(No Model.)

J. C. HENRY.

ELECTRIC RAILWAY.

No. 494,477. Patented Mar. 28, 1893.

Fig. 1.

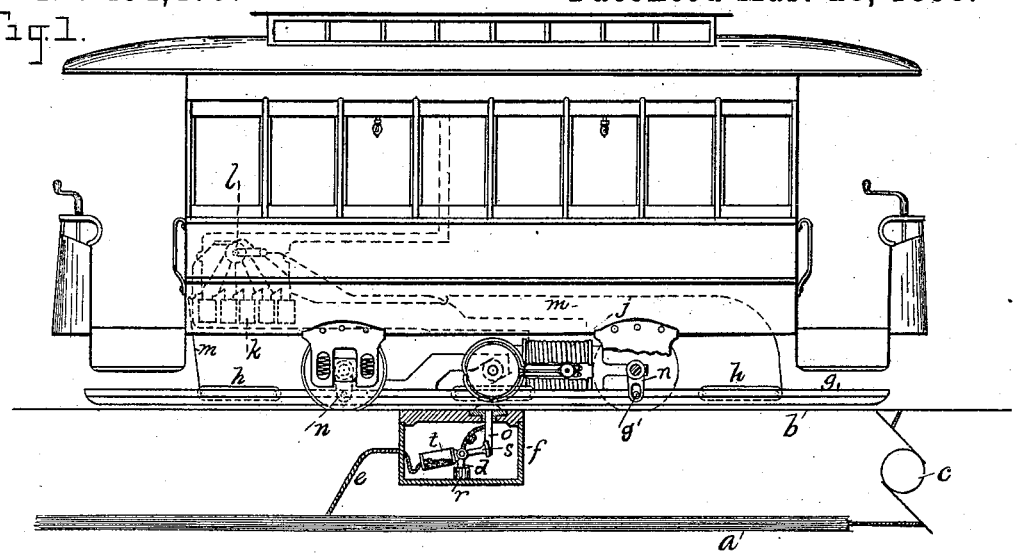


Fig. 2.

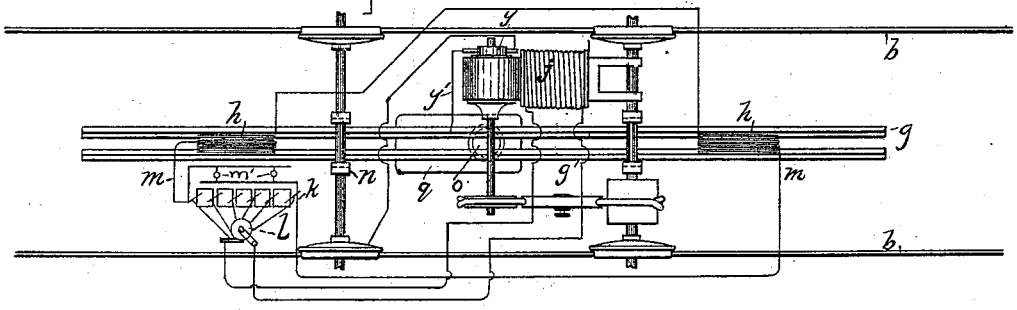


Fig. 3.

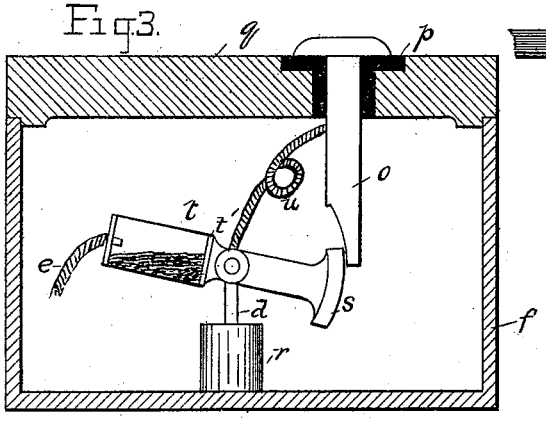
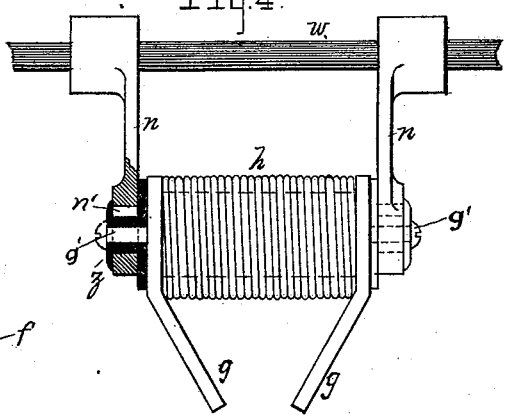


Fig. 4.



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ELECTRIC RAILWAY.

SPECIFICATION forming part of Letters Patent No. 494,477, dated March 28, 1893.

Application filed August 19, 1890. Serial No. 362,458. (No model.)

To all whom it may concern:

Be it known that I, JOHN C. HENRY, a citizen of the United States, residing at New York, in the county and State of New York, have invented certain new and useful Improvements in Electric Railways, of which the following is a specification.

My invention relates primarily to an electric railway system in which current is supplied in part from fixed sources of electricity by means of insulated conductors, but certain portions of the invention are capable of a wider application.

In the accompanying drawings: Figure 1 is a view, partly in sectional side elevation and partly in diagram of a car and other portions of an electric railway system embodying my invention. Fig. 2 is a plan view of a motor truck and its track. Fig. 3 is a sectional elevation, to a large scale, of a contact box. Fig. 4 is a partly sectional end view of a contact.

In cities or other places where the overhead system of wiring is objectionable, it is desirable to find some way of supplying current from a fixed source, to the car motors, without the danger and inconveniences resulting from the use of a slotted conduit in the roadway. A part of my invention therefore relates to that class of electric railways in which the car carries a contact-maker of considerable length which in passing over or alongside of exposed metal projections on the street-surface, makes electrical contact with them and thus establishes connection of the moving car motor with the stationary source of electricity. I therefore employ by preference a buried and insulated feeding conductor *a* connected to one pole of the stationary dynamo or source of electricity *c* and extending along parallel with the track *b*, which is preferably at all points in electrical connection with the other pole of the dynamo.

Where projections which conduct the current to the car are exposed on the surface of the street, as in this instance, it is essential that they be unobtrusive, so as not to interfere with the travel of vehicles or animals, and, finally that they be both insulated, and thoroughly protected from accidental contact at all times when they are in electrical connection with the conductors. In my present system, said contact-projections have current in them only when they are strongly magnetized by the coming into contact with them of powerful electro-magnets carried by the car and are out of circuit, as soon as this influence has passed on.

Suitably spaced along the roadway preferably between the tracks, and at distances apart slightly less than the length of a car are stationary contact boxes *f*. These boxes are of iron or of some durable insulating material and they have removable cast iron covers *q*. In the cover is fixed a soft iron contact pin *o* insulated and cushioned at *p* by rubber or other suitable material from the cover and having a rounded head which projects but slightly from the surface of the ground. The pin *o* is in permanent electric connection by wire *u* or otherwise with the metallic post *d*, which is insulated at *r* from the box *f*.

s is a soft iron armature pivoted on post *d* and moving in proximity to the lower end of pin *o*. On the opposite side of its pivot from the pin *o* the armature has a box *t* of insulating material but with metal end plates *t'*. This box is partially filled with mercury which by reason of the weight of armature *s* (or under the action of a spring if desired) normally rests, as shown in Fig. 3 against the inner end of the box, uncovering the bared end of the insulated branch wire *e*, which projects through the outer end of the box and has permanent connection with main feed wire *a*. It will thus be seen that so long as the parts are in the position shown in Fig. 3, the electric connection between the pin *o* and the main wire *a* is broken, but that if the armature *s* is raised, as by magnetization of the pin *o*, the circuit will be completed between the mercury and the exposed end of wire *e*, and the bead of pin *o* will therefore be in electrical communication with the main feeding conductor. Ordinarily therefore there will be no leakage of electricity and no danger of short circuiting by accidental contacts of exterior objects with pin *o*. But when the car is passing connection is made with the feed conductor. For this purpose, I have, pendent from the car-wheels *w*, by swinging links or hangers *n*, two soft metal shoes or

rails g which are preferably very nearly the length of the car and which are adapted to take the heads of the pins o between them as they move along and make good electrical contact with both sides thereof. The supporting pins g' of the shoes g have some freedom of vertical movement in the slots n' of the hangers or arms n, to allow for slight unevenness of distance between the axles and the contact pins. Great unevenness of distance is prevented by having the shoes supported, as shown, from the car axles instead of from the car-body. The shoes and their supporting pins are insulated from the hangers n at z as shown.

Between the shoes g and preferably surrounding their supporting pins or bolts g' are electro-magnets h of which the shoes g form polar extensions and whose helices are in permanent connection by wires m with a storage battery of any desired number of cells k. A hand-operated switch m' may, if desired, be inserted in the circuit m to enable the demagnetizing at will of the contact shoes g.

The shoes g are connected by wire y' with one terminal of the armature y of the motor, the other armature terminal being connected to the car-wheel and so with the rail return circuit as shown. It is known that the speed or power of the motor-armature and its current supply can be best controlled by varying the ampere turns of and consequently the magnetism of the field magnets. The common practice is to regulate the field and armature currents from the same source. Hence any change in the supply of current to either the field magnets or armature must disturb the other and also the initial source. When series motors are run in multiple arc, it is necessary to use rheostats, (which in a measure block and waste the energy) to regulate them. The same difficulties arise in the use of shunt-wound machines. To avoid these objections, I separately excite the field-magnets of the car-motors, preferably from storage batteries carried by the car. Hence the speed of the armature, its torque and the current supply are controlled by a means which is electrically independent of it. This is of especial value in supplying the extra electro-motive force required at the moment of starting a car. The loss of energy in the field magnets of a motor being a very small percentage of the total energy absorbed by the machine, a battery of comparatively small size is required in this system. I estimate that about five cells of the ordinary storage battery would supply the field-magnets of a street car motor for a twelve hours run, under ordinary conditions, without recharging. By using separately excited fields from a low pressure source the liability of burning them out is averted. The field helices can also be constructed of a much coarser or cheaper quality of insulated wire which may be wound on them without special skill or care. By switching the cells in or out, the speed and power of the motor can be controlled and objectionable disturbances of the main supply are avoided. As shown the same batteries k which supply current to the electro-magnets h, also serve for supplying current to the field magnets j under the control of the switch l placed in position for convenient use by the motorneer and constructed in any approved way to enable the grouping of the batteries in various relations according to the electro-motive force required. While here shown diagrammatically as within the car, the switch would ordinarily be placed on one or both of the end platforms.

In practice I prefer to charge the secondary batteries by a shunt from the mains having the cells coupled up in what is termed "half-and-half" (charging and discharging going on simultaneously), but this matter not being the subject of claim, I have, to avoid confusing the drawings, omitted the charging currents.

The operation is as follows:—The motor field magnets being constantly polarized from the storage batteries on the car under control of the operator, and the contact shoes permanently polarized by the magnets h, the car as it moves along will bring said shoes in contact with the successive pins o in the roadway. So long as the car and the contact shoes remain over a given contact point, the armature s in the contact box will be raised and connection will be made from the buried feeder through the motor armature. As the car passes on and the shoes leave the head of a contact pin, the armature of that particular contact-pin is dropped and the mercury contact will break without sparking because the circuit has already been broken between the contact shoe and pin. The motor is hung from one truck axle at one end and from the car-body or the other axle at the other end.

Having thus described my invention, the following is what I claim as new therein and desire to secure by Letters Patent:

1. The contact box comprising the combination of stationary exposed contact pieces or pin o of magnetic material, armature s arranged in proximity to said pin and having mercury contact box t, and branch wires e, u the whole being arranged and adapted to operate, substantially as set forth.

2. The combination of contact pin o of magnetic material having the exposed terminal or head at the surface of the street, the insulated tilting armature s having mercury box t, the branch conductor u permanently connecting pin o and armature s, and branch conductor e having exposed terminal within said mercury box and permanently connected with a source of electricity, substantially as set forth.

3. The combination of stationary contact pins in the roadway and two contact shoes carried by the car and adapted to grasp the contact pins between them as they move along, substantially as set forth.

4. The combination of the two contact shoes

g, the interposed electro-magnets *h*, means for suspending the same from a vehicle, and an electric circuit comprising the said electro-magnets and a source of electricity.

5. The combination of the car axles, the slotted hangers pendent therefrom, the contact shoes and supporting pins therefor resting in the slots of said hangers and suitably insulated therefrom substantially as set forth.

6. In an electric railway system, the combination of a stationary source of electricity, line conductors extending therefrom along the railway, a traveling vehicle having an electric motor, a branch circuit from said lines to the armature of said motor and batteries carried by said vehicle and connected to the field-magnets of said motor independently of the said branch circuit whereby the said field magnets are separately excited, substantially as set forth.

7. In an electric railway system, the combination of a stationary source of electricity, line conductors therefrom extending along the railway, a traveling vehicle, a motor carried thereby having its armature in a branch circuit making traveling connection with said line conductors, and a local circuit on the car including the motor field magnets, batteries whereby the latter are separately excited and suitable means of regulation, substantially as set forth.

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