(No Model.) 2 Sheets—Sheet 1.

W. A. STERN & H. M. BYLLESBY.

LIGHTING CARS BY ELECTRICITY.

No. 258,149. Patented May 16, 1882.

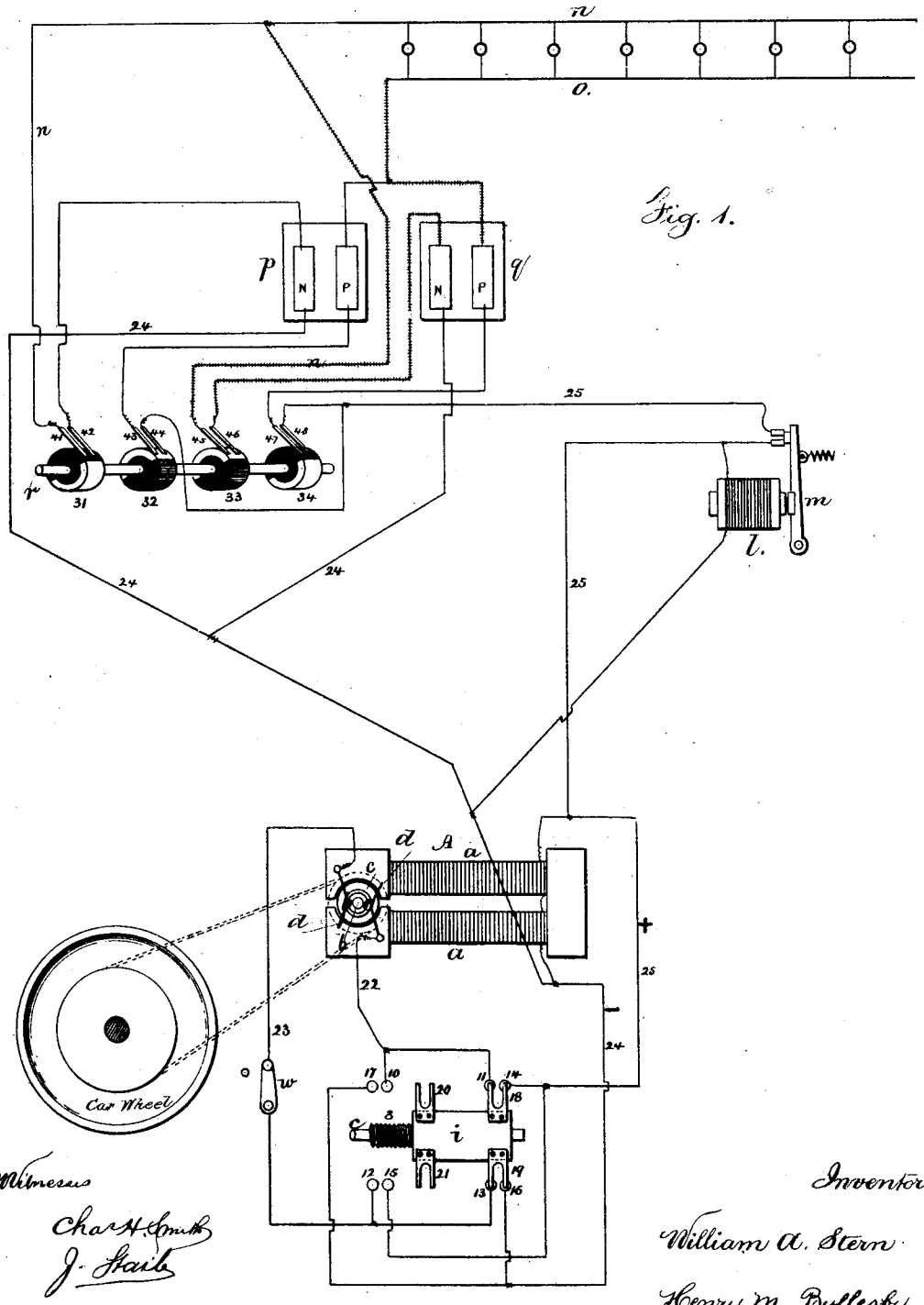


Fig. 1.

Witnesses

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(No Model.) 2 Sheets—Sheet 2.

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Fig. 2.

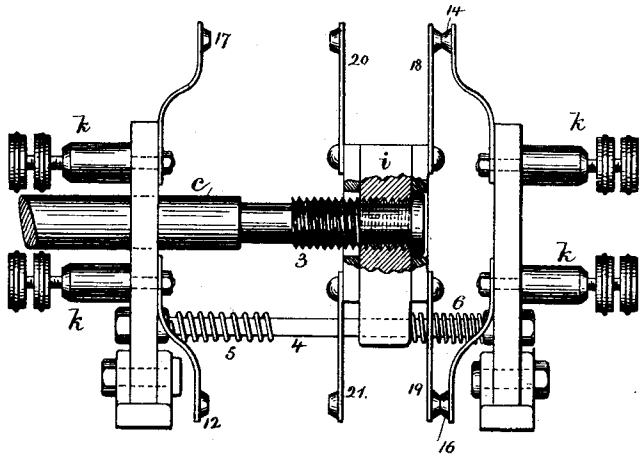


Fig. 3.

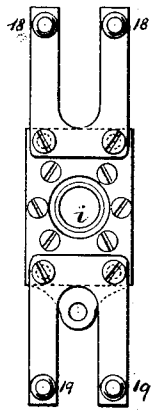


Fig. 4.

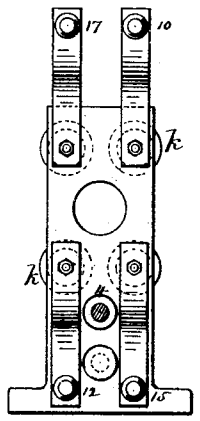


Fig. 7.

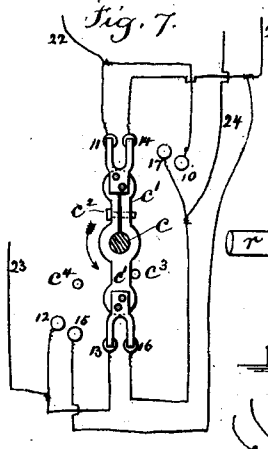


Fig. 5

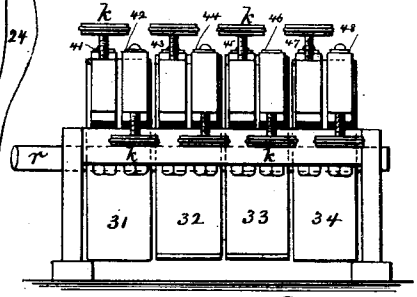


Fig. 6

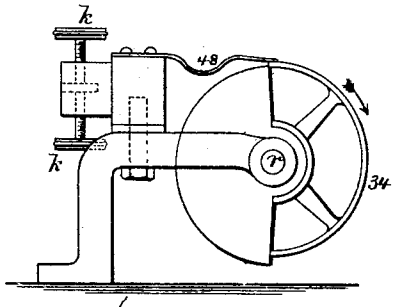
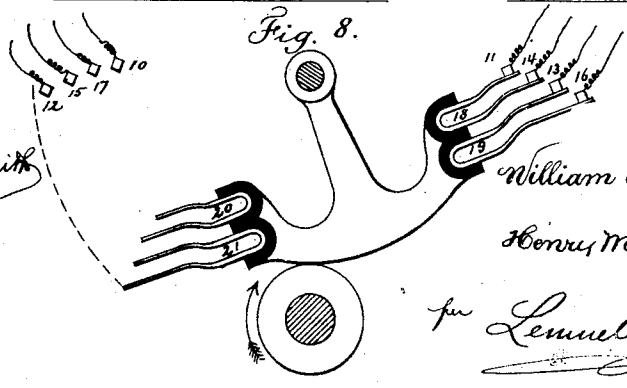


Fig. 8.



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UNITED STATES PATENT OFFICE.

WILLIAM A. STERN AND HENRY M. BYLLESBY, OF NEW YORK, N. Y., ASSIGNORS OF ONE-HALF TO THOMAS A. EDISON, OF MENLO PARK, N. J.

LIGHTING CARS BY ELECTRICITY.

SPECIFICATION forming part of Letters Patent No. 258,149, dated May 16, 1882.

Application filed January 16, 1882. (No model.)

To all whom it may concern:

Be it known that we, WILLIAM A. STERN and HENRY M. BYLLESBY, of the city and State of New York, have invented an Improvement in Lighting Cars by Electricity, of which the following is a specification.

The primary object of this invention is the lighting of cars by a combination of generator, storage-batteries, and switches for operating the same; and, secondly, to change the circuit-connections of a dynamo-electric machine automatically and in such a manner that the polarity of the generator remains the same no matter which way the armature may be revolved. This allows the armature to be revolved by a connection to the wheels of a car or locomotive, and the parts work equally well when the locomotive or cars are going in either direction.

This invention also provides storage-batteries between the generator and the lights and the circuit-changing devices, whereby the generator is connected with one storage-battery or set of coils while the lights are being supplied from a second storage-battery. Then the circuits are reversed, so that one storage-battery is being charged while the lights are run by the other battery, and the connections are changed periodically, so as to insure uniformity of light, and the lights do not burn dimly while the car is stationary. These storage coils or batteries are each to be adapted to the supply of the necessary current to the lamps for any desired period — say two or three hours—so that the lights will burn during any ordinary stoppage of a train. An automatic circuit-breaker is provided between the storage-batteries and the generator, so that the current will not react on the generator when at a state of rest.

In the drawings, Figure 1 is a diagram of the circuit-connections. Fig. 2 is an elevation of the circuit-director on the shaft of the armature. Figs. 3 and 4 are side views of the circuit-closing springs detached. Fig. 5 is a side view, and Fig. 6 is an end view, of the commutator or circuit-changer between the storage-cells and the generator. Fig. 7 shows the circuit-changer in a modified form. Fig. 8 shows a circuit-changer in the form of a sector.

The generator A is to be of any desired character, having field-magnets *a a* with their helices, a revolving armature, *b*, on a shaft, *c;* and the circuit-connections are made so as to pass the whole or a portion of the current through the field-helices. The connections are represented in Fig. 1, so that the entire current passes through the field-helices. The current is taken off by commutator-springs *d d*, which are V-shaped where they rest upon the commutator-plates, so that the armature may be revolved in either direction; and we remark that the said armature is to be driven by a belt or gearing to one of the axles, or by a wheel kept in contact by a spring with one of the car or locomotive wheels, so that the armature of the magneto-generator will be revolved whenever the car is in motion. The current passes away from the springs *d d*, and if it went directly through the field-helices there would be a reversal of polarity of the field-magnets when the direction of rotation of the armature is reversed. To avoid this we employ the automatic current-director represented in Figs. 2, 3, and 4.

Upon the armature-shaft *c*, near one end, there is a screw-thread, 3, with a plain portion at each side of the screw-thread. The nut *i* is made to fit upon the shaft *c*, and it is guided by the rod 4, around which are helical springs 5 and 6. When the armature is revolved in one direction the screw will be revolved, so as to cause the nut to move toward the spring 5 and compress it. When the nut reaches the end of the screw the shaft and screw continue to turn without moving the nut. So soon as the armature-shaft is revolved the other way the spring 5, expanding, compresses the nut toward the screw and the screw runs into the same, moving the nut the other way, compressing the spring 6, and then, the nut running off the screw, the nut remains in a fixed position until the armature-shaft and screw are again reversed. The nut carries the circuit-closing points upon spring-arms, which are in pairs, as represented in Fig. 3, and are supported by insulating material between the

springs and the nut. There are insulated binding-screws *k*, with separate spring-contacts, against which the springs of the nuts are pressed in either one direction or the other by the action of the nut as it is moved one way or the other by the rotation of the armature and shaft. The wire from one commutator-spring is connected to the binding-posts and springs 10 and 11, and the other from the other commutator-spring to the binding-posts and springs 12 and 13. The + -wire to the field-helices is connected to the binding-posts and springs 14 and 15, and the — -wire to the field-helices is connected to the binding-posts and springs 16 and 17. When the springs 18 and 19 on the nut are in contact with 11 and 14 and 13 and 16, respectively, the plus-current from 22 goes by 11, 18, 14 to + -wire 25 of the field-helix, and negative current from 23 goes by 13, 19, 16 to negative wire 24 of field-helix. When the nut is moved the other way by reversing the direction of rotation of the armature, and the currents in the revolving armature are also reversed, the + -current goes by 23, 12, 21, and 15 to + -wire 25, and the — -current by 22, 10, 20, 17 to negative wire 24. By these devices the magnetism of the field-magnets is maintained regardless of reversal of the armature-currents by changing the direction of revolution. The circuit-wires 25 and 24, after passing through the field-helices, or having branches to such helices, continue to the commutators or circuit-changers; but we place a switch, *m*, in one wire, 25, and use an electro-magnet, *l*, in a branch circuit between 24 and 25. The switch is operated by the armature of this magnet *l*. When the dynamo-generator is at rest the current ceases to flow and the electro-magnet *l* liberates the switch, so that there is no possibility of the current from the storage-cells reacting on the dynamo-generator to demagnetize the field-magnets; but when the generator is again set in action the current in *l* closes the switch *m* in the circuit to the storage-batteries.

Let *n o* represent the conductors leading to the lamps. Said lamps may be incandescent carbons in multiple arc, or lamps of any other suitable character. *p* and *q* represent storage cells or batteries of any suitable size and character, and in the circuit-wires there are introduced circuit-changers that connect the generator periodically with first one storage-battery and then the other, and simultaneously connect the other storage-cell with the light-circuit.

In Figs. 5 and 6, *r* represents a shaft supported in a frame, and carrying four wheels, 31 32 33 34, and said shaft is to be revolved by clock-work, or turned periodically a half-revolution by hand or by any suitable means. Each of the wheels is made up of two halves. One half is of wood or other non-conductor. The other half is of metal. Eight insulated springs, 41 42 43 44 45 46 47 48, each being provided with a binding-post, are placed in a row, with the ends of the springs resting in pairs on the edges of the wheels, and the wheels are placed on the shaft *r*, so that a metal half-wheel coincides with the next wooden half-wheel, so that on turning the shaft and wheels and causing the division between metal and non-conducting material to pass below the ends of the springs two pairs of such springs that had rested on metal are caused to rest on wood, and the other two pairs that had rested on wood are caused to rest on metal. It is preferable to make the surfaces slightly eccentric, as seen in Fig. 6, so that there may be a sudden snapping of the springs as they pass from one surface to the other.

The wire 24 branches to the negative elements of the two storage-cells *p* and *q*. The conductor *o* from the lights branches to the positive elements of such storage-batteries. The wire 25 branches to the binding-posts and springs 44 and 48. The conductor *n* branches to the binding-posts and springs 41 and 45. The negative elements of the batteries are also connected to the binding-posts and springs 42 and 46. When the metal of 32 and 33 is in contact with their springs 43 44 and 45 46 the current from 25 passes by 44, 32, 43 to storage-battery *p*, thence to the wire 24 and generator. At the same time the current from *q* passes to lamps by *o*, 46, 33, 45, and *n*. When the wheels are changed and the metal of 31 and 34 brought into contact with springs 41 42 and 47 48 the current from 25 passes to 48, 34, and 47 to storage-cells *q*, thence by 24 to generator. At the same time the lamps are supplied from storage-cells *p* by wire *o* and through 42, 31, and 41 to *n*. A switch at *w* stops the action of the dynamo-generator by breaking the circuit when the development of electricity is not required. These devices allow for the lights being run under all the ordinary circumstances of use in cars or on railway-trains; and we remark that one complete apparatus may be placed in each car or only in one car or engine with the circuit-wires to the lamps running through the train. The head-light and rear lights may be electric lamps, if desired.

Instead of the nut *i* bringing its springs into contact flatwise with contact-springs to the binding-posts, the springs may be arranged, as illustrated in the diagram Fig. 1, so as to be moved along endwise and slide over and rest upon contact-studs in a slab of insulating material.

In Fig. 7, I have shown a circuit-changer acted upon by friction, instead of the screw 3. The shaft *c* is provided with a double arm, *c'*, that is split and provided with a clamp-screw, c^2, so that more or less friction can be applied to the shaft at the eye upon the arm. Stops c^3 and c^4 limit the movement of this arm, and when the armature-shaft *c* is turning in the direction indicated the pairs of insulated spring contact-points will be in contact with the studs 11, 14, 13, and 16, corresponding to the binding-posts similarly marked in Fig. 1,

and when the armature-shaft is revolved the other way the pairs of insulated spring-contacts will be moved with the arm by the friction of said arm on the shaft, and the circuit-connections will be reversed.

The friction-arms may be used with springs like those in Fig. 2, that come together flatwise, said springs being arranged as in Fig. 7, but nearer together, and the pairs of contact-springs being moved by a rocking or oscillating motion given by friction at the eye of the arm, as in Fig. 7.

In place of the frictional arm upon the shaft of the armature being swung by the friction thereof upon the shaft, there may be a sector forming the circuit-changing devices, the edge of said sector being in contact with the armature-shaft, so as to roll the sector either one way or the other, according to the direction of rotation, as seen in the detached view, Fig. 8.

It will be observed that in all instances the circuit-changer acts between the armature-helices and the line-connections, as well as between the armature-helices and the field-helices, so that the direction of the current on the lines is not reversed by changing the direction of the car.

It will be apparent that the circuit-changer wheels may be revolved by a small electric motor and gearing that reduces the speed.

We claim as our invention—

1. The combination, in an apparatus for developing electric currents, of a dynamo-electric generator, mechanism for connecting the same to the driving-motor, so that it may be rotated thereby in either one direction or the other, an automatic circuit-changer operated by the shaft of the dynamo-generator, and the circuit-connections, substantially as specified, whereby the current is caused to pass in the same direction through the field-helices regardless of the direction of rotation of the armature and its helices, substantially as set forth.

2. The combination, with the armature and field-helices, of the nut and screw on the armature-shaft, and the circuit-closing springs and contact-points, brought into action in opposite directions by the movement of the nut and the circuit-connections to the field-helices, substantially as set forth, whereby the direction of current in the field-helices is not reversed when the direction of rotation of the armature is reversed, as set forth.

3. The combination, in an apparatus for lighting cars by electricity, of a dynamo-generator, means for revolving the armature thereof by a connection to the wheels or axle, automatic circuit-changing devices between the field-magnets and the armature, storage-batteries, circuit-changers between the lights, the storage-batteries, and the dynamo-generator, and an electro-magnetic circuit-breaker between the storage-batteries and the dynamo-generator, substantially as and for the purposes specified.

4. The circuit-reversing apparatus consisting of the wheels 31, 32, 33, and 34, composed of conducting and non-conducting material, the pairs of springs bearing on each wheel, and the shaft carrying such wheels and means for revolving such shaft, the dynamo-generators, storage-batteries, and lights or other working apparatus, and the circuit-connections to the same, for the purposes and substantially as set forth.

Signed by us this 11th day of January, A. D. 1882.

WM. A. STERN.
H. M. BYLLESBY.

Witnesses:
GEO. T. PINCKNEY,
CHAS. H. SMITH.