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J. L. CREVELING.

SYSTEM OF ELECTRICAL DISTRIBUTION.

(Application filed Dec. 7, 1900.)

(No Model.)

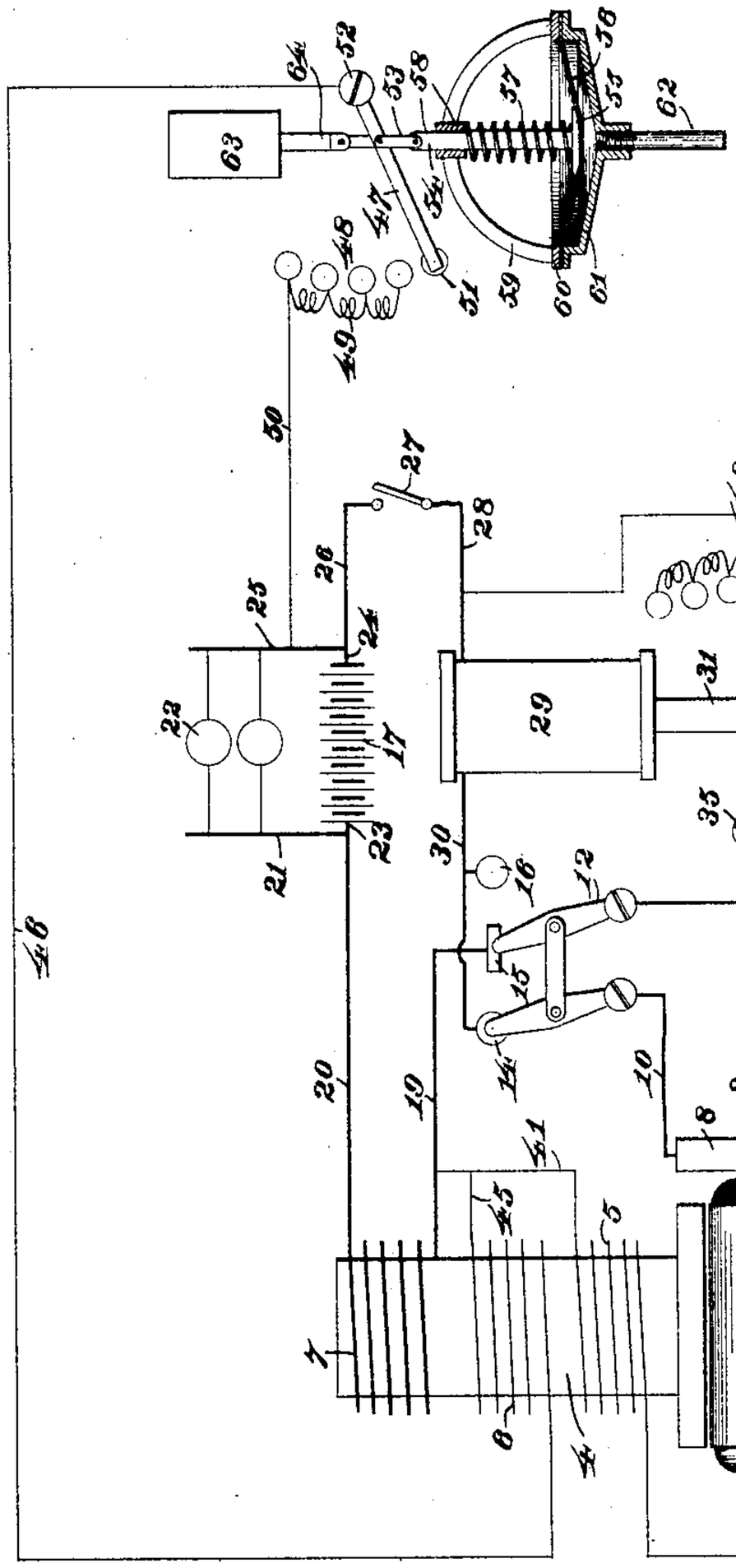

Fig. I.

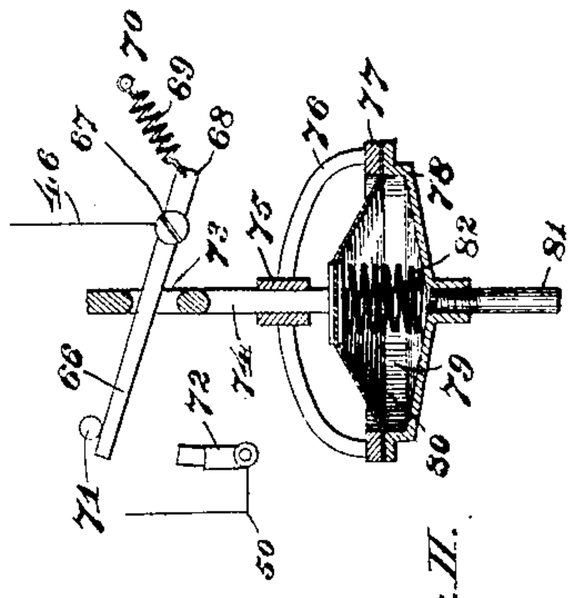

Fig. II.

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UNITED STATES PATENT OFFICE.

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SYSTEM OF ELECTRICAL DISTRIBUTION.

SPECIFICATION forming part of Letters Patent No. 688,394, dated December 10, 1901.

Application filed December 7, 1900. Serial No. 39,049. (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 drawings.

My invention relates to improvements in systems of lighting cars by electricity, in which the electricity is generated by power taken from the axle.

The object of my invention is to provide means for automatically regulating the strength of the current in such systems, so as to obtain practical steadiness of current, and particularly an improved system in which the field-exciting circuit, or "battery shunt-circuit," as it is hereinafter denominated, is closed by a pneumatically-actuated prime mover. So far as the promotion of steadiness of current is concerned my system is adapted to be used to advantage with any generator which derives its motion from a driving-shaft of variable speed; but it is especially applicable to railway-car service, because of the presence in it of the pneumatically-actuated prime mover, since pneumatic energy is generally available on all passenger-car service.

In the accompanying drawings I show in Figure I, diagrammatically and solely for the purposes of illustration, one form of embodiment of my invention in which the prime mover is adapted to be actuated by compressed air. Fig. II illustrates, partly in section, prime-mover-actuating mechanism adapted to be operated by suction.

Referring to the numerals on the drawings, 1 indicates the armature, 2 the shaft, 3 the commutator, and 4 the field-magnet, of any preferred form of generator. The form of generator illustrated is a compound machine, the field-magnet being provided with a shunt-coil 5, a battery shunt-coil 6, and a differential series coil 7, the several functions of which will be hereinafter explained.

8 and 9 indicate the respective brushes, from which, respectively, proceed leads 10 and 11, which communicate, respectively, with a suitable pole-changer 12. The structure of the pole-changer and its function being well understood, it will suffice in this connection to say that it is adapted, through intervention of the contacts 14, 15, and 16, to provide for rotation of the shaft 2 in either direction and to transmit current from the generator through the main 19, differential coil 7, and main 20 to the translating main 21 of the translating device 22 and to one pole of a storage battery 17, as indicated at 23. From the other pole of the battery, as indicated at 24, connection is made with a translating main 25 and with a main 26, which communicates with a switch 27. From the switch a main 28 leads through the windings of a solenoid 29 to the main 30, which, carrying contact-plates 14 and 16, is adapted, through the operation of the pole-changer 12, to complete the main circuit. The solenoid 29 is provided with a core 31, which being operatively connected, as by a link 32, with a yielding member or spring-actuated lever 33 is adapted to cause it to oscillate upon its pivot 35 against the resistance of a weak spring 36, secured at one end to the lever and at the other to an adjustment-screw 37, working in a stud 38. The lever 33 constitutes, in effect, a movable section of the shunt-coil circuit, being connected, on the one hand, as by a wire 40, with the shunt-coil 5, which communicates with the main 19 through the wire 41. On the other hand, its free end sweeps successively across contact-plates 42 of the variable-resistance device 43, the terminal contact-plate 42, with which the lever 33 is normally in contact, being directly connected, as through a wire 44, with the main 28. The main 28 connecting with the pole-changer through the windings of the solenoid 29 and the main 30 and the main 19 also making connection with the pole-changer, the shunt-circuit is completed across the brushes 8 and 9 of the generator by the leads 10 and 11, respectively. The battery shunt-coil 6 is connected with the main 19, as by the wire 45. The wire 19, as above specified, connects with the pole 23 of the battery, so that the coil 6, being connected by the wire 46 with a yielding member or lever 47, which is adapted to sweep across the contacts 48 of a variable-resistance device 49, is adapted, through the wire 50, to close circuit with the remaining battery-pole 24. In addition to the series of contact-plates 48 an isolated contact-plate 51 is pro-

vided, with which the lever 47 may normally make contact and from it pass to the next adjacent contact-plate in making and breaking the battery shunt-circuit.

The lever 47, which, inasmuch as it is adapted to make and break the battery shunt-circuit by which the field-magnet is excited, I denominate the "prime mover," is pivoted, as indicated at 52, in electrical contact with the wire 46. It is connected, as by a link 53, with a rod 54, which, as by flanges 55, is supported upon a flexible diaphragm 56, against which it is held, as by a coiled spring 57. The spring 57 is seated at one end against a collar 58, which is secured, as by an open frame-piece 59, to a ring 60, that surmounts an air-chamber 61. The ring 60 completes the air-chamber 61 by confining in place, as the upper wall of the air-chamber, the diaphragm 56. The interior of the chamber 61, as completed by the diaphragm 56, is supplied with pneumatic pressure, as by a pipe 62, that communicates with a source of air-supply. (Not illustrated.) The source of air-supply may be the air-brake reservoir or the reservoir of the whistle-signal service of the train. Such a source of air-supply is preferred, because it is present and available in ordinary train equipment, and of the two sources I prefer to employ that of the whistle-signal service, for reasons which will hereinafter be indicated.

63 indicates a dash-pot, which being operatively connected with the lever 47, as by the rod 64, may serve to prevent a too-sudden rise of the lever 47 under the impulse of air-pressure.

The variable-resistance device 49 in connection with the isolated contact-plate 51 is employed for reasons which will hereinafter become apparent to prevent injurious sparking as the movement of the lever 47 makes and breaks the circuit. In Fig. II, I show a snap-acting device for accomplishing the same purpose and illustrate in connection therewith pneumatically-actuated means for operating the prime mover in which the pneumatic energy is exerted by suction instead of internal pressure, as previously specified. Moreover, as the means shown in Fig. II are introduced into the battery shunt-circuit, which is otherwise the same as that previously described, I retain the numerals 46 and 50 to designate the wires of that circuit which the prime mover is designed to make and break. In this instance the prime mover being slightly different in construction from the lever 47 I designate it by the distinctive numeral 66. The lever 66 is pivoted, as indicated at 67, in electrical circuit with the wire 46; but it projects beyond its pivotal point in a tailpiece 68, to which is secured at one end a spring 69, that is secured at the other, as indicated at 70, to a relatively fixed object. The lever 66 oscillates between a stop-pin 71 and a contact-piece 72, which constitutes the terminal of the wire 50. The lever is loosely engaged, as by the walls of a slot 73, in a rod 74, working in a collar 75, supported by an open frame-piece 76 upon a ring 77, that surmounts a chamber 78. The parts 76 to 78, inclusive, may be substantially identical with the corresponding parts previously specified. The ring 77 secures in place the diaphragm 79, to which the rod 74 is secured, as by a plate 80.

81 indicates a pipe communicating with a vacuum-producing device (not illustrated) and adapted to actuate the diaphragm against a spring 82.

It may be noted that the means for actuating the prime mover by the compressed air or by a vacuum are equally adapted to actuate the lever 47 and the lever 66, and the two modes of actuation are illustrated and described in order to make it apparent that my device is equally applicable to trains equipped with compressed-air systems and to trains equipped, for example, with the vacuum-brake system.

With respect to the operation of the lever 66 it remains to be specified that the slot 73 is somewhat larger than the lever, so as to allow lost motion. Consequently if by the movement of the rod 74 the lever be forced beyond the center in one direction or the other the spring 69 completes the movement with a snap action, thereby causing the lever either to strike the stop-pin 71 or the contact-piece 72 by an abrupt movement which, as is understood in the art, will prevent that injurious sparking or formation of an arc which the two devices illustrated in the drawings with respect to the movement of the levers 47 and 66, respectively, are equally designed to prevent.

The operation of my system is as follows: Referring to Fig. I, suppose the generator to be at rest and the several mechanical parts to be in the positions illustrated. Under those conditions no current will flow from the battery through the shunt-coil or through the generator, inasmuch as the battery shunt-coil circuit is broken by the lever 47 and the main circuit is open by the switch 27. If the car upon which the apparatus shown in Fig. I is assumed to be located be made up as ready for service and the air-pressure placed upon the brake apparatus and the whistle-signal-system apparatus, with either of which the pipe 62 may communicate, as above specified, as a source of air-pressure supply, the diaphragm 56 will move against the force of the spring 57 and through the rod 54 actuate the lever 47. Accordingly the lever 47 passes from the contact-plate 51 and sweeps successively across the contact-plates 48 of the resistance device 49. The first of the series of contact-plates 48 that the lever touches will connect the field-coil with the battery, but through a very high resistance. As the lever slips to the next contact this resistance will be lessened, and so on till the last contact is reached, when the coil will be in multiple across the battery. The specified movements

of the lever 47 successively across the series of contact-plates 48 is very gradual, and there will therefore be no appreciable sparking as the lever moves from one contact to the other. As above specified, by the use of the snap-acting lever 66 (shown in Fig. II) the formation of an arc may be prevented, even though the current be suddenly interrupted. Returning, however, to the description of Fig. I, as soon as the lever 47 communicates with the resistance device 49 current will flow from the pole 23 of the storage battery through the wire 10, coil 7, wire 45, battery shunt-coil 6, wire 46, lever 47, resistance device 49, and wire 50 to the pole 24 of the battery. This will provide a suitable field for the generator, which will also be afforded by the coil 5, which is in shunt across the dynamo-mains. If the speed of the generator increase until the voltage is equal to that of the battery, the switch 27 will be closed. This switch may be operated either automatically, as by electricity, or mechanically, as desired, a good switch for the purpose being shown in United States Letters Patent No. 644,409, granted to me February 27, 1900. Assuming that the switch is closed and the generator's speed is increased, so that its electromotive force is equal to that of the battery, current will flow from the generator, as by main 11, pole-changer 12, main 19, through differential coil 7, main 20, battery 17, translating device 22, main 26, switch 27, main 28, solenoid 29, main 30, pole-changer 12, and main 10, to the generator. This current will circulate the coil 7 in such direction as to oppose the action of the respective coils 5 and 6. Thus, as is well understood in the art, a wide variation in speed of the generator is possible without any appreciable change in electromotive force. If the current passing through the solenoid 29 increases above the predetermined limit fixed by the power of the spring 36, the solenoid will attract its core 31, raising the lever 33 and inserting resistance of the device 43 into the shunt-coil circuit. This will weaken to some extent the field of the generator and make it impossible to generate more than a predetermined quantity of current. So long as the generator continues to be driven in the same direction and above the voltage of the battery the above-described operation will continue, provided, of course, that air-pressure remain upon the pipe 62, which would be the case in ordinary train practice so long as the train remains intact. If the train stop, as at a station, the switch 27 would open as soon as the speed of the generator fell below critical speed. The opening of the switch prevents all back discharge from the battery through the armature; but the battery shunt-coil being still in circuit will continue a source of electrical supply through the translating device 22. As soon as the train is started up the above-outlined operation is repeated; but if the train should be broken up and being separated from its locomotive be switched into the yard and lie there for some time the air-pressure on the brake or signal system would be allowed to escape, and the source of air-pressure supply being thereby relieved through the pipe 62 the spring 57 would expand, thereby actuating the lever 47. The reverse movement of the lever 47 across the series of contact-plates 48 inserts gradually-increasing resistance until the last of the series is reached, when the lever will pass to the contact-plate 51, thereby breaking the contact. This gradual movement of the lever 47 and the consequent gradual insertion of resistance effectually eliminates vicious sparking.

It is because of the practical necessity of the actuation of the lever 47 while the train is being made up and of the breaking of the battery shunt-coil circuit when the train is broken up that I prefer to employ as a source of air-pressure supply the whistle-signal system of a train. Upon this system there is always pressure while the car is in service and the pressure is always relieved when the locomotive is taken off. There is not only no necessity for field excitation for the generator when the locomotive is detached, but also when the car is out of service it is desirable to prevent waste of energy from the battery.

If the prime-mover-actuating mechanism shown in Fig. II be substituted for the corresponding mechanism shown in Fig. I, the pipe 81 would be connected with the vacuum-producing apparatus of a vacuum brake system, for example. In this case the pipe 81 is so connected because the reservoir of the vacuum brake system is always partially exhausted while the train is running and receives atmospheric pressure when the train is laid up. A partial vacuum produced in the chamber 78 will actuate the diaphragm 79 and through its movement cause the rod 74 to draw the lever 66 beyond the neutral point, when the spring 69 will cause the lever 66 to snap into contact with the contact-piece 72 and retain it in that position until the vacuum in the chamber 78 be relieved—that is to say, as long as the car is in service. If the car be taken out of service and air allowed to enter the chamber 78, the spring 82 will tend to restore the rod to the position shown in Fig. II until as the lever passes the neutral point the spring 69 will cause it to leave the contact-piece with a snap, thereby preventing the formation of an arc and accomplishing by different means the same function performed by the actuation of the lever 47 with respect to its correlative members, as previously specified.

It has been suggested in the foregoing specification, but may be here repeated for emphasis, that a distinct advantage of my system is in the combining of means for practically regulating the strength of the circuit with means which breaks the battery shunt-circuit, it being found in practice that the waste caused by a closed battery shunt-cir-

cuit, however desirable under favorable conditions, occasions no inconsiderable loss if the car is laid up for any considerable time.

What I claim is—

1. The combination with a generator, storage battery and translating device in electrical communication one with the other, of a field-coil deriving current from the battery, and pneumatically-controlled means for varying the resistance in the battery field-circuit.

2. The combination with a generator, storage battery and translating device in electrical communication one with the other, of a field-coil in shunt to the generator-circuit, a battery field-coil deriving current from the battery, and pneumatically-controlled means for varying the resistance in the battery field-circuit.

3. The combination with a generator, and translating device in electrical communication one with the other, of means for automatically controlling the current of the generator, a field-coil, and pneumatically-actuated means for varying the resistance in the field.

4. The combination with a generator, storage battery and translating device in electrical communication one with the other, of a field-coil in circuit with the generator, means for automatically controlling the current therein, a field-coil deriving current from the battery, a spring-actuated prime mover adapted to vary the resistance in the battery field-circuit and pneumatically-actuated means for operating said prime mover against the force of its spring.

5. The combination with a generator, storage battery and translating device in electrical communication one with the other, of a field-coil in circuit with the generator, means for automatically controlling the current therein, a field-coil deriving current from the battery, a prime mover adapted to make and break the battery field-circuit, and means in the battery field-circuit for preventing injurious sparking through the movement of the prime mover.

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

JOHN L. CREVELING.

Witnesses:
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