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W. L. BLISS.

TRAIN LIGHTING SYSTEM.

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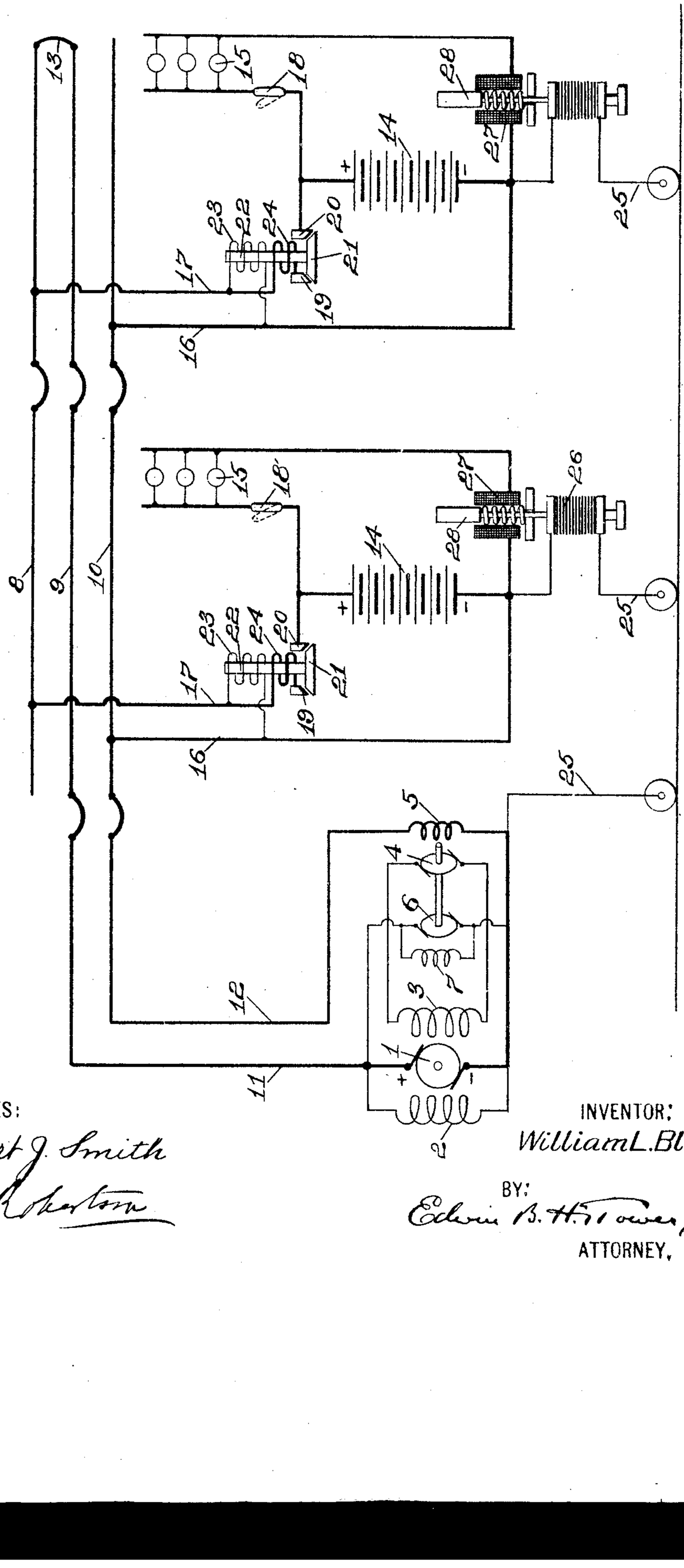

WITNESSES:

Herbert J. Smith

J. R. Roberts

INVENTOR:

William L. Bliss

BY:

Edwin B. H. Brower, Jr

ATTORNEY.

UNITED STATES PATENT OFFICE.

WILLIAM L. BLISS, OF BROOKLYN, NEW YORK, ASSIGNOR TO BLISS ELECTRIC CAR LIGHTING COMPANY, OF MILWAUKEE, WISCONSIN, A CORPORATION OF WISCONSIN.

TRAIN-LIGHTING SYSTEM.

No. 799,529. Specification of Letters Patent. Patented Sept. 12, 1905.

Application filed April 24, 1905. Serial No. 257,143.

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 especially adapted to be employed for lighting a train of cars. Each car in the train is equipped with a storage battery and lamps, and a single generator, which is driven by an axle or similar means, furnishes current to all of the cars.

The present application sets forth and claims a modification of an invention which is disclosed in an application filed by me June 16, 1904, Serial No. 212,835.

According to the present invention an exciter is provided for the purpose of regulating the generator.

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

The generator which furnishes current for lighting the cars is preferably carried by the tender of the locomotive; but it may be carried by another unit of the train. It is preferably provided with an armature 1, which is geared to an axle. It is also preferably provided with a shunt field-winding 2 and a differential field-winding 3. The current for energizing the shunt field-winding 2 is furnished by the generator; but the current for exciting the differential field-winding 3 is furnished by an exciter, which may be provided with an armature 4 and a field-winding 5, the differential field-winding being connected to the exciter-armature. The exciter may be driven by a motor, which is preferably provided with an armature 6 and a shunt field-winding 7. The exciter field-winding 5 is preferably connected in circuit in series with armature 1 of the generator. The strength of the field-winding 2 is always greater than that of the field-winding 3. Throughout the train may extend a train-line, which is preferably composed of conductors 8, 9, and 10. The conductors 9 and 10 are preferably connected to the generator at the forward end of the train by supply-mains 11 and 12, and the conductors 8 and 9 are preferably connected to each other at the rear end of the train by a conductor or jumper 13.

The equipment which is provided for each car will now be explained. The drawing illustrates equipments for two cars, and as both equipments are alike reference will be made to a single car in explaining the same. Each car preferably carries a storage battery 14 and lamps 15. The storage battery and the lamps are connected to a local circuit, which may be composed of conductors 16 and 17, said storage battery being arranged in one parallel branch of said local circuit and said lamps in another. The local circuit may be connected across the train-line, the local main 16 being connected to the train-line 10 and the local main 17 being connected to the train-line 8. As the length of the circuit between each local circuit and the generator is the same, equal voltages will prevail upon each car. The lamp branch of the local circuit is preferably provided with a switch 18, by which the circuit of the lamps may be opened and closed. The local circuit is preferably provided with an automatic switch for connecting the storage battery and the lamps to the generator and disconnecting the same therefrom. The automatic switch may be provided with stationary contacts 19 and 20 and a movable contact 21. The movable contact is preferably carried by a plunger 22, which is actuated by windings 23 and 24 to open and close the switch. The winding 23 is preferably connected across the local circuit between the switch-contacts and the train-line, and the winding 24 is preferably connected to the local circuit in series with the switch-contacts and the storage battery. The shunt-winding 23 will cause the switch to close whenever the voltage of the generator equals that of the storage battery, and while the switch remains

closed the series winding 24 will be energized by the current in the local circuit. So long as the generator sends current through the local circuit the series winding will assist the shunt-winding in keeping the movable contacts firmly in engagement with the stationary contacts; but whenever the storage battery sends current through the local circuit, as occurs when the voltage of the generator falls below that of the battery, the series winding will oppose the shunt-winding, and thereby cause the switch to open.

When the generator is in operation, current will flow from the positive terminal of the generator, through the supply-main 11, train-line 9, and jumper 13, to train-line 8, thence dividingly through the local circuits, and finally through train-line 10, supply-main 12, and exciter field-winding 5 to the negative terminal of the generator. If the voltage of the generator be substantially equal to that of the storage battery, the generator and the battery will coöperate in furnishing the current for operating the lamps; but if it be greater than that of the storage battery the generator will furnish the entire current for operating the lamps, and in addition it will furnish current for charging the storage battery. It being assumed that the latter condition exists, current will flow in the local circuit of each car from the local main 17 through switch-contacts 19, 21, and 20, thence dividingly through the lamp branch and the battery branch of the local circuit to the local main 16. When the generator becomes inoperative, the automatic switch will open, and thus prevent the storage battery from discharging current onto the train-line, and the current for operating the lamps will be furnished by said battery. Whenever the speed of the generator increases, the current in the exciter field-winding 5 will increase, thereby causing the exciter to increase the current which it sends through the differential field-winding 3, and then the resultant strength of the generator field-windings will be decreased, and likewise upon a decrease in the speed of the generator the current in the exciter field-winding 5 will decrease, thereby causing the exciter to decrease the current which it sends through the differential field-winding 3, and then the resultant strength of the generator field-windings will be increased. The strength of the field-generator will therefore vary inversely as the speed of the generator varies, and in consequence the output of the generator will be confined within safe limits notwithstanding the excessive variations in the speed of the armature of the generator. Inasmuch as the current for charging the storage battery will increase in almost direct proportion to the rise in voltage of the generator above the normal voltage of said battery, the exciter-field 5 will be subjected to considerable variations in current upon slight variations in the speed of the armature 1, and in consequence it will be very effective in causing the exciter to regulate the generator.

It will be understood that the exciter may be of different forms and that it may be arranged in various ways to regulate the generator.

From the local circuit of each car to one of the terminals of the generator extends a shunt-circuit 25, which passes around the exciter field-winding 5. Each shunt-circuit is preferably provided with a variable resistance 26, which may be composed of a series of resistance-plates, of carbon or other suitable material. These resistance-plates are placed in contact with each other, and the pressure between the same is regulated by an electromagnet 27, which preferably attracts a core 28. The electromagnet 27 is preferably arranged in the lamp branch of the local circuit. The shunt-circuits of the several cars are arranged in parallel, and the same divert current from the exciter field-winding 5.

The current which the generator delivers depends upon the number of cars in the train. Whenever cars are added to the train, the output of the generator will increase, and likewise whenever cars are taken from the train the output of the generator will decrease. Moreover, whenever the number of lamps in operation in any car is increased, the output of the generator will increase, and likewise whenever the number of lamps in operation in any car is decreased the output of the generator will decrease. The output of the generator will therefore vary in accordance with the demands for current. It may be assumed, where there are two cars in the train, as illustrated in the drawing, that the generator delivers seventy amperes, thirty-five 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 five amperes, and when one is taken from the train it will decrease to thirty-five amperes. It may be further assumed that in each car twenty amperes are consumed by the lamps and fifteen amperes are delivered to the storage battery. If the number of lamps in operation be increased until thirty-five amperes are consumed thereby, the output of the generator will increase until fifty amperes are distributed between the storage battery and the lamps. The current for charging the storage battery will therefore remain fifteen amperes notwithstanding the variations in the current consumed by the lamps. Whenever the number of cars in the train is changed, an additional shunt-circuit 25 will be placed around the exciter field-winding 5 for each car which is added to the train, or one of the parallel shunt-circuits 25 will be removed from around said field-winding for each car which is taken from the train. These changes in the number of parallel shunt-circuits will

so change the portion of the output of the generator which is carried around the exciter field-winding 5 that no substantial change will result in the current in said field-winding from the change in the number of cars. Whenever the number of lamps in operation in any car is increased, the current in the electromagnet 27 will increase, and then said magnet will cause the resistance 26 to be decreased, and likewise whenever the number of lamps in operation in any car is decreased the current in said magnet will decrease, and then said magnet will cause the resistance 26 to be increased. These variations in the resistance 26 cause the shunt-circuit 25 to so vary the current which is carried around the exciter field-winding 5 that no substantial variation results in the current in said winding from the changes in the number of lamps. The current in the exciter field-winding 5 will therefore remain substantially constant so long as the speed of the generator remains constant notwithstanding changes in the number of cars in the train and in the number of lamps in operation in any car. If the exciter field-winding 5 were subjected to variations in current upon changes in the number of cars in the train, it would cause the exciter to so alter the resultant strength of the generator field-windings 2 and 3 that the generator would be incapable of delivering sufficient current for a larger number of cars, and it would perhaps deliver an excessive current for a lesser number of cars. Moreover, if the said exciter field-windings were subjected to variations in current upon changes in the number of lamps in operation in any car it would further cause the resultant strength of the field-windings 2 and 3 to be so altered that the generator would be incapable of maintaining constant current for charging the storage battery at constant speed of the generator-armature.

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

1. 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 connected to said generator, an exciter operatively arranged in circuit with said generator to regulate the same and thereby confine the output thereof within prearranged limits, and means for preventing said exciter from altering the regulation of said generator upon changes in the number of cars in the train and in the number of translating devices in operation.

2. 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, an exciter operatively arranged in circuit with said generator to regulate the same and thereby confine the output thereof within prearranged limits, said exciter being provided with an electromagnetic winding for controlling the operation thereof, and said winding being arranged in circuit to be subjected to variations in current upon variations in the speed of said generator, and means for preventing said winding from being subjected to such variations in current as result from changes in the number of cars in the train and in the number of translating devices in operation in any car.

3. 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 connected across the terminals of the armature of said generator, an exciter for regulating said generator to confine the output thereof within prearranged limits, the armature of said exciter being connected to said differential field-winding and the field-winding thereof being connected in circuit in series with the armature of said generator, a storage battery and translating devices carried upon each of a plurality of units of the train, and means for preventing said exciter field-winding from being subjected to such variations in current as result from changes in the number of cars in the train and in the number of translating devices in operation in any car.

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, said shunt field-winding being connected across the terminals of the armature of said generator, a main circuit extending from said generator, a storage battery and translating devices carried upon each of a plurality of units of the train and connected to said main circuit, an exciter operatively arranged in circuit with said generator to regulate the same and thereby confine the output thereof within prearranged limits, the armature of said generator being connected to said differential field-winding and the field-winding thereof being connected in said main circuit in series, a motor for driving said exciter, said motor being connected to said main circuit, and means for preventing said exciter field-winding from being subjected to variations in current upon changes in the number of cars in the train and in the number of translating devices in operation in any car.

5. 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 connected to said generator, an exciter operatively arranged in circuit with said generator to regulate the same and thereby confine the output thereof within prearranged limits, said exciter being provided with an electromagnetic winding for controlling the op-

eration thereof, a shunt-circuit extending from each of said units and passing around said winding, and means for causing the current in said shunt-circuits to so vary upon changes in the number of cars in the train and in the number of translating devices in operation in any car as to prevent substantial variations in the current in said field-winding.

6. 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 connected to said generator, an exciter operatively arranged in circuit with said generator to regulate the same and thereby confine the output thereof within prearranged limits, said exciter being provided with a field-winding for controlling the operation thereof and said winding being connected in circuit in series, a shunt-circuit extending from each of said units to said generator and passing around said field-winding, and automatic means for varying the resistance of said shunt-circuits upon variations in the current consumed by said translating devices.

7. In a train-lighting system, in combination, a generator driven at a variable speed, a main circuit extending from said generator, a local circuit arranged upon each of a plurality of units of the train and connected to said main circuit, a storage battery and translating devices connected to each local circuit, an exciter operatively arranged in circuit with said generator to regulate the same and thereby confine the output thereof within prearranged limits, said exciter being provided with a field-winding for controlling the operation thereof and said field-winding being arranged in circuit in series, a shunt-circuit extending from each local circuit to said generator and passing around said field-winding, and means for automatically varying the current in said shunt-circuits upon variations in the current consumed by said translating devices.

8. In a train-lighting system, in combination, a generator driven at a variable speed and carried upon one of the units of the train, a storage battery and lamps carried upon another unit of the train and connected in circuit with said generator, an exciter operatively arranged in circuit with said generator to regulate the same and thereby confine the output thereof within prearranged limits, said exciter being provided with a field-winding for controlling the operation thereof and said winding being arranged in circuit in series, a shunt-circuit extending from the last-mentioned unit to the first-mentioned unit and passing around said field-winding, and means for automatically varying the current in said shunt-circuit upon variations in the current consumed by the lamps.

9. In a train-lighting system, in combination, a generator driven at a variable speed and carried upon one of the units of the train, a storage battery and lamps carried upon another unit of the train and connected in circuit with said generator, said storage battery being arranged in one parallel branch circuit and said lamps in another, an exciter operatively arranged in circuit with said generator to regulate the same and thereby confine the output thereof within prearranged limits, said exciter being provided with a field-winding for controlling the operation thereof and said winding being arranged in circuit in series, a shunt-circuit extending from the last-mentioned unit to the first-mentioned unit and passing around said field-winding, a variable resistance arranged in said shunt-circuit, and an electromagnet arranged in the lamp branch circuit and controlling said resistance.

10. In a train-lighting system, in combination, a generator driven at a variable speed and carried upon one of the units of the train, said generator being provided with a shunt field-winding and a differential field-winding and said shunt field-winding being connected across the terminals of the armature of said generator, an exciter operatively arranged in circuit with said generator to regulate the same and thereby confine the output thereof within prearranged limits, the armature of said exciter being connected to said differential field-winding and said field-winding thereof being connected in circuit in series, a local circuit arranged upon another unit of the train and connected to said generator, a storage battery and lamps connected to said local circuit, said storage battery being arranged in one parallel branch of said local circuit and said lamps in another, a shunt-circuit extending from said local circuit to said generator and passing around said exciter field-winding, and means for controlling the current in said shunt-circuit, said means being provided with an electromagnet for controlling the operation thereof and said electromagnet being arranged in the lamp branch circuit.

11. In a train-lighting system, in combination, a generator driven at a variable speed and carried upon one of the units of the train, said generator being provided with a shunt field-winding and a differential field-winding and said shunt field-winding being connected across the terminals of the armature of said generator, a local circuit arranged upon another unit of the train and connected to said generator, a storage battery and lamps connected to said local circuit, said storage battery being arranged in one parallel branch of said local circuit and said lamps in another, automatic means for connecting said storage battery and said lamps to said generator and disconnecting the same therefrom, an exciter operatively arranged in circuit with said generator to regulate the same and thereby confine the output thereof within prearranged limits, the armature of said exciter being connected to said differential field-winding and the

field-winding thereof being arranged in circuit in series, means for driving said exciter, a shunt-circuit extending from said local circuit to said generator and passing around said exciter field-winding, a variable resistance arranged in said shunt-circuit, and an electromagnet for controlling said variable resistance, said magnet being arranged in the lamp branch of said local circuit.

12. In a train-lighting system, in combination, a generator driven at a variable speed, a storage battery and lamps carried upon each of a plurality of units of the train, an exciter operatively arranged in circuit with said generator to regulate the same and thereby confine the output thereof within prearranged limits, said exciter being provided with an electromagnetic winding for controlling the operation thereof and said winding being arranged in circuit in series, a shunt-circuit extending from each of said units to said generator and passing around said field-winding, and means for varying the current in said shunt-circuits upon changes in the number of lamps in operation in any car.

13. In a train-lighting system, in combination, a generator driven at a variable speed, a storage battery and lamps carried upon each of a plurality of units of the train and connected to said generator, said storage battery being arranged in one parallel branch circuit and said lamps in another, an exciter operatively arranged in circuit with said generator to regulate the same and thereby confine the output thereof within prearranged limits, said exciter being provided with a field-winding for controlling the operation thereof and said winding being connected in circuit in series, a parallel shunt-circuit extending from each of said units to said generator and passing around said field-winding, a variable resistance arranged in each shunt-circuit, and an electromagnet arranged in each lamp branch circuit and controlling the variable resistance upon the unit of the train therewith.

14. 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 connected across the terminals of the armature of said generator, a main circuit extending from said generator, a local circuit arranged upon each of a plurality of units of the train and connected to said main circuit, a storage battery and translating devices arranged in each local circuit, said storage battery being arranged in one parallel branch of said local circuit and said lamps in another, an exciter operatively arranged in circuit with said generator to regulate the same and thereby confine the output thereof within prearranged limits, the armature of said exciter being connected to said differential field-winding and the field thereof being arranged in said main circuit in series, means for driving said exciter, a shunt-circuit extending from each local circuit to said generator, means for controlling the current in each shunt-circuit, said means being provided with an electromagnet for controlling the operation thereof and said magnet being arranged in the lamp branch circuit upon the unit of the train therewith.

15. 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 main circuit extending from said generator, a local circuit arranged upon each of a plurality of units of the train, a storage battery and lamps arranged in each local circuit, said storage battery being arranged in one parallel branch of said local circuit and said lamps in another, automatic means for connecting said storage battery and said lamps to said generator and disconnecting the same therefrom, an exciter operatively arranged in circuit with said generator to regulate the same and thereby confine the output thereof within prearranged limits, the armature of said exciter being connected to said differential field-winding and the field-winding thereof being connected in said main circuit in series, a shunt-circuit extending from each local circuit to said generator and passing around said field-winding, a variable resistance arranged in each shunt-circuit, an electromagnet arranged in each lamp branch circuit and controlling the variable resistance upon the unit of the train therewith.

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

WILLIAM L. BLISS.

Witnesses:
J. N. ROBERTSON,
EDWIN B. H. TOWER, Jr.