

(No Model.)

2 Sheets—Sheet 1.

E. T. STARR.

ELECTRIC LIGHTING APPARATUS FOR RAILWAY TRAINS.

No. 250,764.

Patented Dec. 13, 1881.

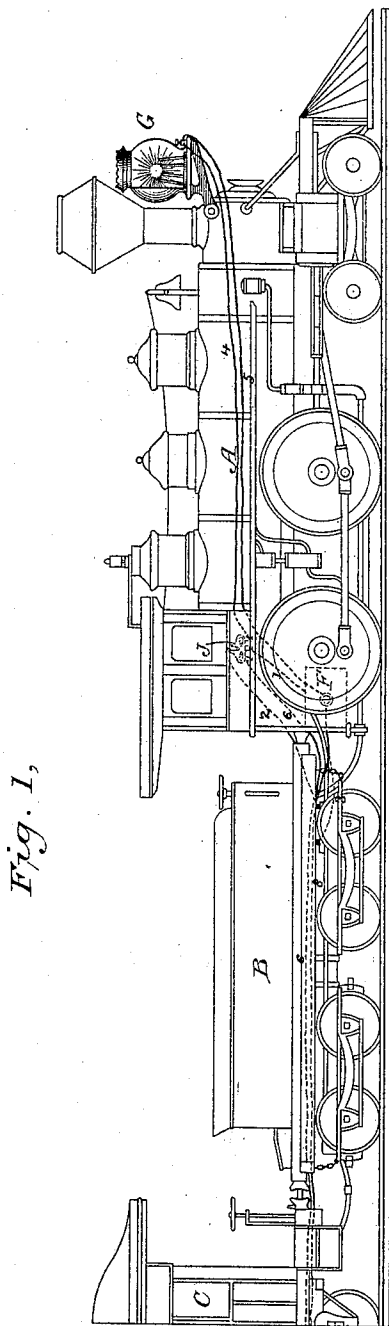


Fig. 3,

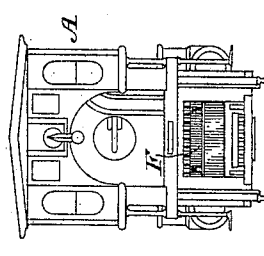
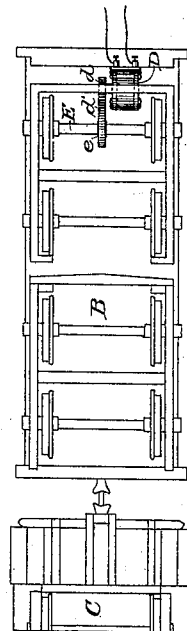


Fig. 2,



WITNESSES

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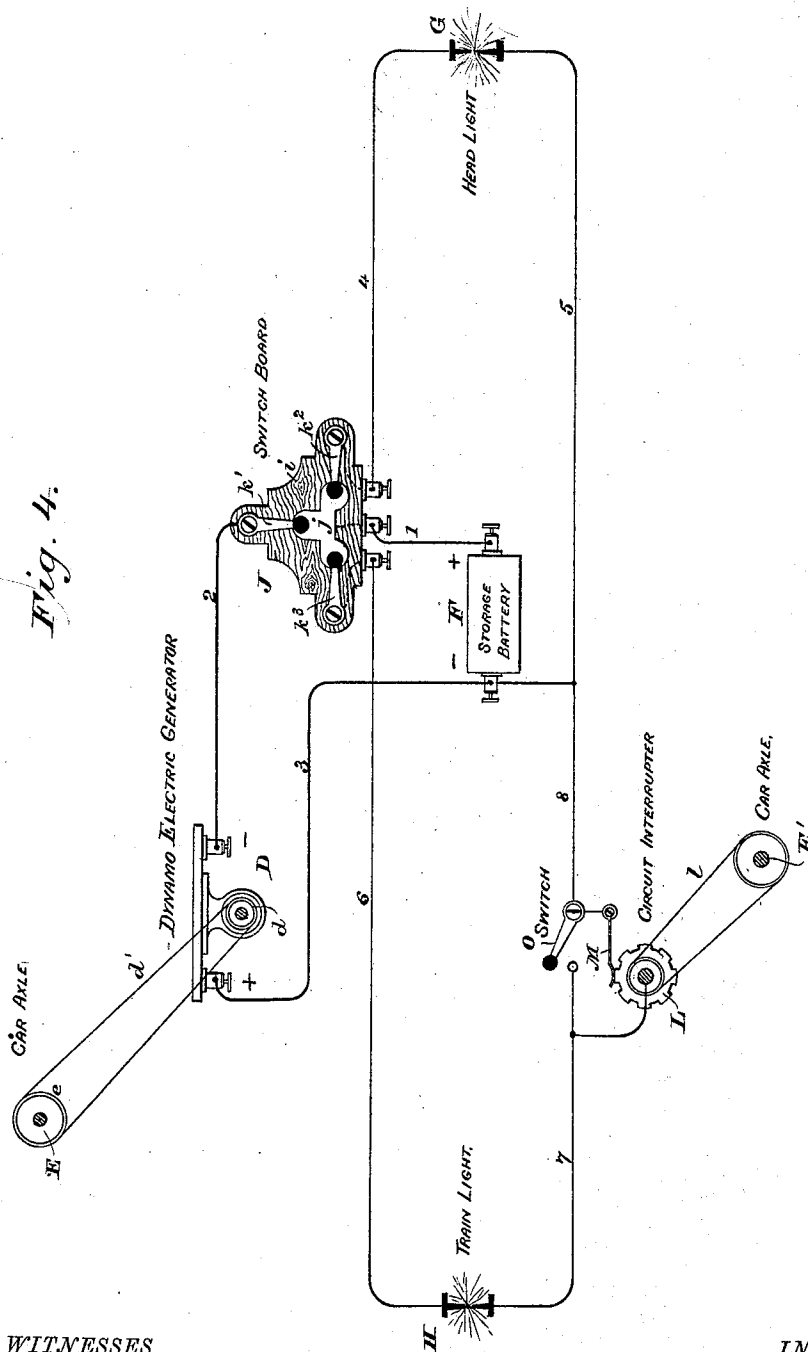
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UNITED STATES PATENT OFFICE.

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ELECTRIC LIGHTING APPARATUS FOR RAILWAY-TRAINS.

SPECIFICATION forming part of Letters Patent No. 250,764, dated December 13, 1881.

Application filed August 5, 1881. (No model.)

To all whom it may concern:

Be it known that I, ELI T. STARR, a citizen of the United States, and a resident of Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Electric Lighting Apparatus for Railway-Trains, of which the following is a specification.

My invention relates to an improved organization of instrumentalities for producing the lights which are required on board of railway-trains for illuminating the track at night in advance of the locomotive and for exhibiting a warning-signal in the rear of the train or other analogous purposes.

I make use of apparatus for generating or producing electric currents by the conversion of mechanical energy, derived from the motion of the train itself, into electricity, store a portion of the electricity so produced for use at such times as the train is not in motion, and apply the same to the development of light from electric lamps placed at suitable points upon the train.

My invention consists in certain new organizations and combinations of parts or devices, which are particularly recited at the close of the specification.

In the accompanying drawings, Figure 1 is a side elevation of a locomotive and portion of a train to which my invention has been applied. Fig. 2 is an inverted plan of a portion of the same. Fig. 3 is a rear elevation of the locomotive, showing a portion of the apparatus; and Fig. 4 is a theoretical diagram, illustrating the electrical connections which unite the different portions of the apparatus with each other.

Referring to Fig. 1, A represents a locomotive of the ordinary construction, and B is its tender, consisting of a separate vehicle coupled to the locomotive, and upon which the necessary supplies of fuel and water therefor are carried. C is a car, which, either alone or in connection with a number of other cars or like vehicles, is attached to the locomotive and tender, and constitutes the train.

In carrying out my invention I make use of a magneto or dynamo electric generator, D, of the ordinary or any suitable construction, preferably placed beneath the floor of the tender B

and near its forward end, as best seen in the inverted plan, Fig. 2. The armature of this dynamo-electric machine is provided with a driving-pulley, *d*, which is mechanically connected with another pulley, *e*, upon the axle E of the tender B by means of a belt or band, *d'*, so that when the tender is in motion and its axle revolving the armature of the dynamo-electric generator D will be caused to revolve thereby. Any other suitable or convenient mechanical instrumentalities may be employed in lieu of those I have described, whereby the necessary motion of the armature of the generator may be derived from one of the axles of the tender or other vehicle upon which it is mounted. I prefer to couple one of the two pulleys *d* and *e* to its axis by means of a suitable clutch, so that the armature of the generator may be set in action only when the locomotive is moving forward, and not when, as is sometimes necessary, it is required to move temporarily in a reverse direction.

Upon some convenient portion of the train I place a box or case containing a liquid-condenser or storage-battery, F. I prefer to place this storage-battery or accumulator upon the locomotive, and perhaps the most convenient place for the same is underneath the platform of the cab, as illustrated in Fig. 3. This storage-battery may be constructed in a well-known manner of plates of thin sheet-lead immersed in dilute sulphuric acid. When a storage-battery thus constructed is connected with the conductors leading from an electric generator the anode-plates become coated with peroxide of lead and the cathodes in a similar manner with a gray compact film. Such a battery will accumulate and retain a large quantity of electricity in what may be termed a "static condition," and will produce a strong and continuous electric current for a considerable time after the generator has been disconnected therefrom, if a connection be formed between its opposite electrodes.

Upon the front of the locomotive, in the place ordinarily occupied by a powerful oil-lamp, which is technically termed the "head-light," I place an electric lamp, G, which may be either an incandescent or an arc lamp, both of which are of well-known construction, and at the rear of the car or train I also place another

electric lamp, H, which is termed the "tail-light," and is principally useful as a signal-light. This last-named lamp may be covered with a transparent screen of red glass, in order to distinguish it from the ordinary white lights of the train, and it will then act as a warning or danger signal for the information of the engineer of any other train which may approach too near to the preceding one upon the same track.

The manner in which the electrical connections are arranged is clearly shown in the drawings, and will be best understood by reference to the diagram Fig. 4.

J is a switch-board, whereby the various electric circuits are controlled. This is preferably placed within the cab upon the locomotive, so as to be conveniently accessible to the engineer. The switch-board may be constructed of any convenient form. I have shown a suitable organization for this purpose in Figs. 1 and 4, consisting of a metallic plate, *j*, mounted upon an insulating-base, *i*, and connected by means of a suitable binding-screw or otherwise with a conductor, 1, leading to one of the terminals of the storage-battery F, marked +.

k' is a switch-button, which may be turned on or off the plate *j*, and which is connected by means of a conductor, 2, with one pole of the dynamo-generator D. The other pole of the generator is permanently connected by means of a wire, 3, with the negative pole of the storage-battery F. The button *k'*, when closed upon the plate *j*, as shown in the figure, connects the + pole of the storage-battery with the electric lamp G of the locomotive head-light by means of the wire 4, and the circuit of the lamp is completed by the wire 5 extending therefrom to the negative pole of the storage-battery. In the same manner the button *k''*, when closed upon the plate *j*, forms a connection between the + pole of the storage-battery and the tail-light H through the wires 6, 7, and 8. These several conducting-wires are to be enveloped in suitable insulating-coatings, and may be extended lengthwise underneath the locomotive, tender, or cars, or other vehicles. They may be coupled together by means of any suitable or well-known coupling device, which is to be applied at the points where the conductors pass from one vehicle to another.

The operation of my improved system is as follows: When the apparatus is connected and arranged in the manner shown in Fig. 4, the switch-buttons *k'* *k''* *k'''* being closed upon the plate *j*, and the locomotive and train are in motion upon a railway, the dynamo-electric generator D is kept in continuous action by the revolution of the axle of the tender, with which it is mechanically connected, as hereinbefore explained, and a powerful electric current is generated thereby, which, having first charged the accumulator or storage-battery F to its utmost capacity, divides at the point J and passes over the circuits hereinbefore de-

scribed, leading respectively to the head-light G and the tail-light H, the current being divided between these two circuits in the ratio of their respective resistances in accordance with the well-known laws of electric conduction. Thus a powerful illumination is produced upon the track in advance of the locomotive, while at the same time, if desired, an equally powerful light may be exhibited at the rear of the train, although I may remark that in general the last-named light may be of less volume or intensity than the head-light, as is well understood. Either of the lamps G or H may be disconnected from the storage-battery and generator at pleasure by means of the buttons *k''* and *k'''*, which are under the immediate control of the train-engineer or other proper official.

It is desirable and necessary at night to exhibit a distinctive light at the rear of each train as a danger-signal, and this may be accomplished, as hereinbefore stated, by screening the light-giving portion of the electric lamp H by a transparent colored glass. I have devised a much more effective organization for this purpose, which may be employed either with or without the screen of colored glass. This consists, essentially, of a mechanical circuit-breaker placed in the electric circuit of the tail-lamp, which circuit-breaker is actuated continuously and automatically by the train itself while in motion, thus producing an interrupted or flashing light. I prefer to employ for this purpose a toothed circuit-breaking wheel or mechanical interrupter, L, which is caused to rotate continuously by means of a band, *l*, or other equivalent device connected with an axle, *E'*, of the rear vehicle of the train. A spring-finger contact, M, rests upon the circuit-breaking wheel L, and is electrically connected with the wire 8, while the wheel itself is in like manner connected with the wire 7. Thus it will be obvious that so long as the train is in motion the circuit of the tail-lamp H will be alternately closed and broken, and the lamp will emit a continuous series of luminous flashes, which will form a most efficient danger-signal, and one, moreover, which will indicate to the engineer of an approaching train whether the train bearing the signal is standing still or is in motion, and, if in motion, at what rate of speed it is moving. The circuit-breaking device, which has been described, may, with advantage, be provided with a switch or button, O, whereby it may be shunted or cut out when desired, so that a continuous light may be exhibited.

In making practical use of my improved apparatus it will be found advantageous to charge the storage-battery (which should be of as large capacity as possible within the limits of space rendered necessary) by placing it in circuit through the switch J with the generator D at such times as the power and momentum of a train requires to be checked—as, for example, in approaching a station or running down an inclined plane, as in that case the dy-

namo-generator will act as a brake to check the momentum of the train, and the retarding force, instead of being converted into heat and wasted, as in the application of the ordinary friction-brakes, will be converted into electricity and stored in the accumulator F, from whence it may be drawn as required for illuminating purposes.

My invention may, without essential modification, be applied to steam-vessels of every description, the dynamo-generator in such case being attached to any convenient part of the machinery which is employed to propel the vessel, and the storage-battery, lamps, and switches for controlling and regulating the same, with their electrical connections, being arranged in substantially the same manner in any convenient locality therein.

I am aware that heretofore it has been proposed to mount an electric light on a locomotive, the light-giving current being generated by a dynamo-machine mounted thereon, and driven by a separate engine, also carried by the locomotive.

I am also aware of the suggestion that in railroad engineering a dynamo-electric machine may be run by the motion of the train, or the motive power derived from the locomotive-engine to charge storage-batteries placed under the train and employed for operating the head-light or other illuminating device for electric-signal apparatus, or for other purposes; but such suggestion is unaccompanied by any description or illustration of the apparatus suggested. I do not, therefore, broadly claim every method of or apparatus for attaining these results, but limit my invention to the particular organizations and combinations set forth in the claims.

I claim as my invention—

1. The combination, substantially as herein set forth, of an electric generator, an electric lamp electrically connected with said generator so as to produce an electric light, a circuit-breaker forming part of the electric circuit, to alternately make and break said circuit in order to make the light an intermittent one, consisting of a continuous series of luminous electric flashes, and a switch to cut out or shunt said circuit-breaker.

2. The combination, substantially as herein set forth, of the vehicle or train of vehicles, the dynamo-electric machine driven by the motion of said vehicle or train, the storage-

battery, an electric lamp, a connection between said dynamo-machine, storage-battery, and lamp, to transmit the electric current generated by said machine to said battery and the current of said battery to said lamp, and mechanism, substantially as described, under the control of the engineer, to electrically connect and disconnect said battery and said lamp at will during the motion of the vehicle or train.

3. The combination, substantially as herein set forth, of a vehicle or train of vehicles movable upon or along a railway, a dynamo-electric generator, driving mechanism therefor connected with an axle of one of said vehicles, a storage-battery or liquid-condenser, one or more electric lamps mounted upon said vehicle or train of vehicles, circuit-wires connecting said generator, battery, and lamp or lamps, a circuit-changer, k' , for completing or interrupting the electric connection between said generator and the storage-battery, and a circuit-changer, $k^2 k^3$, for completing or interrupting the electrical connection between the storage-battery and the lamps.

4. The combination, substantially as herein set forth, of a vehicle or train of vehicles, a dynamo-electric generator driven by said vehicle or train, an electric lamp mounted upon said vehicle or train, circuit-wires connecting said generator and said lamp, a circuit-breaker between said generator and said lamp, to automatically alternately interrupt and restore the current traversing said lamp, an axle or moving part of said vehicle or train, and a connection running from said axle or moving part to said circuit-breaker to operate it.

5. The combination, substantially as herein set forth, of a vehicle or train of vehicles, a dynamo-electric machine driven by said vehicle or train, an electric lamp mounted upon said vehicle or train, circuit-wires connecting said dynamo-machine and said lamp, a circuit-breaker between said dynamo-machine and said lamp, an axle or moving part of the vehicle or train, a connection between said axle or moving part and said circuit-breaker to operate said circuit-breaker, and a switch, O, for shunting or cutting out said circuit-breaker.

In testimony whereof I have hereunto set my hand this 3d day of August, A. D. 1881.

ELI T. STARR.

Witnesses:

GEO. P. MORGAN,
J. A. B. WILLIAMS.