

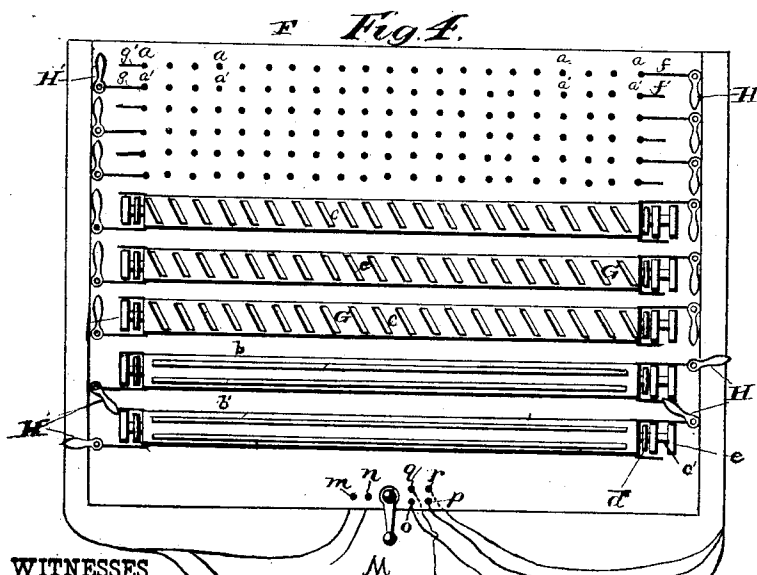
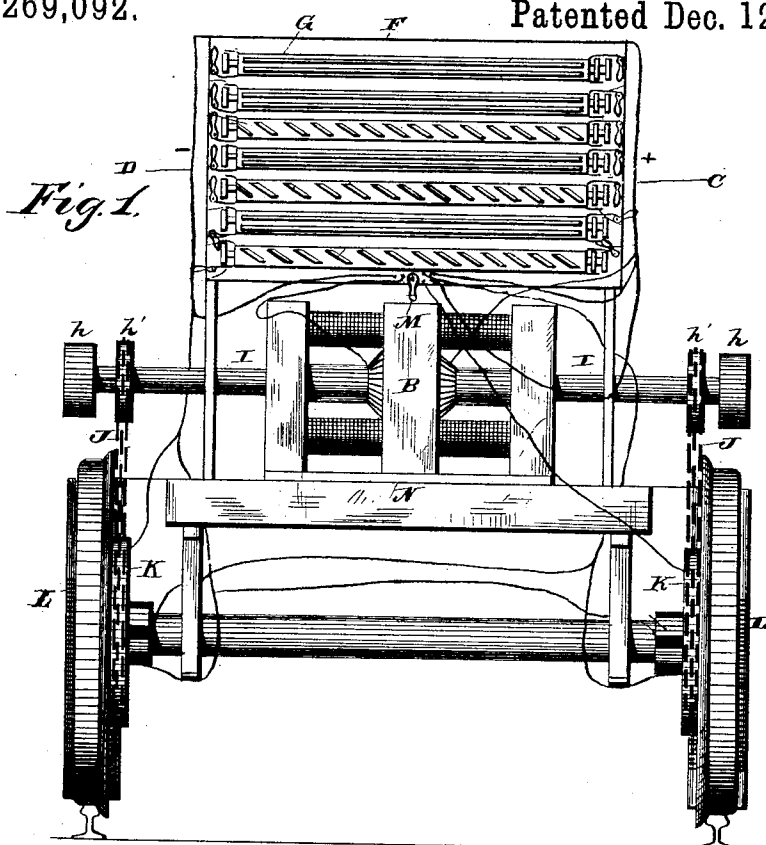
(No Model.)

4 Sheets—Sheet 1.

E. J. MOLERA.
ELECTRIC LOCOMOTIVE.

No. 269,092.

Patented Dec. 12, 1882.



WITNESSES

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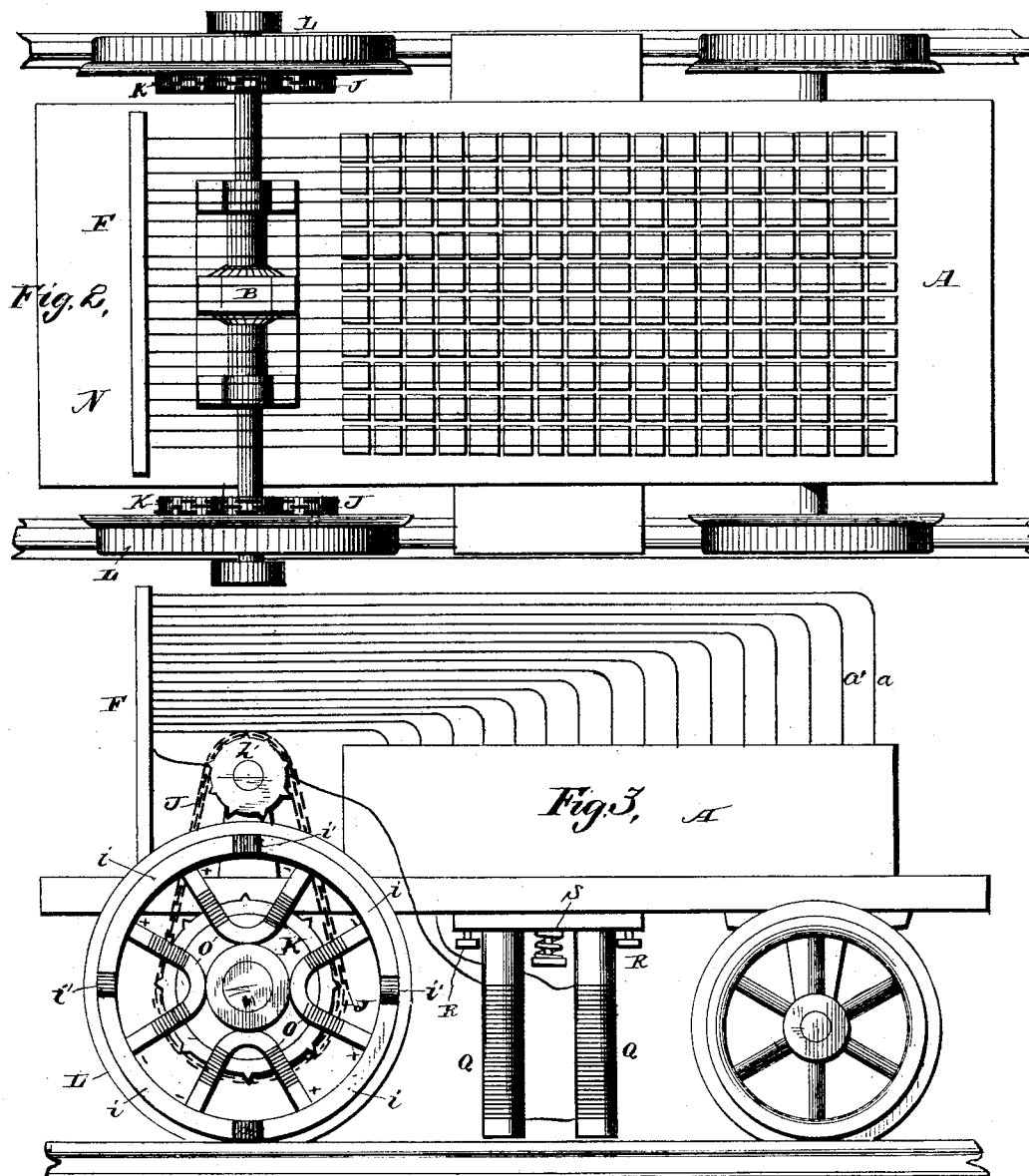
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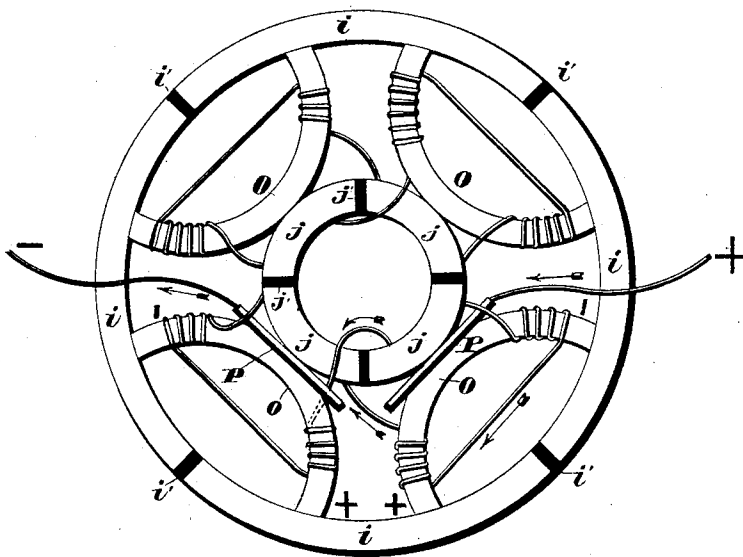
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Fig. 1.



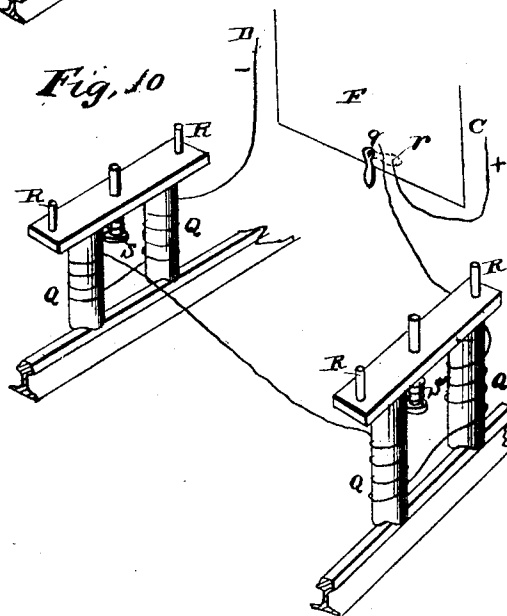
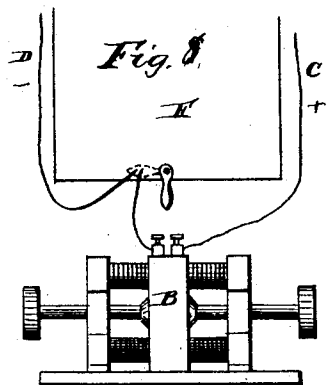
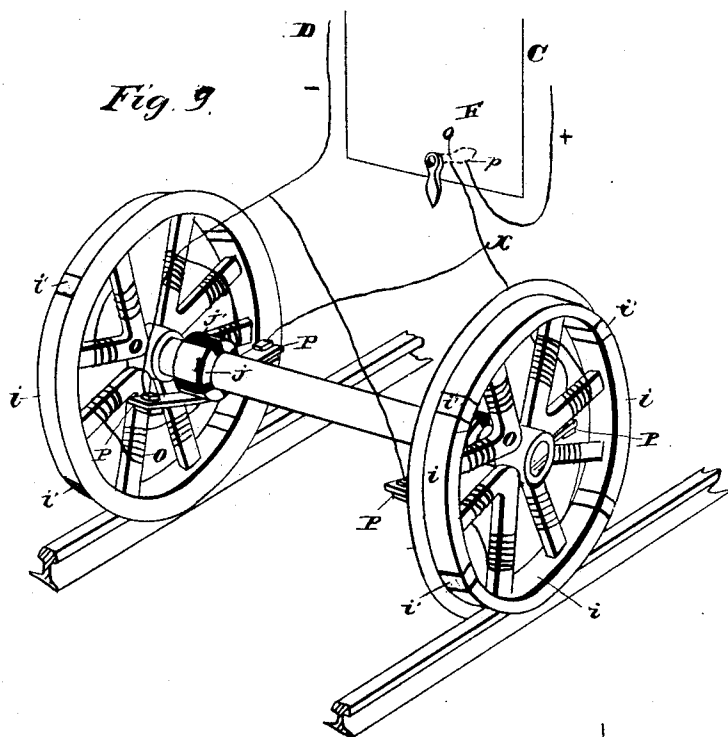
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UNITED STATES PATENT OFFICE.

EUSEBIUS J. MOLERA, OF SAN FRANCISCO, CALIFORNIA, ASSIGNOR OF
ONE-HALF TO JOHN C. CEBRIAN, OF SAME PLACE.

ELECTRIC LOCOMOTIVE.

SPECIFICATION forming part of Letters Patent No. 269,092, dated December 12, 1882.

Application filed November 4, 1880. (No model.)

To all whom it may concern:

Be it known that I, EUSEBIUS J. MOLERA, of San Francisco, in the county of San Francisco and State of California, have invented certain new and useful Improvements in Electric Locomotives; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it pertains to make and use it, reference being had to the accompanying drawings, which form part of this specification.

My invention relates to an improvement in electric locomotives. Heretofore devices of this character have principally been driven by apparatus which may be classified under one of the two following heads: first, those engines which are provided with galvanic batteries, and, second, those engines which are actuated by electrical energy developed by independent generators, and supplied to the engines by an insulated conductor following the track on which the engines travel. Electric locomotives of the first class are objectionable, owing to the difficulty of manipulating the battery, to the expense of maintaining it, and to the inconstancy of the current developed, consequent upon changes in the acids employed. On the other hand, electric locomotives of the second class are objectionable in that a large proportion of the electricity is dissipated into the atmosphere by the conductor and into the running connection between the latter and the locomotive. The second class of locomotives also entail the expense of a long conductor, the cost of laying it, and the employment of at least two magneto-electric machines.

The broad principle upon which my invention is based consists in providing a locomotive with a storage-battery and with an electromotor, the latter being arranged to be utilized as a generator of the electricity which is stored, and, reversely, as a medium through which the stored energy is utilized in driving the locomotive. In addition to this controlling feature of construction the invention comprehends devices adapted to vary the quantity and tension of the electricity supplied by the storage-reservoir, and a novel form of drive-wheel, the

same being arranged to be converted into a traction-brake by the deflection of an electrical current through it.

My invention further consists in certain details of construction and combinations of parts, as will be hereinafter described, and pointed out in the claims.

The drawings represent one form of mechanism for carrying out my invention, the same having been chosen because of the simplicity of its construction, and because it is well adapted to accomplish the purpose of the invention. It is to be observed, however, that certain of the devices may be omitted without interfering with the action of the remainder; that any one or all of the elements embodied in the illustrated mechanism may be modified as circumstances may dictate, and that the leading features of construction may be employed in apparatus differing in form from that herein shown.

Figure 1 is a view in elevation of a locomotive embodying my invention. Fig. 2 is a plan view thereof. Fig. 3 is a view in side elevation. Fig. 4 is a view of the switch-table. Fig. 5 is a view thereof in side elevation. Fig. 6 is a view of one of the bearings in which the reversible electrode-connecting bars are mounted. Fig. 7 is a view of the inner side of one of the drive-wheels. Fig. 8 is a view, showing the connection between the magneto-machine and the battery. Fig. 9 is a detail view, showing the connection between the drive-wheels and battery; and Fig. 10 is a view showing the connection between the depending brakes and battery.

The reservoir A consists of a battery of storage-cells or accumulators of any approved type, Planté's or Houston and Thompson's being suitable for the purpose. The said reservoir is connected to a magneto-electric machine, B, by two main conductors, C and D, which are respectively connected to the positive and negative poles of the battery. The electrodes of all of the different cells are secured in an upright switch-board, F, each row of cells having a double row of electrodes, the electrodes *a* of each double row being of positive and the electrodes *a'* being of negative polarity. The electrodes of each row of cells are provided with

reversible electrode-connecting bars G, the same being adapted to couple the cells of each row for quantity or for tension. This adaptation consists in providing one face of the bars with two longitudinal strips, *b* and *b'*, adapted to be respectively engaged with the electrodes *a* and *a'* of the cells, and insulated from each other and from the bars. When the strips aforesaid are engaged with the electrodes, the cells will be coupled for quantity.

The adaptation of the bars to couple the cells for tension consists in providing their opposite faces with insulated transverse strips *c* equal in number to the number of cells in each row and grouped diagonally across the faces of the bars, being thus adapted to couple the positive electrode of one cell with the negative electrode of an adjoining cell of the same row. The said bars G are provided at each end with short square journals *c'*, which are mounted in bearings *d*, the same being secured to the switch-board, provided with slots *d'*, the inner portions of which correspond in shape and size with the journals.

To reverse the bars face for face, they are grasped by their handles *e* and moved sufficiently from the electrodes to allow their journals to be turned over in the outer portions of the slots *d'*. When this is accomplished the bars are again moved back and engaged with the electrodes, being locked in place by the shape of the lower portions of the said slots. While the devices above described answer every purpose, it is apparent that other constructions to fulfill the same function may be resorted to.

The right-hand electrode *a* of each row of cells is extended by a wire, *f*, which terminates in a key, H, adapted to be engaged either with the main conductor C, or with the extension *f'* of the right-hand electrode *a'* of an adjoining row of cells.

In Fig. 4 of the accompanying drawings the key connected with the right-hand electrode *a* of the lower row of cells is shown in engagement with the extension *f'* of the right-hand electrode *a'* of the next row of cells above, the key of this row of cells being connected with the main conductor C. The left-hand electrode *a'* of each row of cells is extended by a wire, *g*, which terminates in a key, H', adapted to be engaged either with the main conductor D, or with the extension *g'* of the left-hand electrode *a* of an adjoining row of cells.

In Fig. 4 of the drawings, the key H' of the lower row of cells is engaged with the main conductor D, while the key of the next row of cells above is engaged with the extension *g'* of the left-hand electrode *a* of the lower row of cells.

From the foregoing description it is apparent that through the agency of the reversible bars G and the keys H and H' a wide range of operation is offered for obtaining electricity from the storage-battery in the desired quantity and at the desired tension. For in-

stance, supposing the bars G to be arranged to present the strips *b* and *b'* to the electrodes of the several rows of cells, thus connecting the cells for quantity, by turning the keys the rows of cells may be individually connected to the main conductors or collectively in one or more groups. On the other hand, supposing the bars G to be arranged to present the strips *c* to the electrodes of the several rows of cells, thus coupling the cells for tension, by turning the keys the rows of cells may be individually connected to the main conductors, or collectively in one or more groups. In this connection it should be observed that the keys H and H' of the upper row of cells can be engaged only with the conductors contiguous to them, as their position precludes their engagement with appropriate electrode-extensions of adjoining cells.

The devices herein shown for adapting the magneto-electric machine to be employed both as a generator of the electricity to be stored and as a medium for the utilization of the stored electricity in driving the locomotive consist of band-wheels *h* and sprockets *h'*, the same being mounted upon the shaft I of the magneto-electric machine, and of bands or chains J encircling the said sprockets *h'*, and sprockets K, associated with the driving-wheels L.

In running the locomotive it is first necessary to charge the battery A. This is done by disconnecting the chains from the fixed pulleys *h'* and connecting the band-wheels *h* with any suitable motive power, whereby the shaft I is revolved, and the magneto-machine actuated in the generation of electricity which is transmitted by the main conductors C and D to the battery, the cells of which are coupled for quantity, and connected to the conductors by the switches H and H' in the manner hereinabove set forth. When the battery is charged as desired, the band-wheels are disconnected from the independent motor, and the chains are restored to the sprockets, whereby the shaft I is connected with the sprockets K of the drive-wheels. The electrodes of the battery-cells are now coupled for tension, inasmuch as in such combination the electrical energy stored in the battery is most advantageously employed to actuate the magneto-machine which drives the locomotive. A handle, M, located in the center of the lower end of the switch-board is adapted in three movements to be engaged with six terminals. When the terminals *m* and *n* are united by the handle a circuit will be closed through the battery and the magneto-electro machine through the connections shown in Fig. 8 of the drawings. When the terminals *o* and *p* are united by the handle a circuit is closed through the battery and the drive-wheels, whereby they are converted into traction-brakes, as will be herein-after described. The connections between the drive-wheels and the battery are shown in Fig. 9 of the drawings. A union of the terminals

q and r by means of the handle will effect the closing of a circuit through the battery and the depending brakes, the connections between the same and the said battery being shown in Fig. 10 of the drawings. The engineer stands on the platform N, from which he is able to to manipulate the handle M, the bars G, and the keys H and H'.

For the purpose of governing the speed of the locomotive when descending grades and also for stopping it or for retarding its motion when running over level tracks, its wheels are adapted to be converted into traction-brakes by the deflection of electrical currents through them. With this end in view the wheels are composed essentially of electro-magnets O, which constitute their spokes, and of tires divided into insulated segmental sections i by non-magnetic blocks i' , the said sections and the poles of the magnets being relatively so arranged that similar poles of adjacent magnets are secured to the same sections of the tire. The wires of the magnets terminate in contact-plates j , insulated from each other by the interposition between their ends of blocks or sections j' of any desired insulating material, the plates and blocks being adapted when grouped together to form rings encircling the axle of the wheels. Two pairs of stationary brushes, P, connected with opposite poles of the storage-battery located below the wheel-axle and respectively contiguous to the wheels, are adapted to simultaneously engage with two of the contact-plates j when the same are brought in proper positions by the rotation of the wheels, the said plates and tire-sections being relatively arranged so that the former will be properly engaged with the brushes to energize the magnets having similar poles secured to the contacting tire-sections from the time they first come in contact with the rails until they leave the same.

In illustration of the manner in which electrical currents from the battery are deflected through the wheels in converting them into traction-brakes a wheel has been shown in detail in Fig. 7 of the drawings. The arrangement of electric connections disclosed in this figure renders the pair of magnets, respectively located above and below a horizontal line bisecting the wheel, co-operative in effecting the magnetization of the tire-sections upon which their poles rest, the two pairs of magnets operating independently of each other.

It has been observed that the contiguous poles of two adjacent magnets are of the same polarity. Consequently the most separated poles of the same magnets will have the same polarity, this result being effected by disposing the wires encircling the legs of the magnets so that the current will be deflected around them in like directions for poles of like polarity.

In converting the wheels into traction-brakes the handle M is turned into position to unite the terminals o and p , which will result in closing a circuit through the storage-battery and

the electro-magnets O, the current flowing from the positive conductor of the battery to the point x , shown in Fig. 9 of the drawings, where it will divide and flow to the positive brush, P, of each wheel. Let it be assumed that the wheels are in the position shown in Fig. 7 of the drawings, wherein the two brushes are respectively in contact with the two plates in which the wires of the lower pair of magnets terminate. From the positive brushes the current will flow to the right hand contact-plates, when it will again divide, one portion flowing in the direction indicated by the arrows through the wire encircling the legs of the right-hand magnet, thence to the left-hand contact-plate, from which it will pass to the brush P. The other portion of the current will flow from the right-hand contact-plate to the wires encircling the legs of the left-hand magnet, passing therefrom to the left-hand contact-plate, and thence to the brush P. In the deflection of these currents, as described, the contiguous poles and the most separated poles of the lower pair of magnets will be positively and negatively magnetized respectively, and induce magnetism in the tire-sections upon which they rest. The said sections in turn will induce magnetism in the track-rails, the attraction between them and the said rails operating as a brake to retard the locomotive. The degree of braking-power exerted by the wheels will be directly proportionate to the strength of the current deflected through them.

It will be seen that the tire-sections on which the positive poles of the magnets rest will be magnetized once in every revolution of the wheel and retard the locomotive, while the tire-sections upon which the negative poles of the magnets rest will be inoperative as regards retarding effect.

Depending from each side of the locomotive and in line with the track-rails are electro-magnets Q. These magnets are adapted to serve as friction-brakes, and have vertical movement upon suitable guides, R. When demagnetized they are supported above the track-rails by springs S. They are connected to the storage-battery by wires disposed as shown in Fig. 10 of the drawings. When the terminals q and r are united by the handle M, a circuit will be closed through the magnets magnetizing them and causing them to descend upon the track-rails, which will serve in the capacity of armatures.

I would have it understood that I do not limit myself to the construction herein shown and described, but that I hold myself at liberty to make such changes and alterations as fairly fall within the spirit and scope of my invention.

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

1. In an electric locomotive, the combination, with the wheels thereof and a storage-

battery, of an electromotor and suitable connections, whereby the said motor is adapted to be employed to charge the storage-battery and to utilize the stored energy in driving the locomotive, substantially as set forth.

2. In an electric locomotive, the combination, with the drive-wheels thereof, an electromotor provided with a revolving shaft and gearing connecting the said wheels and shaft, of a storage-battery supported on the locomotive and electrically connected with the motor, whereby the same is actuated by the stored energy in driving the locomotive, substantially as set forth.

3. In an electric locomotive, the combination, with an electromotor and a storage-battery electrically connected with each other, of driving-wheels and gearing connecting them with the motor, whereby they are driven when it is actuated by the energy stored in the battery, said gearing being adjustable to disconnect the wheels and motor when the latter is being employed to charge the battery, substantially as set forth.

4. In an electric locomotive, the combination, with the driving-wheels thereof, an electromotor and gearing to transmit the power of the motor to the wheels, of a storage-battery electrically connected with the motor, a switch-board in which the electrodes of the battery elements terminate, electrode-connecting bars

to connect the elements together in rows for quantity or for tension, and keys to connect the rows with the conductors leading to the motor either individually or collectively, substantially as set forth.

5. In an electric locomotive, drive-wheels composed of electro-magnet spokes and of tires formed in insulated segmental sections, similar poles of two adjacent magnets being connected to common tire sections, substantially as shown and described.

6. In an electric locomotive, drive-wheels composed essentially of electro-magnet spokes and of tires formed in insulated segmental sections, similar poles of adjacent magnets being connected to common tire-sections, of insulated contact-plates, in which the wires of the magnets terminate, and brushes connected with the battery and arranged to properly engage with said plates to close circuits through the pairs of magnets having similar poles upon the tire-sections in contact with the rails, substantially as set forth.

In testimony that I claim the foregoing I have hereunto set my hand this 24th day of September, 1880.

E. J. MOLERA.

Witnesses:

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ANDRES MAUIR.