(No Model.) 2 Sheets—Sheet 1.

E. J. PRESTON & A. B. GILL.

DYNAMO FOR ELECTRIC CAR LIGHTING SYSTEMS.

No. 602,182. Patented Apr. 12, 1898.

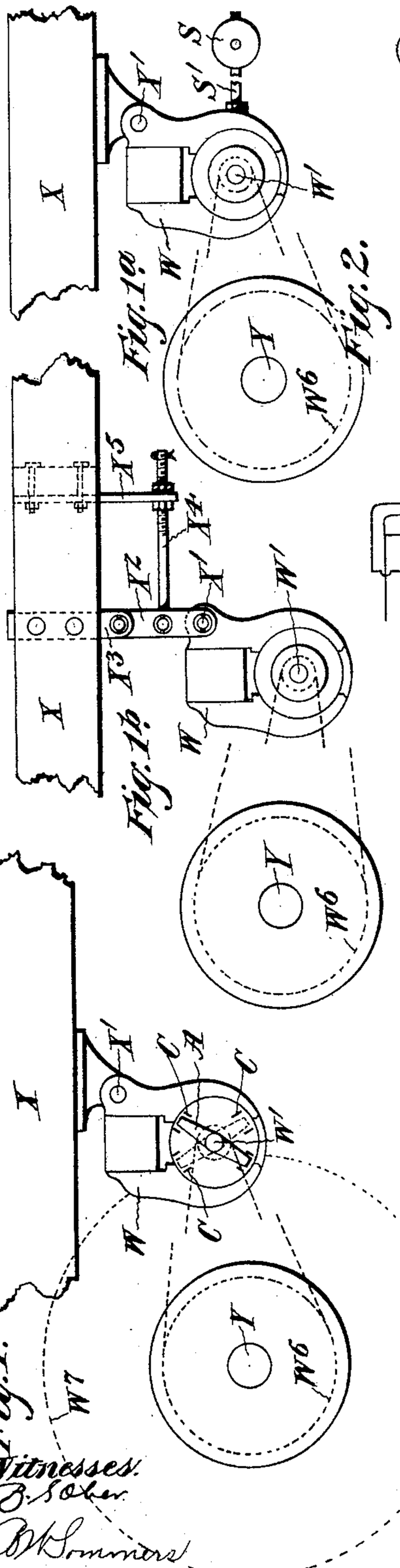

Fig. 1a.

Fig. 1b.

Fig. 1c.

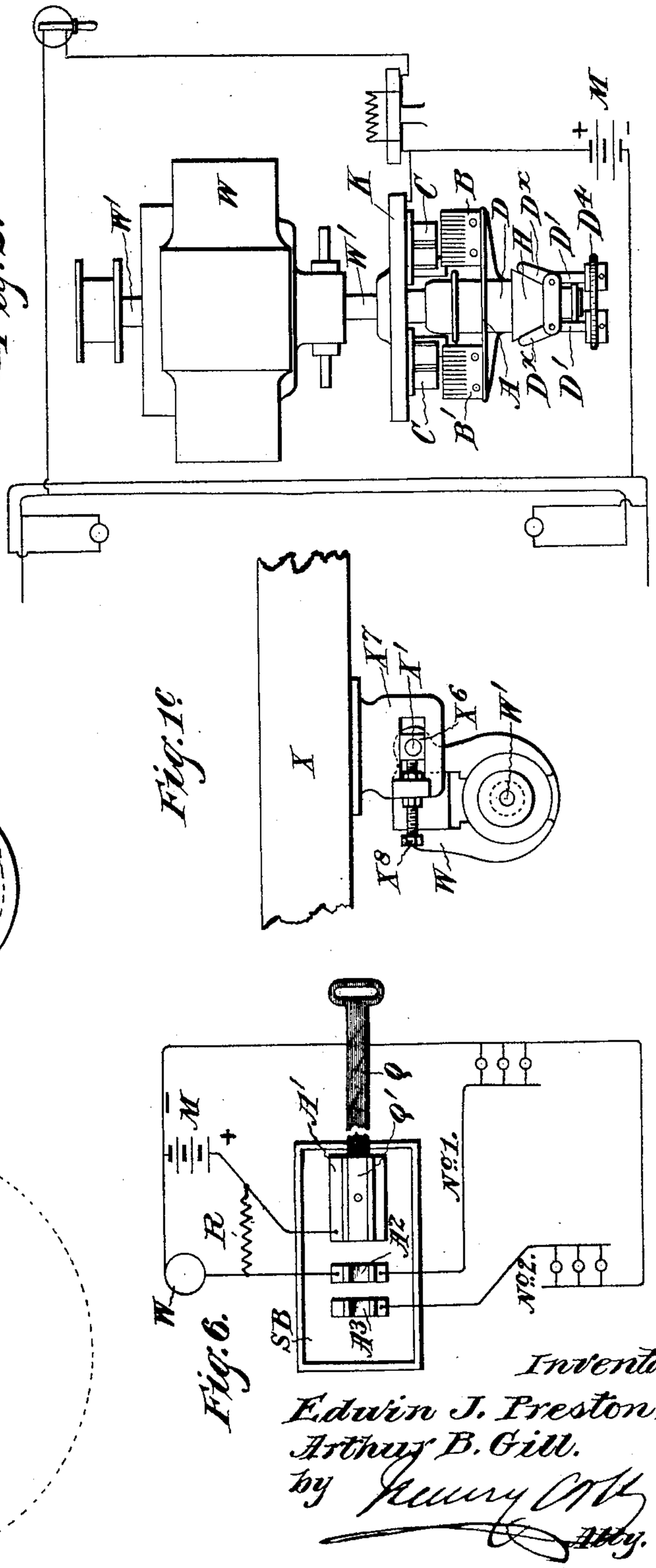

Fig. 2.

Fig. 4.

Fig. 6.

Witnesses.
B. Sober.
B. L. Sommers

Inventor
Edwin J. Preston,
Arthur B. Gill.
by Henry C. Hazard
Atty.

(No Model.) 2 Sheets—Sheet 2.

E. J. PRESTON & A. B. GILL.

DYNAMO FOR ELECTRIC CAR LIGHTING SYSTEMS.

No. 602,182. Patented Apr. 12, 1898.

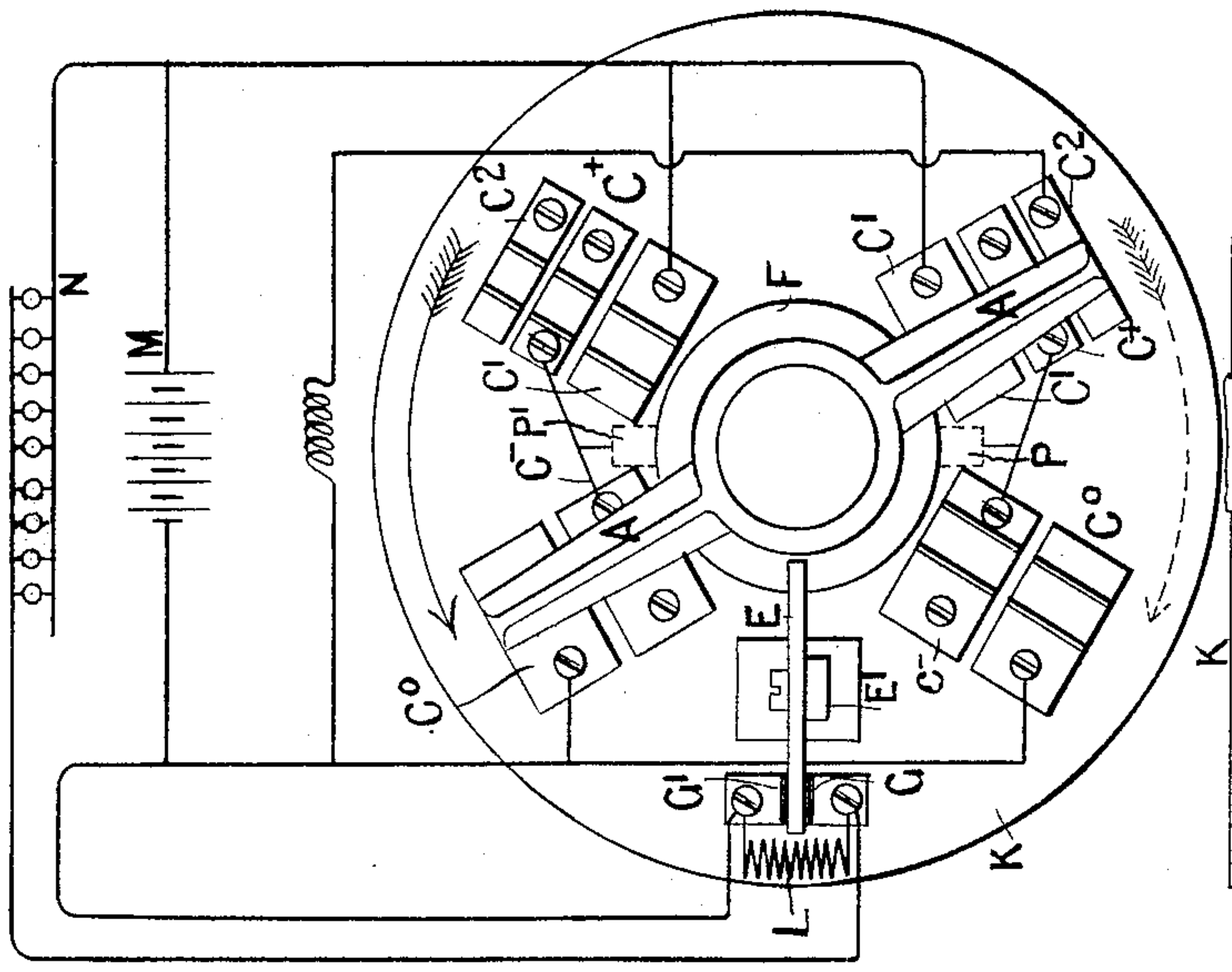

FIG. 3.

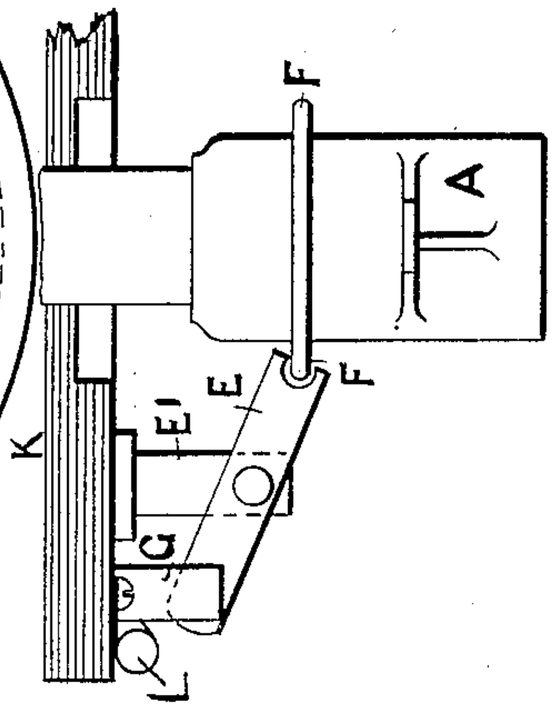

FIG. 5.

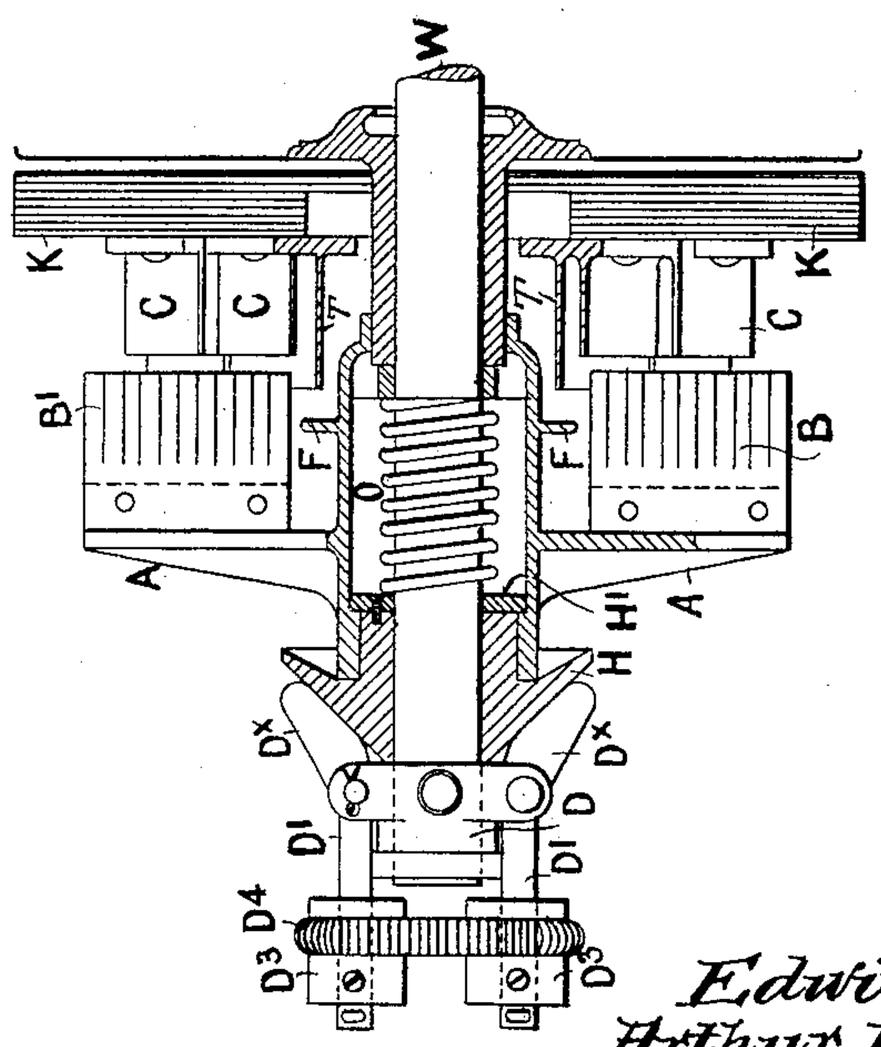

FIG. 4.

Witnesses.
R. S. Ober
Henry Orth

Inventors.
Edwin James Preston
Arthur Bernard Gill.
By Henry Orth
Atty.

UNITED STATES PATENT OFFICE.

EDWIN JAMES PRESTON AND ARTHUR BERNARD GILL, OF LONDON, ENGLAND, ASSIGNORS TO J. STONE & CO., OF SAME PLACE.

DYNAMO FOR ELECTRIC-CAR-LIGHTING SYSTEMS.

SPECIFICATION forming part of Letters Patent No. 602,182, dated April 12, 1898.

Application filed February 25, 1895. Serial No. 539,618. (No model.) Patented in England March 17, 1894, No. 5,631, and November 25, 1895, No. 1,611; in France January 17, 1895, No. 244,404; in Belgium January 17, 1895, No. 113,673; in Germany January 19, 1895, No. 92,768; in Switzerland February 5, 1895, No. 9,978; in Italy March 31, 1895, No. 38,175; in Brazil April 24, 1895, No. 1,849; in Austria April 30, 1895, No. 45/1,521; in Canada October 3, 1895, No. 50,161; in Hungary November 3, 1895, No. 4,238; in Victoria December 7, 1895, No. 12,725, and in India December 27, 1895, No. 77.

To all whom it may concern:

Be it known that we, EDWIN JAMES PRESTON and ARTHUR BERNARD GILL, subjects of the Queen of Great Britain, residing at Deptford, London, in the county of Kent, England, have invented certain new and useful improvements in and connected with dynamos especially applicable to the electric lighting and heating of railway-carriages and other vehicles, (for which Letters Patent have been obtained in the following countries, to wit: Great Britain, No. 5,631, dated March 17, 1894, and No. 1,611, dated November 25, 1895; France, No. 244,404, dated January 17, 1895; Belgium, No. 113,673, dated January 17, 1895; Germany, No. 92,768, dated January 19, 1895; Switzerland, No. 9,978, dated February 5, 1895; Italy, No. 38,175, dated March 31, 1895; Brazil, No. 1,849, dated April 24, 1895; Austria, No. 45/1,521, dated April 30, 1895; Canada, No. 50,161, dated October 3, 1895; Hungary, No. 4,238, dated November 3, 1895; Victoria, No. 12,725, dated December 7, 1895, and India, No. 77, dated December 27, 1895;) and we hereby declare that the following is a full, clear, and exact description of the said invention, such as will enable others skilled in the art to make and use the same, reference being had to the accompanying drawings, and to letters of reference marked thereon, which form a part of this specification.

These improvements have for their chief objects the automatic reversing of the current by means of a frictionally-actuated switch-lever when the direction of rotation of the dynamo is reversed and the automatic limitation of its speed of rotation and output by means of frictional dynamo-driving gear when a certain normal speed has been attained. The invention is therefore especially applicable to the lighting and heating of railway-carriages and other vehicles. Each carriage is by preference fitted with a dynamo and accumulator for the independent generation and supply of current, all so arranged that when the speed of the dynamo falls below the predetermined rate or ceases the current is supplied partly or wholly by automatic means from the battery and so that when the normal speed of the dynamo has been attained resistance is automatically inserted. The fitting of each carriage with an independent electric plant of the character described has been found to offer great practical advantages in railway-trains.

Figure 1 of the accompanying drawings is a side elevation of a dynamo suspended to the under frame of a railway-carriage and suitable driving mechanism. Fig. 2 is a plan of same, showing also the electrical connections to the secondary battery, the lamps or heaters, or both. Figs. 1^A, 1^B, and 1^C are views similar to Fig. 1, showing various means for adjusting the fulcrum of the dynamo for the purpose of adjusting the tension of the driving-belt. Fig. 3 is an end view of the reversing-switch; Fig. 4, a vertical longitudinal section thereof, and Fig. 5 a plan. Fig. 6 is a diagram illustrative of the means for, at discretion, inserting a resistance between the dynamo and the battery for the purpose, as may be desirable in some cases, of allowing the dynamo to produce more electrical energy when all the lamps in the carriage are to be lighted.

The dynamo W, Fig. 1, is suspended from the under frame X at the fulcrum-point X′, and may be driven by belt from a pulley W^6 on the axle Y of one of the carriage-wheels W^7. The tension of the belt ordinarily should be such that any tendency to increase the speed of rotation of the dynamo beyond its normal or proper speed is diminished by the slipping of the belt.

In order that the dynamo may be driven at different speeds, we provide means for adjusting the tension of the belt. This may be effected by providing the dynamo with an arm S′, that carries a weight S, adjustable thereon, Fig. 1^A, or by providing a shiftable fulcrum, as shown in Figs. 1^B and 1^C. In Fig. 1^B the dynamo has its fulcrum X′ in one end of a

link X^2, whose other end is pivoted to a supporting-bracket X^3, secured to the under frame X of the carriage. To the link X^2, about its longitudinal center, is pivoted one end of a screw-threaded rod X^4, that works in a correspondingly-threaded opening in a hanger X^5, secured to the aforesaid under frame X of the carriage, said rod being locked into its adjusted position by means of suitable lock or jam nuts, or, as shown in Fig. 1C, the dynamo may have its fulcrum X′ in a block X^6, that is adjustable in a slot formed in a bracket X^7 on the under frame X by means of an adjusting screw-bolt X^8, working in a threaded opening in said bracket.

By whatever means the dynamo may be driven the driving element or elements should be so arranged as not to result in an abnormal speed, and when driven by belt, which is the preferred mode, this can readily be effected by the means described, so that when the speed of the dynamo becomes greater than the desired speed the belt will slip, and whatever the further increase of speed of the drive-wheels may be the speed of the dynamo remains practically constant.

In order that the current may always flow in the same direction whichever way the carriage runs, a contact switch-lever is provided.

A, Figs. 1, 3, 4, and 5, is a double-armed insulated contact-lever which is capable of rocking on the boss of a cam-disk H, which latter is free to slide along on the dynamo-shaft W′. The lever A is provided with insulated switch-plugs B B′, which are capable of being inserted in one set or other of the contacts C^+, C^-, C^0, C′, and C^2, which are fixed on the insulating-switchboard base K, mounted on the dynamo-frame. The lever A will by reason of friction with the cam-boss follow the direction of rotation of the dynamo-shaft W′ until it is arrested by stops T, Fig. 4, opposite to one set of aforementioned contacts or the other, whereupon as the speed increases the plugs B B′ are pushed into the said contacts by the operation of a governor. The head D of a centrifugal governor, which, as an example, may be of the form shown in Fig. 4, is fixed on the shaft W′, and has two arms D′ jointed thereto, and a coiled spring D^4 serves to partially counteract the centrifugal effort of the balls or weights D^3. The other ends $D^\times$ of the levers D act against the cam-disk H, which slides on the shaft W′ and transmits a corresponding sliding motion to the lever A, or, instead of the cam-disk H, we may use other forms of sliding sleeve operating in connection with the governor and the lever A.

E, Figs. 3 and 5, is a lever used for introducing resistance between the dynamo and the lamps or heaters, or both, when the dynamo is running at its normal speed. It is mounted on the bracket E′ on the base K. One forked end of this lever engages with the flange F on the boss of the lever A and the other end carries an insulated contact-piece, which, by coming between the contacts G and G′, Fig. 3, serves to short-circuit the resistance L, inserted between the secondary battery M and the lamps N, when the dynamo is not working or working at a low speed or below the normal speed; or the resistance L may be made variable by subdividing it and causing the contact-piece at the end of the lever E to slide over suitable contacts connected with such resistances; or we may substitute for the lever E a sliding bar, which operates the necessary resistances directly. As soon as the normal or desired speed has been attained and the switch-plugs B B′ inserted the lever E is actuated by the governor, so that the short circuit is broken and the current of the lamps then passes through resistance L. The arms $D^\times$ of the governor at the same time act against the conical cam H and push it, and therewith also the contact-arm A, in such manner as to overcome the resistance of the spring O, so that the switch-plugs B B′ are pushed into one set of contacts and complete the circuit of the dynamo with the secondary battery on the one side and with the lamps on the other. The contacts C′ and C^- do not rise as high above the board K as the other contacts, hence are not engaged until the speed required for charging the battery has been attained.

The current from the dynamo when the parts are in the position shown in Fig. 3 leaves the radially-set carbon brush P, passes to the contact-piece C^+ and through the contact-plug B, Fig. 4, on rocking lever A to the contact-piece C^2, and thence through the field-magnets to the contacts C^0, the contact-plug B′, Fig. 4, and the contact C^- to the brush P′. When the speed necessary to charge the battery has been attained, the plugs B B′ are pushed so far along the shaft as to connect C^+ to C′, thereby allowing the current to pass to the battery or to that and the lamp-circuit also, returning through the contact C^0, and thence through C^- to the brush P′. When the carriage-axle or other driver runs in the opposite direction, the lever A is swung round so as to come opposite the other contacts, the governor then pressing the plugs B B′ into said contacts. The current is then reversed and goes from the brush P′ through the contact C^- to the contact C^+ in the manner above described.

The field-magnets may be wound with two windings and the supply of current regulated by a switch in such manner that when both battery and lamps require current the two windings are joined to assist each other, whereas if only the battery or the lamps have to be supplied the windings do not assist each other; or instead of the second winding we may use a resistance in the magnet-coils or in the main circuits.

In some cases it is advantageous that the dynamo should produce more electrical energy than is required for the lamps in the carriage when alight. To this end we insert be-

tween the dynamo and the battery a resistance through which the current passes when the lamps are out, but which when the lamps are alight is reduced or short-circuited, thus allowing the dynamo to supply current to the lamps and battery. The diagram Fig. 6 shows a convenient mode of attaining this result. S B indicates a switch-box of insulating material and contains three grooved or channeled contacts A′ A^2 A^3, in the channel of which is adapted to slide a contact-block Q′, secured to an operating-rod Q, of insulating material. W indicates the dynamo, whose negative pole is connected with the like pole of a battery M and the positive pole with the contact A^2, while the positive pole of battery M is electrically connected with the contact A′, a resistance R being interposed in the electrical connections of the dynamos and battery with said contacts A^2 and A′. The contact A^2 is also electrically connected with the positive poles of a certain number or a set of lamps whose negative pole is connected to the like pole of battery M and indicated as lamp-circuit No. 1 in said Fig. 6. The contact A^3 is electrically connected to the positive poles of another set of lamps, lamp-circuit No. 2, whose negative poles are connected to the like pole of battery M through the connection of lamp-circuit No. 1. When the contact-block Q′ is in the position shown in said Fig. 6, current will flow from plus pole of dynamo W, through resistance R, plus pole of battery M, back to minus pole of dynamo. When, on the other hand, the contact Q′ is moved into the contact A^2, then current will flow from dynamo to A^2, lamp-circuit No. 1, back to dynamo. Finally, if the contact Q′ is pushed into the channel of contact A^3 both lamp-circuits Nos. 1 and 2 will be included in the dynamo-circuit, current then flowing from dynamo to A^2 and lamp-circuit No. 1 and through contact Q′ to A^3 and lamp-circuit No. 2, as will be readily understood, so that either one or the other or both sets of lamps can be supplied with current.

Instead of allowing the main current to flow through resistance R a resistance may be actuated in the field-magnet circuit or a different winding may be actuated by the sliding switch.

In practice the contact Q′ is held against A′ or A′ A^2 or A′ A^2 A^3 by a suitable spring which may conveniently be secured to the lid of the switch-box S B.

Having thus described our invention, what we claim as new therein, and desire to secure by Letters Patent, is—

1. The combination with the driving-axle provided with a pulley, of a dynamo provided with a pulley and mounted to be capable of movement toward and from the driving-axle in a substantially horizontal direction, a driving-belt applied to said pulleys, and means whereby the dynamo is pressed away from the driving-axle and the pressure is applied to the belt which is necessary for producing the desired normal speed of the dynamo, while the dynamo is drawn toward the axle by an increased speed of the belt, thereby loosening the belt and causing a slip which neutralizes such increase of speed, thus maintaining the desired normal speed of the dynamo-shaft under an excessive speed of the driving-axle, substantially as set forth.

2. The combination with the driving-axle provided with a pulley, of a dynamo provided with a pulley, a substantially horizontal driving-belt applied to said pulleys, and a one-sided suspension device supporting the dynamo and causing the same to swing away from the driving-axle and tighten the belt for producing the desired normal speed of the dynamo, while permitting the dynamo to be drawn toward the driving-axle by an increased speed of the belt, substantially as set forth.

3. The combination with the driving-axle provided with a pulley, of a dynamo provided with a pulley, a substantially horizontal driving-belt applied to said pulleys, a one-sided suspension device supporting the dynamo and causing the same to swing away from the driving-axle and tighten the belt for producing the desired normal speed of the dynamo, while permitting the dynamo to be drawn toward the driving-axle by an increased speed of the belt, and means for altering the tension of the belt, substantially as set forth.

4. The combination with a railway-carriage or other vehicle, of a dynamo in one-sided suspension from the under side thereof, pulley-and-belt connection between the shaft of the dynamo and one of the vehicle-axles, the belt being in about a horizontal direction, said dynamo acting as a tension device for the belt, and means for shifting the point of suspension of the dynamo and thereby altering the tension of the belt.

5. The combination with a dynamo and its switchboard provided with two pairs of contacts and electric circuits leading therefrom, of a reversible contact-lever adapted to connect either pair of contacts and mounted loosely on the dynamo-shaft to be shifted from one pair of contacts to the other by the reversal of the direction of rotation, said lever being also capable of movement lengthwise on the dynamo-shaft for engagement with and disengagement from said contacts, and a centrifugal governor mounted on the dynamo-shaft and connected with said contact-lever to hold the latter in engagement with the contacts of the switchboard during the rotation of the dynamo-shaft and to withdraw the lever from said contacts as the rotatory speed falls, preparatory to shifting the lever to the other pair of contacts by the reversal of the rotation, after which the contact-lever is again moved into engagement with the contacts by the increase of the rotatory speed, substantially as set forth.

6. The combination with a vehicle, a dynamo pivotally suspended from the under side thereof, pulley-and-belt connection between

the dynamo-shaft and one of the vehicle-axles, said dynamo performing the function of a belt-tightener, suitable contacts on the dynamo-framing, electric circuits leading from said contacts to the brushes, the battery and lamps or other current-receivers, and a rocking switch-lever loose on the dynamo-shaft; of a centrifugal governor controlled by the rotation of the dynamo-spindle, and controlling the switch-lever thereon, substantially as and for the purpose set forth.

7. The combination with a vehicle, a dynamo pivotally suspended therefrom, pulley-and-belt connections between the dynamo-shaft and one of the vehicle-axles, said dynamo performing the function of belt-tightener, suitable contacts and stops on the dynamo-framing, electric connections between said contacts and the dynamo-brushes, the battery and lamps or other current-receivers, and a rocking switch-lever loose on the dynamo-shaft and provided with suitable contacts adapted to coöperate with those on the dynamo-framing; of a centrifugal governor, also on the dynamo-spindle, provided with a retractile spring, said governor connected with the switch-lever and operating to automatically separate its contacts from those on the dynamo-framing so soon as the dynamo-shaft ceases to revolve, for the purpose set forth.

8. The combination with the dynamo and its spindle, suitable contacts on the dynamo-framing, electric circuits including said contacts and the dynamo-brushes, suitable stops on said dynamo-framing, and a switch-lever loosely mounted on the dynamo-shaft; of a centrifugal governor on said shaft provided with a retractile spring, said governor connected with the switch-lever and operating to move the same so as to interrupt the electric circuits when the dynamo-shaft ceases to revolve and to position the said lever to reverse the direction of the current when the motion of the dynamo-shaft is reversed, for the purpose set forth.

9. The combination with the dynamo and its spindle, suitable contacts on the dynamo-framing, a battery, electric circuits leading therefrom to said contacts and to the dynamo-brushes, suitable stops on said dynamo-framing, and a switch-lever loosely mounted on the dynamo-shaft; of a centrifugal governor on said shaft provided with a retractile spring, said governor connected with the switch-lever and operating to move the same so as to interrupt the electric circuits when the dynamo-shaft ceases to revolve and to position the said lever to reverse the direction of the current when the motion of the dynamo-shaft is reversed, for the purpose set forth.

10. The combination of a dynamo, the brushes P, P′, a rocking switch-lever A mounted freely on its shaft and provided with contact-plugs B, B′ and cone-sleeve H, contacts C^+ C^- C^0 C′ and C^2 and stops on the dynamo-framing, electrical circuit-connections therefrom to the brushes, a suitable current-receiver, the centrifugal governor D, D′, $D^\times$ with spring O and the cone-sleeve H against which the governor-arms $D^\times$ act, substantially as and for the purpose set forth.

11. The combination of a dynamo, the brushes P, P′, a rocking switch-lever A mounted freely on its shaft and provided with contact-plugs B, B′, and cone-sleeve H, contacts C^+, C^- C^0 C′ and C^2 and stops on the dynamo-framing, electrical circuit connections therefrom to the brushes, the battery M and the lamp N, the centrifugal governor D, D′, $D^\times$, with spring O and the cone-sleeve H against which the governor-arms $D^\times$ act, substantially as and for the purpose set forth.

12. The combination of the dynamo, the switch-lever A with contact-plugs B B′ and cone-sleeve H, contacts C^+ C^- C^0 C′ and C^2 and stops, the centrifugal governor D, D′ $D^\times$ with spring O, the lever E, contacts G and resistance L, and electrical circuit connections between the latter, a suitable current-receiver, the brushes P P′ and the aforesaid contacts C, substantially as set forth.

13. The combination of the dynamo, the switch-lever A with contact-plugs B B′ and cone-sleeve H, contacts C^+ C^- C^0 C′ and C^2 and stops, the centrifugal governor D, D′ $D^\times$ with spring O, the lever E, contacts G and resistance L, and electrical circuit connections between the latter, the battery M, the brushes P, P′ and the aforesaid contacts C, substantially as set forth.

EDWIN JAMES PRESTON.
ARTHUR BERNARD GILL.

Witnesses:
V. JENSEN,
T. J. OSMAN.