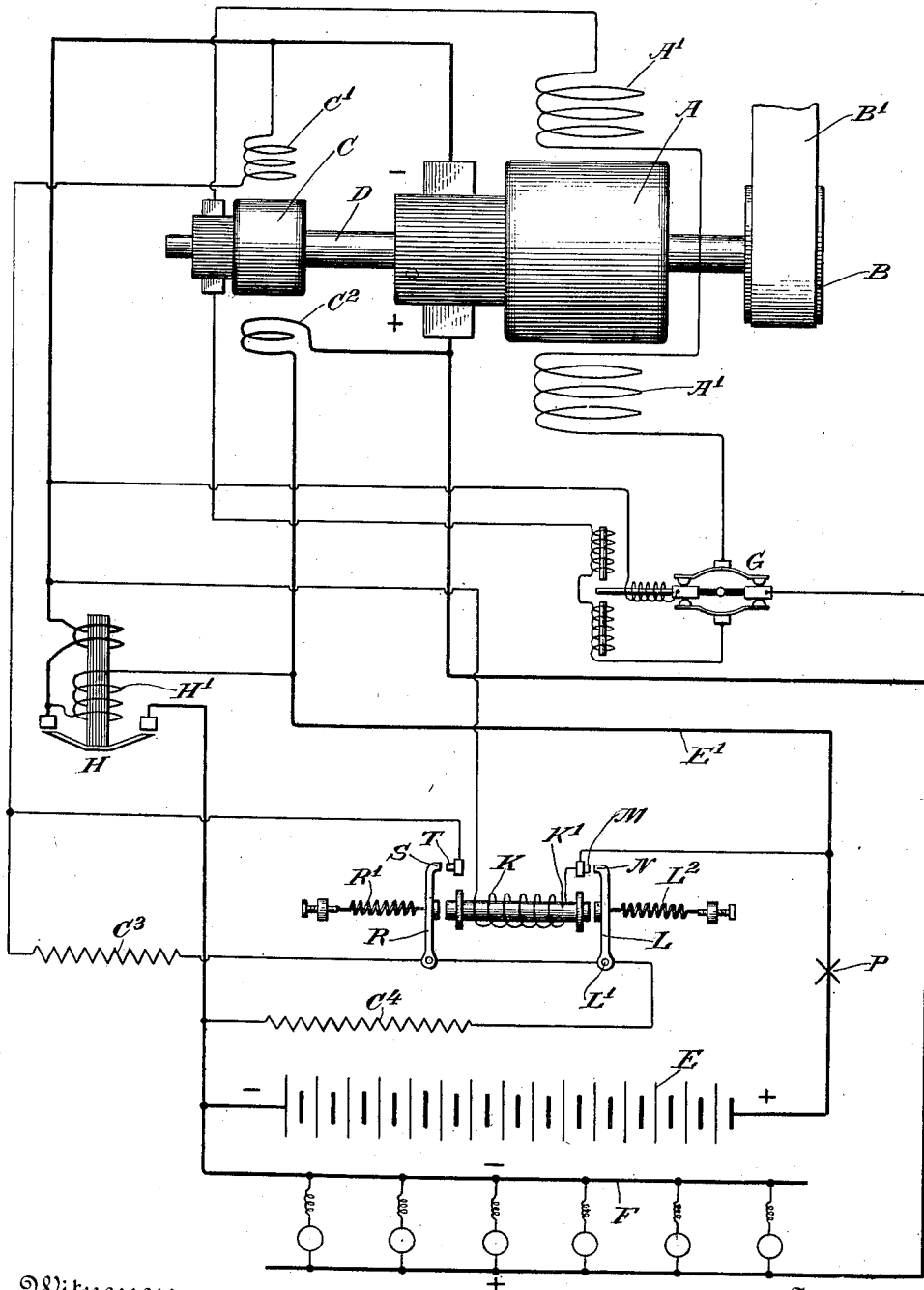


W. A. TURBAYNE.
ELECTRICAL SYSTEM OF DISTRIBUTION.
APPLICATION FILED JAN. 16, 1909.

991,109.

Patented May 2, 1911.



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UNITED STATES PATENT OFFICE.

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ELECTRICAL SYSTEM OF DISTRIBUTION.

991,109.

Specification of Letters Patent.

Patented May 2, 1911.

Application filed January 16, 1909. Serial No. 472,605.

To all whom it may concern:

Be it known that I, WILLIAM A. TURBAYNE, a citizen of the United States, and a resident of Lancaster, in the county of Erie, State of New York, have invented certain new and useful Improvements in Electrical Systems of Distribution, of which the following is a specification.

My invention relates to electrical systems of distribution and has been devised more especially with relation to car lighting systems in which the main dynamo is driven from the car axle and in which automatic means are employed to properly regulate the voltage of the main generator. My invention is not, however, limited to such a specific system.

A number of features of the system which I shall show and describe and with which my invention may be employed, have been shown and described in a previous application of mine, Serial No. 430,461, filed May 2nd, 1908.

My present invention involves means whereby the operation of such systems may be made more reliable and safe and the main object of my invention is to provide automatic means which will cause the proper regulation of the main generator upon the failure of the apparatus which normally produces such regulation.

Further objects, features and advantages will more clearly appear from the detailed description given below taken in connection with the accompanying drawing which diagrammatically shows a system embodying one form of my invention.

In the drawing, A indicates the main dynamo and A' the field winding thereof. The dynamo is indicated as being driven by a pulley B and belt B' from any suitable source of power, as, for example, the axle of a railway car.

C represents an auxiliary or regulating dynamo which is mechanically connected to the main dynamo A by the shaft D and, therefore, rotates in the same direction as the main dynamo.

C' and C² are field windings of the auxiliary dynamo.

E represents a storage battery and E' its circuit which is fed by the main generator A.

F represents a work circuit which is also operatively arranged with the main dynamo A to be supplied thereby. In the present instance the work circuit consists of a number of lamps with a regulating resistance in the circuit of each.

G is a switch that controls the connection of the field winding A' of the main dynamo in such a manner that this field winding is connected so that the main generator produces an electro-motive force always in the same direction regardless of the direction of rotation. The operation of the switch G is not new with this application and forms no part of the present invention. It is fully described in my previous application, Serial No. 430,461 above mentioned.

Various parts of the system are shown in the positions they occupy when the system is about to be started up.

The switch H is open and the work circuit is being fed from the battery. The coil C' of the auxiliary dynamo or generator is energized from the battery, the terminals of the coil being connected across the battery through the armature of the generator A, resistances C³ and C⁴.

The resistance C⁴ is inserted to cut down the value of the exciting current in the coil C' when the machines are being started up and to prevent the battery being short-circuited upon the operation of the lever or armature L. When the machines are being started up the coil C' furnishes the initial excitation for the auxiliary dynamo C. It is only necessary that a very small excitation be provided by the coil C', to cause the machines to properly build up, and the resistance C⁴ prevents a needless waste of current for this purpose. When the generators are at rest the lamps or other load at F are fed by the battery and the switch H is open to prevent a reverse current flowing from the battery through the main generator A. The field coil C' is provided with a weak current from the battery, as above explained, and when the generators are started up the auxiliary machine C excited by the coil C', will produce an exciting current in the field windings A' in such a direction as to always maintain the same brush of the main generator, positive. This current also operates

the pole changer G to properly connect the field windings A' in shunt with the armature of generator A to maintain this condition of polarity. The machine will now build up independently of the generator C, although it may be aided somewhat thereby.

When the electro-motive force of the main generator has reached its normal value the switch H is closed by the action of the voltage coil II'. This throws the work circuit and battery in series with the main generator and a heavy current passes through the coil C². At the same time the coil C' is short-circuited so that it has practically no effect as an exciting element. The heavy current in coil C² now reverses the polarity of the dynamo C which has heretofore aided in building up the field A', and then causes the dynamo C to become a counter-machine to oppose the electro-motive force of the main dynamo A applied to its shunt field coil A'. As the current varies in this coil C² the electro-motive force of the auxiliary generator will vary and the electro-motive force of the main dynamo will vary, the arrangement being such that as the current of the coil C² increases the electro-motive force of the main dynamo will decrease and vice versa, thus regulating the main dynamo to give a substantially constant current through the coil C². The tendency in such a system is to keep the current in the coil C² constant and, therefore, to keep the battery charging current constant. In order to markedly and materially decrease or eliminate this charging current when the battery has become charged to the proper extent a solenoid K is connected directly across the battery circuit so that it will be subject to the battery voltage. This solenoid is provided with a core K' and the armature L pivoted at L' is adapted to be attracted by the core K' against the action of a spring L². At its positive terminal the solenoid K is provided with a contact terminal M adapted to contact with the terminal N on the armature L when the latter is attracted toward the core K' under the action of the solenoid K. The armature L, and consequently contact terminal N, is connected to the coil C' through the resistance C³. The parts are so adjusted that when the battery voltage rises to that point where it has received the proper charge, the strength of the solenoid K becomes great enough to overcome the opposing force of spring L² and the armature L is drawn toward the solenoid and the contact terminals M and N are brought together. This throws the field coil C' directly across the terminals of the generator A so that a comparatively heavy current will flow within this coil C' so that it will aid the field coil C² to increase the voltage of the dynamo C and thereby cut down the voltage of the main generator A to a point where the battery will receive

very little charging current or will float across the line.

From the above it will be evident that should the external battery circuit for any reason become open, as at P, or disabled so that it would fail to accomplish its regulating functions the field coil C² would also fail to accomplish its regulating functions and the auxiliary machine C would fail to properly regulate the main generator A. The voltage of the main generator A would then rise abnormally with increase of speed, so much so, that various parts of the apparatus would be liable to become injured or the system thrown out of operation. In order to overcome this objectionable feature I provide the solenoid K with a second armature R operating under the tension of a spring R'. The armature R is electrically connected with the circuit of the field coil C' between the resistances C³ and C⁴. It is also provided with a contact terminal S which, when the armature is operated, is adapted to contact with the contact terminal T. Contact terminal T is connected to the circuit of the field coil C' between said coil and the resistance C³, so that, when the armature R is attracted by the solenoid K the contacts S and T are brought together and the resistance C³ is short-circuited, thereby causing a much heavier current to flow in the field coil C' to further and greatly increase the excitation of the auxiliary machine C. This increase in excitation, due to the field coil C', causes the auxiliary dynamo C to cut down the voltage of the main generator A until it reaches a value such that the solenoid K again releases the armature R. The tension of the springs R' and L² is so arranged that the armature R is not operated except when a voltage exists upon the line somewhat higher than is necessary to cause the actuation of the armature L.

From the above it will be seen that upon the failure of the field coil C² to produce its regulating functions and upon an abnormal rise in voltage across the generator A the armature R will be brought into operation to properly excite the dynamo C by increasing the excitation of its field coil C' by short-circuiting the resistance C³. The various parts are so arranged that upon the actuation of the armature R the excitation of the dynamo C is increased more than enough to bring the voltage of the dynamo A back to the predetermined value at which the armature R is operated. The armature R will therefore vibrate back and forth when in operation, thus keeping the excitation of the main generator A down to such a value that the voltage of the main generator will not rise materially above its normal value. By my invention, therefore, I provide a simple and effective means for carrying out the various objects thereof and an arrangement

which is efficient and economical in construction and operation.

Although I have shown my improvements with great detail I do not desire to be limited to such details, but

Having fully and clearly described the same what I claim as new and desire to secure by Letters Patent, is:

1. The combination of a generator, regulating means therefor having a coil arranged to affect said regulating means to cause the generator to be regulated responsive to changes in its output, and a coil arranged to affect said regulating means to cause the generator to be regulated responsive to voltage changes of the generator upon the failure of said first mentioned coil to regulate.

2. In an electrical system of distribution, a generator, a work circuit and storage battery supplied thereby, means for regulating the voltage of the generator, provided with means for affecting said regulating means to cause the voltage of the generator to be regulated responsive to current changes of the system and means for affecting the regulating means to cause the generator voltage to be regulated responsive to voltage changes of the system upon the failure of said second mentioned means.

3. In an electrical system of distribution, a generator driven at a variable speed, a work circuit and storage battery supplied thereby, means for regulating the voltage of the generator including a coil responsive to current changes in the system and a coil for causing the generator to be regulated responsive to voltage changes of the system upon the failure of current in said first mentioned coil.

4. In combination, a generator driven at a variable speed, means for regulating the voltage of said generator responsive to certain electrical fluctuations in its output, and a coil for acting upon said means and arranged to be brought into operation on the failure thereof, to cause said means to regulate the voltage of said generator.

5. In an electrical system of distribution, the combination of a variable speed generator, an auxiliary dynamo for regulating the same provided with means for controlling said dynamo to regulate its voltage, and means for controlling said dynamo arranged to be brought into operation upon the failure of said first mentioned controlling means.

6. In combination, a generator, a device for regulating the same provided with means for controlling the operation of said device, and means arranged to control said device responsive to voltage fluctuations of said generator upon the failure of said first mentioned means to operate.

7. In an electrical system of distribution, the combination of a generator driven at a

variable speed, an auxiliary dynamo for regulating said generator provided with means for controlling the operation of said dynamo responsive to fluctuations in the electrical condition of the system and a coil arranged to control said dynamo upon the failure of said controlling means to operate.

8. In an electrical system of distribution, the combination of a generator driven at a variable speed, an auxiliary dynamo for regulating said generator provided with means for controlling the operation of said dynamo responsive to fluctuations in the electrical condition of the system, a coil arranged to control said dynamo upon the failure of said controlling means and an electro-responsive device for controlling said coil responsive to certain voltage variations.

9. In an electrical system of distribution, a generator driven at a variable speed, means for regulating the generator including a coil for controlling the voltage of said generator responsive to certain electrical fluctuations of the system, a coil arranged to control the regulation of said generator upon the failure of said first mentioned coil and means for controlling the operation of said second mentioned coil.

10. In an electrical system of distribution, a generator driven at a variable speed, means for regulating the generator, including a coil for controlling the regulation of the voltage of said generator responsive to certain electrical fluctuations of the system, a coil arranged to control the regulation of said generator upon the failure of said first mentioned coil and a magnet and contact device for controlling the operation of said second mentioned coil.

11. In an electrical system of distribution, a generator driven at a variable speed, an auxiliary dynamo for regulating the voltage of said generator provided with a coil for controlling said auxiliary dynamo responsive to certain electrical fluctuations of the system, and a coil arranged to control said dynamo when the first mentioned coil fails to properly control the same.

12. In an electrical system of distribution, a generator driven at a variable speed, an auxiliary dynamo for regulating the voltage of said generator provided with a coil for controlling said auxiliary dynamo responsive to certain electrical fluctuations of the system, a coil for regulating and controlling said dynamo when the first mentioned coil fails to properly control the same, and an electro-responsive device for controlling said second mentioned coil responsive to voltage fluctuations of said generator.

13. In an electrical system of distribution, a generator driven at a variable speed, a work circuit and storage battery supplied thereby, means for regulating the voltage of the generator including a coil responsive to

current changes through the battery, and a coil for causing the generator voltage to be regulated responsive to voltage changes of the generator responsive to a failure in the operation of said first mentioned coil by a failure of current therein.

14. In an electrical system of distribution, a generator driven at a variable speed, a storage battery and work circuit supplied thereby, means including a coil carrying a current responsive to current changes of the system whereby the voltage of the generator is regulated responsive to current changes of the system and a coil arranged to carry a current responsive to voltage changes of the system upon a failure of current in said first mentioned coil whereby the generator will be regulated responsive to voltage changes of the system upon an abnormal increase in voltage thereof.

15. In an electrical system of distribution, a generator driven at a variable speed, a storage battery and work circuit supplied thereby, means including a coil carrying a current responsive to electrical changes of the system whereby the voltage of the generator is regulated responsive to electrical changes of the system and a coil arranged to carry a current responsive to voltage changes of the system upon a failure of current in said first mentioned coil whereby the generator will be regulated responsive to voltage changes of the system upon an abnormal increase in voltage thereof.

16. In an electrical system of distribution, a generator driven at a variable speed, a battery and its circuit fed thereby, a work circuit in operative relation therewith, an auxiliary dynamo for regulating the generator, having a coil responsive to battery current fluctuations for regulating said dynamo and means for regulating said dynamo upon the failure of said coil to operate.

17. In an electrical system of distribution, a generator driven at a variable speed, a battery and its circuit fed thereby, a work circuit in operative relation therewith, an auxiliary dynamo for regulating the generator, provided with means for causing the dynamo to regulate the generator responsive to certain electrical fluctuations of the system, a field coil on said dynamo arranged to be responsive to voltage fluctuations of the generator when said means fails to operate properly and a device for automatically bringing said field coil into operation.

18. In an electrical system of distribution, a generator driven at a variable speed, a battery and its circuit fed thereby, a work circuit in operative relation therewith, an auxiliary dynamo for regulating the generator, having a field coil responsive to certain electrical fluctuations, a second field coil, and means for causing said second field coil to regulate the dynamo to keep down the volt-

age of the generator upon the failure of said first mentioned field coil.

19. In an electrical system of distribution, a generator driven at a variable speed, a battery and its circuit fed thereby, a work circuit in operative relation therewith, an auxiliary dynamo for regulating the generator, having means for causing the dynamo to regulate the generator responsive to certain electrical fluctuations, a field coil normally inoperative and means for causing the same to become operative upon the failure of operation of said first mentioned means.

20. In an electrical system of distribution, a generator driven at a variable speed, a battery and its circuit fed thereby, a work circuit in operative relation therewith, an auxiliary dynamo for regulating the generator, a field coil for said dynamo responsive to certain electrical fluctuations, a second field coil for said dynamo, and a vibrating regulating device for controlling said second field coil responsive to abnormal voltage changes of the system.

21. In an electrical system of distribution, a generator driven at a variable speed, a battery and work circuit supplied thereby, means for regulating the voltage of the generator, a coil for controlling the operation of said means responsive to current variations of the system, a coil arranged to control said means responsive to voltage changes of the system and to be brought into operation upon the failure of current in said first mentioned coil, and means responsive to voltage changes of the system acting to bring said second mentioned coil into operation on the failure of the first mentioned coil.

22. In an electrical system of distribution, a generator driven at a variable speed, a battery and its circuit fed thereby, a work circuit in operative relation therewith, an auxiliary dynamo for regulating the generator, a field coil for said dynamo responsive to certain electrical fluctuations, a second field coil for said dynamo, means for bringing said second coil into operation to cut down the battery charging current and means for greatly increasing the current in said second coil responsive to abnormal voltage changes of the system.

23. In an electrical system of distribution, a generator driven at a variable speed, a battery and its circuit fed thereby, a work circuit in operative relation therewith, an auxiliary dynamo for regulating the generator, a field coil for said dynamo responsive to certain electrical fluctuations, a second field coil for said dynamo, a solenoid responsive to voltage changes of the system for causing said second coil to be brought into operation to cut down the charging current of the battery, and means operated by said solenoid upon an abnormal increase in voltage of the system to further increase

the action of said second mentioned coil to cause it to properly regulate the voltage of said generator.

24. In an electrical system of distribution, a generator driven at a variable speed, a battery and its circuit fed thereby, a work circuit in operative relation therewith, an auxiliary dynamo for regulating the generator, a field coil for said dynamo responsive to certain electrical fluctuations, a second field coil for said dynamo, a solenoid connected across the battery for causing said second coil to be brought into operation to cut down the charging current of the battery, and means operated by said solenoid upon an abnormal increase in voltage of the system, to further increase the current of said second mentioned coil to cause it to properly keep down the voltage of said generator.

25. In an electrical system of distribution, a generator driven at a variable speed, an auxiliary dynamo for regulating the field thereof having a coil for automatically controlling said dynamo, and a second coil normally inoperative for automatically controlling said dynamo responsive to an abnormal increase in voltage of said dynamo.

26. In an electrical system of distribution, the combination of a main generator driven at a variable speed, an auxiliary dynamo for regulating the field thereof, and arranged to oppose the current in said field, a battery and its circuit fed by said generator, a work circuit in operative relation therewith, a field coil for said dynamo responsive to certain electrical fluctuations and adapted to regulate the same to cause the main generator to be regulated, a second field coil for said generator, a solenoid responsive to voltage fluctuations of the generator, and means actuated by said solenoid when the voltage

applied thereto has reached a predetermined value, to greatly increase the strength of said second field coil so that the opposing action of said dynamo causes the voltage of said generator to drop below said predetermined value.

27. In combination, a generator driven at a variable speed, a device for regulating the voltage thereof, including means for controlling said device, and supplementary means arranged to control said device upon the failure of said first mentioned means, said supplementary means being brought into operation upon a certain increase of generator voltage.

28. In combination, a generator driven at a variable speed, a battery and its circuit fed thereby, a work circuit in operative relation thereto, means for regulating the generator to govern its voltage including means actuated upon failure of current in the battery circuit for causing the regulation of said generator.

29. In combination, a generator driven at a variable speed, a battery and its circuit fed thereby, a work circuit in operative relation thereto, an auxiliary dynamo for regulating said generator having controlling means responsive to variations of current in the battery circuit and controlling means responsive to voltage variations of the generator, said last mentioned means being arranged to be brought into operation upon failure of current in the battery circuit.

In testimony whereof, I have signed my name to this specification, in the presence of two subscribing witnesses.

WILLIAM A. TURBAYNE.

Witnesses:

RAYMOND HUMMELL,
P. HAUNGS.