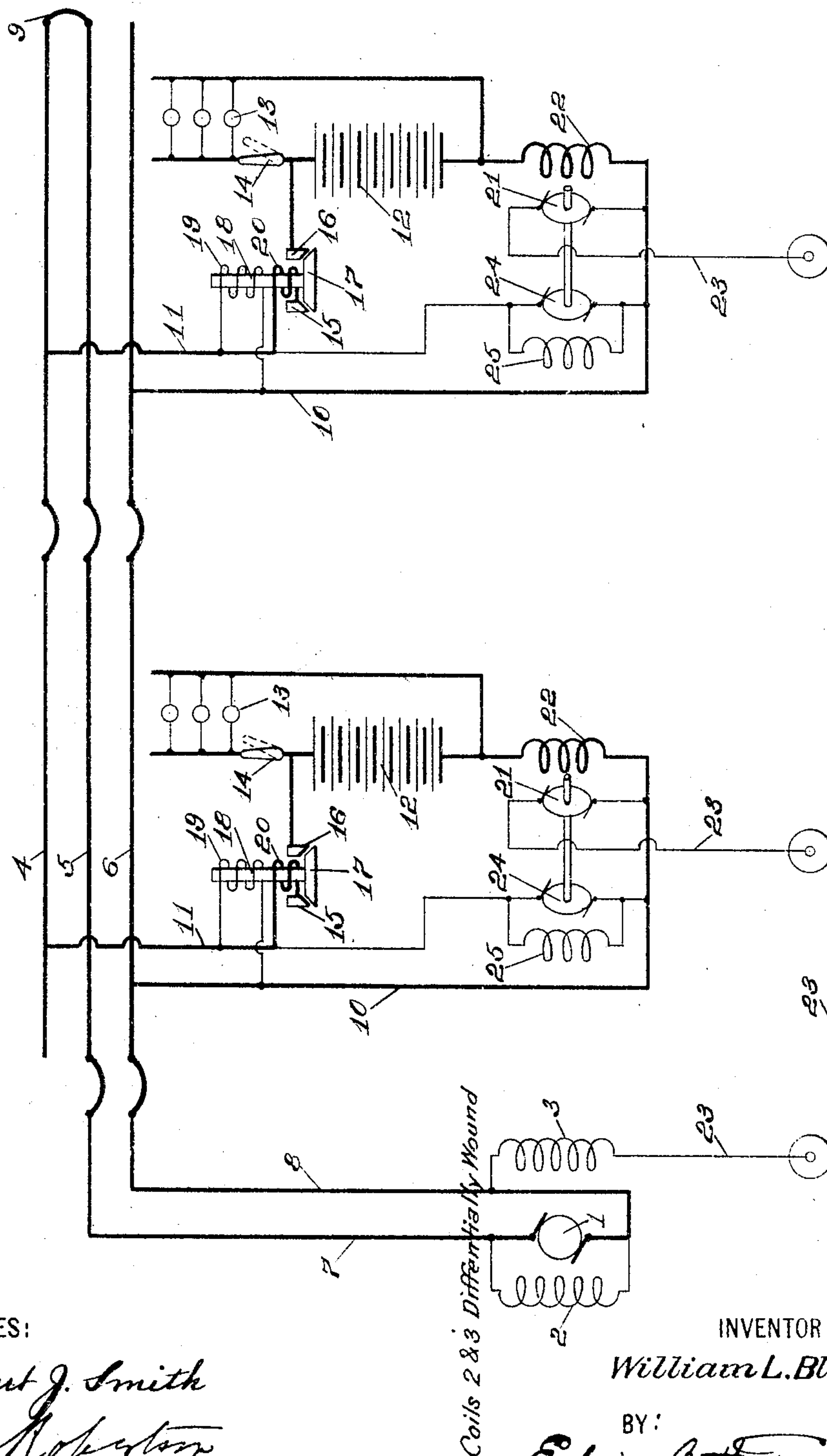


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W. L. BLISS.
TRAIN LIGHTING SYSTEM.
APPLICATION FILED MAR. 18, 1905.



WITNESSES:

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TRAIN-LIGHTING SYSTEM.

No. 799,518.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, WILLIAM L. BLISS, a citizen of the United States, residing at Brooklyn, in the county of Kings and State of New York, have invented new and useful Improvements in Train-Lighting Systems, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawing, forming a part of this specification.

The present invention relates to improvements in lighting systems which are especially adapted to be employed for lighting cars or other units of transportation by electricity.

The particular form of system to which the present invention relates is adapted to be employed for lighting a train of cars, it being provided with a single generator which furnishes the current to light all of the cars in the train. The generator must be capable of varying the output thereof whenever the number of cars in the train is changed, as the demands for current will be increased when cars are added to the train and the same will be decreased when cars are taken from the train.

It is the object of the present invention to provide a train-lighting system which will be suitable for lighting a train of cars. The various other objects will be apparent from an explanation of the invention.

The present application sets forth and claims a modification of an invention which is disclosed in an application filed April 27, 1904, Serial No. 205,062. According to the present invention the generator is regulated by an exciter to confine the output thereof within prearranged limits. It is preferable to provide each car in the train with an exciter; but it will be understood that a single exciter may be employed to regulate the generator so far as the broad features of this invention are concerned.

The accompanying drawing illustrates a system which will now be explained for the purpose of disclosing the present invention. It will of course be understood that the system illustrated in the drawing may be changed in many ways without departing from the invention and, furthermore, that said drawing illustrates merely sufficient features of the system to disclose the invention.

The generator is preferably arranged upon

the tender of the locomotive; but it may be located elsewhere upon the train. The armature 1 of the generator is preferably geared to the axle, and the field thereof is preferably provided with a shunt-winding 2 and a differential winding 3. The shunt field-winding is preferably energized by current delivered from the generator, and it preferably initially excites the field. The differential field-winding opposes the shunt field-winding, the shunt field-winding always predominating in action. The exciter which regulates the generator furnishes the current for energizing the differential field-winding. If the current in the differential field-winding increases, it will cause the field strength to decrease, and if it decreases the reverse result will take place.

The train is preferably provided with a train-line or main circuit which extends through the cars or units thereof, said train-line preferably being composed of conductors 4, 5, and 6. The conductors 5 and 6 are preferably connected to the generator at the forward end of the train by conductors 7 and 8, and the conductors 4 and 5 are preferably connected to each other at the rear end of the train by a conductor or jumper 9.

The equipment which is installed upon each car will now be explained. The drawing illustrates the equipment for two cars, and as both equipments are alike reference will be made to a single car in explaining the same. The car is provided with a local circuit composed of conductors 10 and 11 and arranged across the train-line, the conductor 10 being connected to the conductor 6 and the conductor 11 being connected to the conductor 4. As the length of the circuit between the generator and each local circuit is the same, equal voltages will be impressed upon the local circuits. The car carries a storage battery and lamps 13, said storage battery and said lamps being arranged in the local circuit in parallel. The lamp-circuit is preferably controlled by a switch 14. The local circuit is preferably controlled by an automatic switch, which may be provided with stationary contacts 15 and 16 and a movable contact 17. The movable contact is preferably carried by a plunger 18, which is actuated by electromagnetic windings 19 and 20. The winding 19 is preferably arranged across the local circuit between the switch-contacts and the train-line, and the winding 20 is preferably arranged in

the local circuit in series with the switch-contacts and the storage battery. The shunt-winding 19 will cause the switch to close whenever the voltage of the generator equals that of the storage battery. When the switch is closed, the series winding 20 will be energized by the current flowing through the local circuit, and while the generator sends current through the local circuit the series winding will assist the shunt-winding in keeping the movable contact firmly in engagement with the stationary contacts. Whenever the voltage of the generator falls below that of the storage battery, current will flow backward through the local circuit from said battery, and then the series winding will oppose the shunt-winding, thereby causing the switch to open.

Each car is preferably provided with an exciter for regulating the generator, said exciter preferably being provided with an armature 21 and a field-winding 22. One brush of the exciter-armature is preferably connected to the local main 10, and the other brush thereof is preferably connected to one terminal of the generator differential field-winding by a conductor 23. The other terminal of the differential field-winding is preferably connected to the supply-main 8. The exciter field-winding 22 is preferably arranged in the local circuit in series with the storage battery and the lamps; but it may be arranged in circuit in other ways to attain the results which are sought by the present invention. The armature of the exciter is preferably driven by a shunt-motor, said motor being provided with an armature 24 and a field 25 and arranged in the local circuit across the mains 10 and 11. It will be understood that the exciter may be of any form and that the same may perform its function in various ways.

When the generator is in operation, current will flow from the supply-main 7, through conductor 5 and jumper 9, to conductor 4, thence through the local circuit, and finally through conductor 6 to supply-main 8. If the voltage of the generator be substantially equal to that of the storage battery, the current for operating the lamps will be furnished by the generator and the storage battery together; but if it be greater than that of the storage battery the generator will furnish the entire current for operating the lamps and also the current for charging the storage battery. It being assumed that the voltage of the generator is greater than that of the storage battery, current will flow in each local circuit from local main 11 and through the automatic switch, thence dividing through the storage battery 12 and the lamps 13, and finally through the exciter field-winding 22 to the local main 10. When the generator becomes inoperative, thereby causing the voltage thereof to fall below that of the storage battery, the automatic switch

will open, and thus prevent the storage battery from discharging current through the generator. The storage battery will then furnish the current for operating the lamps.

The output of the generator will tend to vary as the speed thereof varies. When the output of the generator increases, the current flowing through the exciter field-winding will increase, thereby causing the exciter to increase the current in the generator differential field-winding 3, and if the voltage of the generator decreases the current in the said exciter field-winding will decrease, thereby causing the exciter to decrease the current in said differential field-winding. The generator will therefore be regulated to confine the output thereof within safe limits notwithstanding the excessive variations in speed to which it is subjected.

Inasmuch as the current delivered to the storage battery will increase in almost direct proportion to the rise in voltage of the generator above the normal voltage of the storage battery the exciter field-winding 22 will be subjected to considerable variations in current upon slight variations in the speed of the generator.

When cars are added to the train, the output of the generator will increase to supply the increase in the demands for current, because new parallel circuits are placed across the train line or main circuit, and likewise when cars are taken from the train the same will decrease, because parallel circuits are removed from across the train-line of main circuit. The generator will therefore make the output thereof commensurate with the demand for current. It may be assumed where two cars are in the train, as illustrated in the drawing, that the generator delivers one hundred amperes, fifty amperes being distributed to each car. When a car is added to the train, the output of the generator will increase to one hundred and fifty amperes, and when a car is taken from the train it will decrease to fifty amperes.

Inasmuch as the current in each local circuit is independent of the current which the generator may send through the train-line to the other local circuits the output of the generator may vary upon changes in the number of cars in the train without thereby causing the current in the field-winding 22 to vary, and in consequence the action of the exciter will be unaffected. If said winding were subjected to variations in current under such circumstances, it would cause the exciter to change the current in the differential field-winding 3 to such an extent as to prevent the generator from making the output thereof suitable to the conditions. It will be understood that the field-winding of the exciter may be arranged in circuit in other ways to be subjected to variations in current upon variations in the speed of the generator with-

out being subjected to variations in current upon changes in the number of cars or units in the train.

The armatures of the several exciters in the system are arranged in circuit in parallel with each other, the same being placed collectively in series with the differential field-winding of the generator. Inasmuch as the combined electric motive force of the several armatures will be substantially the same as the individual electric motive force of any one of the exciters, the number of cars in the train may be changed without thereby causing the effect of the exciters in regulating the generator to be materially varied.

It will be understood that many changes may be made in the system illustrated in the drawing without changing the results which the present invention seeks to attain.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a train-lighting system, in combination, a generator driven at a variable speed, an exciter for regulating said generator to confine the output thereof within prearranged limits and provided with an electromagnetic winding for controlling the operation thereof, said winding being arranged in circuit to respond to variations in current without causing said exciter to prevent said generator from varying the output thereof upon changes in the number of units in the train, and a storage battery and translating devices carried upon each of a plurality of units of the train and arranged in circuit with said generator in parallel.

2. In a train-lighting system, in combination, a generator driven at a variable speed and provided with a shunt field-winding and a differential field-winding, said shunt field-winding being energized by current from said generator, an exciter arranged in circuit with said differential field-winding to vary the current therein and thereby regulate said generator to confine the output thereof within prearranged limits, a motor for driving said exciter, an electromagnet for controlling the operation of said exciter, said magnet being arranged in circuit to respond to variations in current without causing said exciter to prevent said generator from varying the output thereof upon changes in the number of units in the train, and a storage battery and translating devices carried upon each of a plurality of units of the train and arranged in circuit with said generator in parallel.

3. In a train-lighting system, in combination, a generator driven at a variable speed, a local circuit arranged upon a unit of the train, a storage battery and translating devices arranged in said local circuit, an exciter carried upon said unit and arranged in circuit with said generator to confine the output thereof within prearranged limits, an electromagnet

controlling the operation of said exciter and arranged in said local circuit in series with said storage battery, and a storage battery and translating devices carried upon each of other units of the train and arranged in circuit with said generator in parallel.

4. In a train-lighting system, in combination, a generator driven at a variable speed and provided with a shunt field-winding and a differential field-winding, a local circuit arranged upon a unit of the train, a storage battery and translating devices arranged in said local circuit, an exciter for regulating said generator to confine the output thereof within prearranged limits, said exciter being provided with an armature connected to said differential field-winding and a field-winding arranged in said local circuit in series with said storage battery, and a storage battery and translating devices arranged upon each of other units of the train and arranged in circuit with said generator in parallel.

5. In a train-lighting system, in combination, a generator driven at a variable speed, a local circuit arranged upon a unit of the train and connected to said generator, a storage battery and translating devices arranged in said local circuit, an exciter arranged upon said unit of the train and operatively arranged in circuit with said generator to confine the output thereof within prearranged limits, an electromagnet controlling the operation of said exciter and arranged in said local circuit in series with said storage battery, a local circuit arranged upon each of other units of the train and having a storage battery and translating devices connected thereto, and means connecting said local circuit to said generator.

6. In a train-lighting system, in combination, a generator driven at a variable speed and provided with a shunt field-winding and a differential field-winding, a local circuit arranged upon a unit of the train and having a storage battery and translating devices connected thereto, an exciter for regulating said generator to confine the output thereof within prearranged limits, said exciter being provided with an armature connected to said differential field-winding and a field-winding arranged in said local circuit in series with said storage battery, a motor for driving said exciter, a local circuit arranged upon each of other units of the train and having a storage battery and translating devices connected thereto, and means connecting said local circuits to said generator.

7. In a train-lighting system, in combination, a generator driven at a variable speed, a local circuit arranged upon a unit of the train and having a storage battery and translating devices connected thereto, an exciter operatively arranged in circuit with said generator to confine the output thereof within prearranged limits, said exciter being controlled in operation by an electromagnet ar-

5 ranged in said local circuit in series with said storage battery, a local circuit arranged upon each of other units of the train and having a storage battery and translating devices connected thereto, and a train-line extending through a plurality of units of the train and connecting said local circuits to said generator in parallel.

8. In a train-lighting system, in combination, a generator driven at a variable speed, a local circuit arranged upon each of a plurality of units of the train and having a storage battery and translating devices connected thereto, means connecting said local circuits to said generator, an automatic switch controlling the connection of each local circuit to said train-line, an exciter for regulating said generator to confine the output thereof within prearranged limits, and an electromagnetic winding controlling the operation of said exciter and arranged in circuit to respond to variations in current without thereby causing said exciter to prevent said generator from varying the output thereof upon changes in the number of units in the train.

9. In a train-lighting system, in combination, a generator driven at a variable speed and provided with a shunt field-winding and a differential field-winding, a local circuit arranged upon a unit of the train and having a storage battery and translating devices connected thereto, an exciter arranged upon said unit of the train and having the armature thereof connected to said differential field-winding, the field-winding of said exciter being arranged in said local circuit in series with said storage battery, a motor for driving said exciter, a local circuit arranged upon each of other units of the train and having a storage battery and translating devices connected thereto, and a train-line extending from said generator and passing through said units, said local circuits being connected to said train-line.

10. In a train-lighting system, in combination, a generator driven at a variable speed and provided with a shunt field-winding and a differential field-winding, a local circuit arranged upon a unit of the train and having a storage battery and translating devices connected thereto, an exciter arranged upon said unit and having the armature thereof connected to said differential field-winding, the field of said exciter being arranged in said local circuit in series with said storage battery, a motor driving said exciter, a local circuit arranged upon each of other units of the train and having a storage battery and translating devices connected thereto, a train-line extending from said generator and passing through said units, said local circuits being connected to said train-line, and an automatic switch controlling the connection of each local circuit to said train-line.

11. In a train-lighting system, in combination, a generator driven at a variable speed, a

storage battery and translating devices carried upon each of a plurality of units of the train and arranged in circuit with said generator, an exciter carried upon each of said units of the train and arranged in circuit with said generator to regulate the same and thereby confine the output thereof within prearranged limits, each exciter being controlled in operation by an electromagnetic winding arranged in circuit in series with the storage battery upon a unit of the train therewith.

12. In a train-lighting system, in combination, a generator driven at a variable speed, a storage battery and translating devices carried upon each of a plurality of units of the train and arranged in circuit with said generator, an exciter carried upon each of said units and operatively arranged in circuit with said generator to confine the output thereof within prearranged limits, the several exciters in the system being arranged in circuit in parallel.

13. In a train-lighting system, in combination, a generator driven at a variable speed, a storage battery and translating devices arranged upon each of a plurality of units of the train and connected to said generator, an exciter carried upon a different unit from said generator and operatively connected in circuit with said generator to confine the output thereof within prearranged limits, said exciter being arranged in circuit to respond to variations in current without causing the same to prevent said generator from varying the output thereof upon changes in the number of units in the train.

14. In a train-lighting system, in combination, a generator driven at a variable speed and carried upon the tender of the locomotive, a storage battery and translating devices arranged upon each of a plurality of cars and connected to said generator, and an exciter carried upon each of said cars and operatively arranged in circuit with said generator to confine the output thereof within prearranged limits, said exciter being arranged in circuit to respond to variations in current without causing the same to prevent said generator from varying the output thereof upon changes in the number of units in the train.

15. In a train-lighting system, in combination, a generator carried upon the tender of the locomotive and driven at a variable speed, a main circuit extending from said generator and passing through a plurality of cars, a local circuit arranged upon each of said cars and connected to said main circuit, and an exciter carried upon each of said cars and operatively arranged in circuit with said generator to confine the output thereof within prearranged limits, the field-winding of said exciter being arranged in circuit in series with the storage battery upon the unit of the train therewith.

16. In a train-lighting system, in combination, a generator driven at a variable speed, a

local circuit arranged upon each of a plurality of units of the train and connected to said generator, a storage battery and translating devices arranged in each local circuit, an exciter carried upon each of said units and having the armature thereof connected in circuit with the field-winding of said generator, the field-winding of each exciter being arranged in circuit in series with the storage battery upon a unit of the train therewith.

17. In a train-lighting system, in combination, a generator driven at a variable speed, a local circuit arranged upon each of a plurality of units of the train and connected to said generator, a storage battery and translating devices arranged in each local circuit, an exciter carried upon each of said units and having the armature thereof connected in circuit with the field-winding of said generator, the field-winding of each exciter being arranged in circuit in series with the storage battery upon the unit of the train therewith and the armatures of the several exciters in the system being arranged in circuit in parallel with each other and collectively in series with the field-winding of said generator.

18. In a train-lighting system, in combination, a generator driven at a variable speed, a train-line extending from said generator and passing through a plurality of units of the train, a local circuit arranged upon each of said units and connected to said train-line, a storage battery and translating devices arranged in each local circuit, an automatic switch controlling the connection of each local circuit to said train-line, and an exciter carried upon each of said units and operatively arranged in circuit to regulate said generator to confine the output thereof within prearranged limits.

19. In a train-lighting system, in combination, a generator driven at a variable speed, a train-line extending from said generator and passing through a plurality of units of the train, a local circuit arranged upon each of said units and connected to said train-line, a storage battery and translating devices arranged in each local circuit, an automatic switch controlling the connection of each local circuit to said train-line, an exciter carried upon each of said units and operatively arranged in circuit to regulate said generator to confine the output thereof within prearranged limits, the several exciters in the system being arranged in circuit in parallel with each other.

20. In a train-lighting system, in combination, a generator driven at a variable speed, a local circuit arranged upon each of a plurality of units of the train and connected to said generator, a storage battery and translating devices arranged in each local circuit, an exciter carried upon each of said units and having the armature thereof connected in circuit with the field-winding of said generator, the field-

winding of each exciter being arranged in circuit in series with the storage battery upon the unit of the train therewith.

21. In a train-lighting system, in combination, a generator driven at a variable speed, a local circuit arranged upon each of a plurality of units of the train and connected to said generator, a storage battery and translating devices arranged in each local circuit, an exciter carried upon each of said units and having the armature thereof connected in circuit with the field-winding of said generator, the field-winding of each exciter being arranged in circuit in series with the storage battery upon the unit of the train therewith, and the armatures of the several exciters in the system being arranged in circuit in parallel with each other and collectively in series with the field of said generator.

22. In a train-lighting system, in combination, a generator driven at a variable speed and provided with a shunt field-winding and a differential field-winding, said shunt field-winding being energized by current from said generator, a local circuit arranged upon each of a plurality of units of the train and connected to said generator, a storage battery and translating devices arranged in each local circuit, an exciter carried upon each of said units and having the armature thereof connected to said differential field-winding, the armatures of the several exciters in the system being arranged in circuit in parallel with each other and collectively in series with said differential field-winding and the field-winding of each exciter being arranged in circuit in series with the storage battery upon each unit of the train therewith.

23. In a train-lighting system, in combination, a generator driven at a variable speed and provided with a shunt field-winding and a differential field-winding, said shunt field-winding being energized by current from said generator, a train-line extending from said generator and passing through a plurality of units of the train, a local circuit arranged upon each of said units and connected to said train-line, an automatic switch controlling the connection of each local circuit to said train-line, a storage battery and translating devices arranged in each local circuit, an exciter carried upon each of said units and having the armature thereof connected to said differential field-winding, the field-winding of each exciter being arranged in circuit in series with the storage battery upon the unit of the train therewith, and a motor carried upon each of said units and driving said exciter.

In witness whereof I have hereunto subscribed my name in the presence of two witnesses.

WILLIAM L. BLISS.

Witnesses:

HERBERT J. SMITH,

EDWIN B. H. TOWER, Jr.