the end of the arm 33 reaches the contact 39 the pin 40 engages with the outer end of the slot 41. Consequently the further movement in the same direction of the arm 33 will actuate the lever 16 against the force of its spring 27. It should be noted that the button 45, although in line with the contact-plates 34 of the rheostat 35, is not a part of the rheostat, but is insulated from it. Consequently when the arm 33 is in the position shown in the drawing the battery field-circuit is broken, and it is only after contact is made between the arm 33 and the first of the series of contact-plates 34 that the battery field-circuit, as above described, is completed. By reason of the break in the battery field-circuit waste of the battery energy is avoided when the machine is at rest.

Upon the side of the contact-plate 39 opposite that upon which is located the rheostat 35 I provide another rheostat 46, provided with a series of contact-plates 47. The two series of contact-plates 34 and 46 are disposed in the shape of a continuous segment, so that after the arm 33 passes the contact-plate 39 the gradually-increasing resistance of the

rheostat 46 is by the continued movement of the arm 33 inserted into the battery field-circuit, thereby controlling the excitation of the generator-field.

It will be apparent from the foregoing description that if the arm 33 be turned upon its pivot 38 to complete the battery field-circuit the field-magnet 3 may be excited, so that by rotation of the armature the generator may be enabled to develop its voltage. It will also appear that if the movement of the arm 33 be continued beyond a prescribed limit it will at the same time cut in the rheostat 46 and, actuating the lever 16, introduce the resistance of the rheostat 25 into the main. The introduction of the resistance of the rheostat 46 will diminish the excitation of the field-magnet 3, while at the same time the introduction of the resistance of the rheostat 25 into the main may be made to prevent excess of voltage in the translating-circuit. In order, therefore, to accomplish that object, I prefer to employ means for making the movement of the arm 33 proportionate to the speed of rotation of the armature. This may be accomplished by providing the armature-shaft with mechanism substantially identical in construction with any of the well-known forms of speed-governors. As a simple form of embodiment of such mechanism I prefer to employ a metallic shell 48, fixed to a suitable prolongation of the armature-shaft 6. Within this shell are provided studs 50 and 51, located equidistantly from the center. Pivoted to said studs, respectively, as indicated at 52 and 53, are bell-crank levers and 55, the arms 56 and 57 of which being 54 preferably united, as indicated at 58, work in a channel 59 in a collar 60, which forms a part of or is connected with a sleeve 61, that works longitudinally upon the shaft 6. The other arms of the levers 54 and 55, respectively, are provided with counterweights 62 and 63, that are yieldingly united, as by a spring 64. The rotation of the shell 48 with its shaft 6 will tend to separate the counterweights 62 and 63 against the tension of their spring or springs 64 under the impulse of centrifugal force. The movement of the counterweights causes the levers 54 and 55 to turn upon their respective pivots 52 and 53, and thereby through engagement of the arms 56 and 57 of the levers with the collar 60 to move the sleeve 61 longitudinally upon the shaft 6. This movement of the sleeve 61 may be utilized to actuate the arm 33, as by the aid of any suitable loose connection between the parts. The connection which I prefer on account of its simplicity consists of a disk 65 upon the sleeve 61, which works between the two members 66 and 67 of a bifurcated tailpiece 68 upon the arm 33. The movement of the sleeve 61, occasioned by centrifugal force in the manner specified, may be yieldingly resisted, as by a coiled spring 69 about the shaft 6 and seated at one end against a slip-collar 70, securable, as by an abutment-screw 71, to any required position upon the shaft 6. The effective force of the spring 69 may be regulated by the position of the collar upon the shaft.

The operation of my apparatus is as follows: Assuming the generator to be at rest and the mechanical elements to be in the respective positions shown in the drawing, when the armature-shaft 6 begins to rotate it will immediately tend to produce movement of the sleeve 61 in the manner last above specified, and the spring 64 being weak will, at a very moderate rate of speed in the shaft 6, cause the arm 33 to make contact with the first of the series of contact-plates 34, thereby completing the battery shunt-circuit and lending excitation to the field-magnet. The employment of the rheostat 35 in the battery field-circuit is to prevent injurious sparking in the making and breaking of the circuit by the arm 33, and the full force of excitation is reached when the arm 33 makes contact with the plate 39. Movement of the arm 33 beyond this point inserts the resistance of the rheostat 46 into the battery field-circuit, producing diminution of the field excitation, and in this way the spring 69 is enabled to determine the speed necessary to cause the governor to begin to cut down the field excitation. It may be observed in this connection that as many contact-plates of the variable-resistance device 46 may be connected directly with each other without any resistance intervening as may be desirable in order to give the arm 33 considerable play without varying the field excitation. This movement without varying the resistance should of course correspond with the variation of speed permissible between the minimum and maximum current output from the generator. As the arm 33 makes contact with the plate 39 the disk 65 should begin to compress the spring 69, and, as specified, the pin 40 at the same time reaches the outer end of the slot 41. Consequently any further movement in the same direction of the arm 33 actuates the lever 16, so as to insert the resistance of the rheostat 25 into the circuit of the translating device or lamp-circuit. It will have been apparent, of course, to one skilled in the art that the battery 12 is designed to supply the lamp-circuit except at such times as the generator is in proper operation, when it is designed that the generator shall maintain the required voltage in the battery and in the lamp-circuit. It is therefore important to provide means for closing the switch 20 only at such times as the voltage of the generator and battery are approximately equal. For that reason provision must be made for properly closing the switch 20, which may be done automatically by electricity or mechanically. A switch well adapted for this purpose is shown in United States Letters Patent No. 644,409, issued to me on February 27, 1900; but other forms of switches may be employed, if desired. At the time when the generator be-

gins to furnish current to the battery and mains the resistance of the rheostat 25 will begin to be inserted in the lamp-circuit, and if the speed of the generator continue to increase more resistance will be inserted into the lamp-circuit as required and at the same time resistance will be inserted into the battery shunt-circuit, which is the field exciting-circuit of the generator. This makes it impossible for the current of the generator to increase with the speed of the shaft 6 beyond a certain prescribed limit. If the generator slow down, the resistance of the rheostat 25 will be cut out and by proper adjustment the generator operated with full excitation at the speed necessary to make the generator-voltage about equal to that of the battery. If the speed increase again, the operation previously described will be repeated; but should it greatly decrease or gradually come to a stop the resistance of the rheostat 25 would gradually be inserted into the battery shunt-circuit until the current becomes very weak and is finally broken without vicious sparking when the arm 33 comes to rest in its position shown in the drawing.

An important advantage of the system herein shown and described is found in the fact that by properly constructing the rheostats 25 and 46 and by proper adjustment of the centrifugal actuating mechanism and the devices operated thereby the voltage upon a lamp-circuit can be maintained, provided the load remains practically constant without any appreciable variation; also, in the fact that although the battery field-circuit is broken when the generator is at rest a strong field excitation may be obtained as soon as the armature is caused to revolve at any appreciable speed, which is the only time when the field excitation would be of any value. Thus not only is waste of current prevented when the generator is at rest, but also until the speed of rotation of the armature becomes available.

It is not my intention to limit this invention to the details set forth in the accompanying sketch, which is only intended to illustrate the principle of my invention in its simplest form of embodiment. Not only may a wide variety of forms of apparatus for cutting in and cutting out the resistance be employed, but the form of the generator may be varied. As specified, I illustrate a differential compound machine. That form is preferred, because a little differential winding diminishes the accuracy of adjustment required; but with proper care the form of the generator may be varied as suggested, and even a plain shunt-machine might be used.

What I claim is—

1. The combination with a generator, storage battery, and translating device in electrical communication one with the other, of a resistance device and coöperative movable member in the work-circuit, and mechanical means for actuating said movable member proportionately to the rate of speed of the armature of the generator.

2. The combination with a generator, battery and translating devices, in electrical communication one with the other, of two variable resistances, one in the work-circuit and one in the field-circuit, movable members coöperative therewith, and mechanical means for actuating said members in proportion to the rate of speed of the generator.

3. The combination with a generator, battery and translating devices, in electrical communication one with the other, of variable resistances, one in the work-circuit and the other in the field-circuit, movable members coöperative with said resistances, respectively, and mechanical means for coregulating the currents in said circuits, respectively, by correlative movements of said members.

4. The combination with a generator, battery and translating devices, in operative communication one with the other, of a pair of variable resistances, one in the work-circuit and the other in the field-circuit, a pair of movable members coöperative with said resistances, respectively, an endwise-movable member operatively connected with said members, and centrifugally-actuated mechanism varying in speed with the armature-shaft of the generator, operatively connected with the endwise-movable member.

5. The combination with a generator, storage battery, and translating device in electrical communication one with the other, of a field-coil, variable resistances and movable members inserted respectively into the work or translating and field circuits, respectively, insulated, mechanical means uniting said movable members, and mechanical means for actuating said movable members relatively to the rate of speed of the armature of the generator.

6. The combination with a generator, storage battery and translating device, in electrical communication one with the other, of a field-coil, variable resistances and movable members inserted respectively, into the work or translating and field circuits, respectively, insulated mechanical means uniting said movable members, and mechanical means for actuating said movable members in successive order, relatively to the rate of speed of the armature of the generator.

7. The combination with a generator, storage battery, and translating device, in electrical communication one with the other, of a resistance device and coöperative movable member, inserted into the work-circuit, and centrifugally-actuated mechanism upon the armature-shaft of the generator, operatively connected with said movable member.

8. The combination with a generator, storage battery, and translating device, in electrical communication one with the other, and a field-coil, of resistance devices and mechanically-connected, but electrically-insulated, movable members, inserted, respec-

tively, into said work or translating and field circuits, and centrifugally-actuated mechanism connected with the armature-shaft of the generator, operatively connected with said movable members.

9. The combination with a system of electrical distribution, comprising a generator, storage battery and translating devices, in electrical communication, and a field-coil, of mechanical means for coregulating the currents in the field and work circuits, relatively to the speed of rotation of the armature of the generator.

10. The combination with a system of electrical distribution comprising a generator, storage battery, and translating devices in electrical communication, and a field-coil, of resistance devices in the work and field circuits, respectively, and mechanical means of coregulating the currents in the field and work circuits through their respective resistances whereby the intensity of the translating devices may be held practically constant.

11. The combination with a generator, storage battery, and translating device, in electrical communication one with the other, and a battery field-coil, of a movable member intersecting the field-circuit, means for actuating said movable member relatively to the rate of speed of the armature-shaft of the generator, and a pair of variable resistances operatively disposed in the path of movement of the movable member, adapted respectively to diminish and increase the degree of resistance in the field-circuit through the continued movement of said movable member, substantially as and for the purpose specified.

12. The combination with a generator, storage battery and translating device, in electrical communication one with the other, of a battery field-coil, resistance devices and cooperative movable members inserted into the translating and field circuits, respectively, a transversely-insulated link, movably secured to one of said members, and loosely united to the other, whereby continued movement of one of said movable members will actuate the other in successive order, and centrifugally-actuated mechanism connected with the armature-shaft of the generator, operatively connected with one of said movable members, substantially as and for the purpose specified.

13. The combination with a generator, storage battery and translating device, in electrical communication one with the other, and a battery field-coil, of resistance devices and movable members, coöperative in successive order, inserted respectively, into the translating and field circuits, a loose sleeve upon the armature-shaft of the generator, operatively connected with one of said movable members, an adjustably-fixed spring upon said shaft opposed to the movement of said sleeve, and centrifugally-actuated mechanism upon said shaft, operatively connected with said sleeve, substantially as and for the purpose specified.

14. The combination with a generator, storage battery and translating devices, in electrical communication one with the other, a battery lamp-circuit being defined between the battery and translating devices, of mechanical means for regulating the lamp-circuit by the speed of the generator, whereby the voltage of the lamp-circuit is kept practically constant, notwithstanding variations of the voltage in the generator and generator-circuit, due directly to the said variations in speed.

In testimony of all which I have hereunto subscribed my name.

JOHN L. CREVELING.

Witnesses:
CHAS. E. RIORDON,
JOSEPH L. ATKINS.