



(No Model.)

2 Sheets—Sheet 2.

J. C. HENRY.  
ELECTRIC MOTOR TRUCK.

No. 520,780.

Patented June 5, 1894.

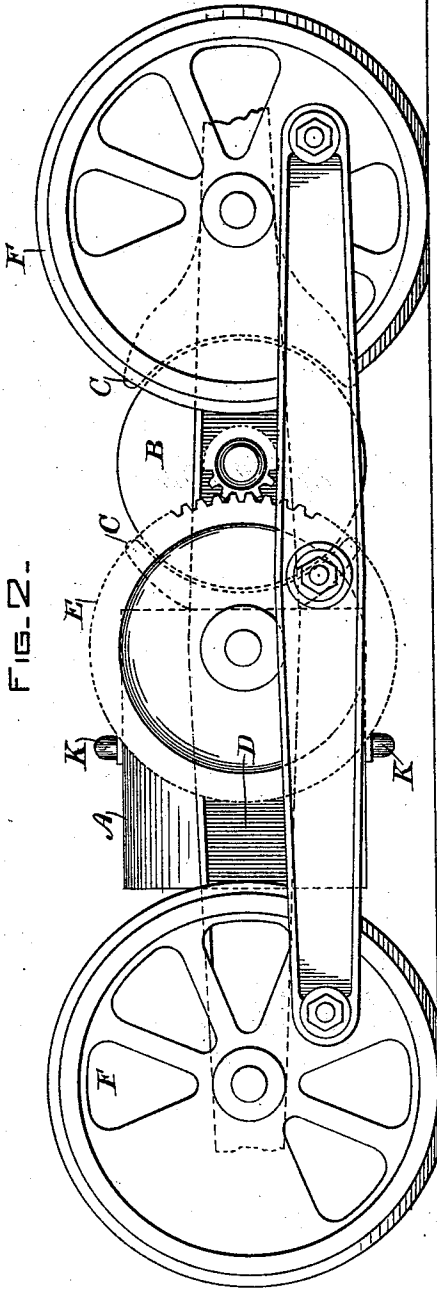


FIG. 2.

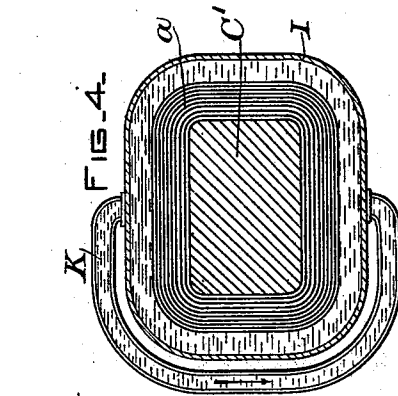


FIG. 4.

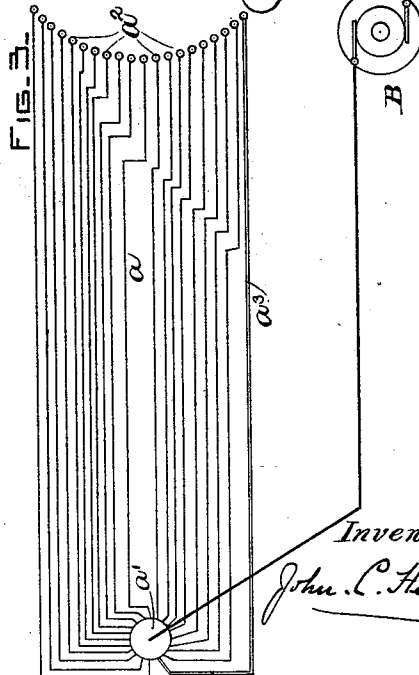
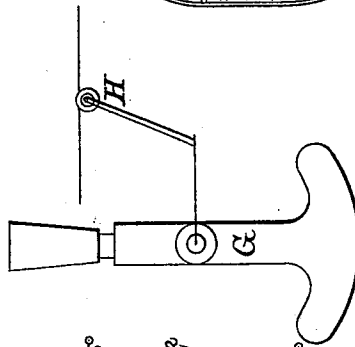


FIG. 3.

Witnesses  
*Al. Blue.*  
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Inventor  
*John C. Henry.*

# UNITED STATES PATENT OFFICE.

JOHN C. HENRY, OF WESTFIELD, NEW JERSEY.

## ELECTRIC-MOTOR TRUCK.

SPECIFICATION forming part of Letters Patent No. 520,780, dated June 5, 1894.

Application filed August 27, 1892. Serial No. 444,307. (No model.)

*To all whom it may concern:*

Be it known that I, JOHN C. HENRY, a citizen of the United States, residing at Westfield, county of Union, State of New Jersey, have invented a certain new and useful Improvement in Narrow-Gage Motor-Trucks, of which the following is a specification.

This invention relates to improvements in electric railroad motors and trucks and has in view first the combining and arranging of parts in such a manner that the truck frame, side rods and track rails all assist in forming a path for the conduction of the magnetic lines of force from one pole piece to the opposite one; second, the placing of the speed reducing gears in such a position that they are protected from injury by the car wheels and track rails; third, a means of regulating the motor without artificial resistance, dangers from self induction or injuries from flashing, and fourth, a means for protecting and insulating the field coils in a liquid insulation which is kept constantly in circulation, thus preventing the coagulation or collection of impurities which in course of time might carbonize and make an improper path for the current.

In the drawings Figure 1 represents a plan of the combined motor and car truck which in this case is designed for use on narrow gage railroads. Fig. 2 represents a side elevation of the same. Fig. 3 is a diagrammatic view of the windings of the field coils, the switch and the connections from the trolley wire to the armature. Fig. 4 represents a sectional view through the field magnet and shows its sealed casing with a liquid circulatory passage-way from the top to the bottom of the coil.

In the construction of electric generators and motors it is usually necessary to employ a mass of metal of great weight to accommodate without throttling the magnetic lines of force in their passage from one pole piece to the other. Usually a much larger percentage of metal is thus employed than the mechanical stability of the machine requires. In the present invention I utilize a portion of this necessary metal to form a very rigid truck frame thus avoiding the use of any superfluous metal in the frame. In addition to this the construction permits some of the lines of force to pass through the car wheels

and track rails around to their proper destination, thus using those members as an aid to the magnetic efficiency of the machine. The passage of the magnetism through the wheels and rails has a tendency to hold the truck to the rails when moving at high speed and also prevents slipping of the wheels.

The construction is clearly shown in Figs. 1 and 2, A being the field magnet, B the armature, C C the pole pieces and D the truck frame magnetically uniting the pole pieces.

In the construction of electric motors for railway work it is desirable that the gearing be as large in diameter as possible, while on the other hand the usual conditions of the streets make it dangerous to use gearing that extends down near the railway surface, as it is liable to encounter paving stones, snow or other obstructions. To avoid this danger I place the gear E on a line with and between the car wheels F so that it is protected by the track and wheels. In the regulation of railway motors the common practice is to throttle the current by passing it through a resistance or by commutating the field wires. The former is objectionable for the reason that it entails superfluous mechanism whose office is to destroy valuable energy; the latter is objectionable as it necessitates the bringing of wires with great differences of potential together with consequent flashing and liability to short circuit. Another objection of serious importance is that when these wires are in series it is dangerous to break the circuit as the secondary discharge is usually of a much higher potential than the initial pressure on the line. This effect increases with the length of the sections of wire on the field magnets.

In the drawings Fig. 3 represents in diagram an improved plan of governing motors. The field magnet A is wound with a multiplicity of fine parallel wires *a* which are all coupled together at one end *a'* and lead to the armature B. At the other end they each connect with separate insulated contact-points to *a''*. The switch G is in connection with the trolley H to the positive side of the dynamo and may be closed and place any or all of said parallel field wires in the circuit. In experimenting with motors regulated in this manner I have found several features

necessary to success; first, the combined resistance of the multiplied strands must not be greater than is necessary to saturate the magnets without materially heating them; 5 second, the conductivity of each separate strand must be great enough to stand the full potential across its terminals without dangerous heating; third, it is desirable that the first strand  $\alpha^3$  (distinguished by the double line) be of higher resistance and more 10 stable material than its fellows. I have found German silver or steel desirable for the purpose; fourth, it is of great importance that the circuit be broken and switching done between the positive side of the circuit and the 15 armature.

I find by experiments that where the armature is left connected on one side to the positive wire it is almost certain to be soon injured from static discharges. When left in 20 this position it seems to act as a condenser and is certain to be injured. By breaking the circuit in the manner shown in the diagram this danger is wholly avoided.

25 In the sectional drawings, Fig. 4 C' represents the field magnet core,  $a$  the parallel field wires, I an external casing surrounding the field magnet which is also a liquid containing receptacle; its object is to keep the 30 wires thoroughly submerged in insulating oil. K is one or more pipes or passage-ways leading from the top to the bottom of the casing; its object is to keep the oil circulating and cool and break up any tendency toward the collection or coagulation of the impurities which might in time carbonize. The 35 heated liquid rises to the top and is cooled off in its passage through the exterior pipe or pipes. If desired this same result may be accomplished by magnetic or mechanical 40 means. This device is also applicable to converters.

What I claim as new, and desire to secure by Letters Patent, is—

45 1. An electric car truck having a frame comprising horizontal side bars of magnetic metal, axles journaled in each end of the side bars, and pole pieces lying in a horizontal 50 plane and projecting from cross bars joining the side bars between the axles, whereby the magnetic connection between said pole pieces lies through the cross bars and side bars, substantially as described.

2. A truck for electric cars, comprising a

horizontal rectangular frame, wheeled axles 55 journaled in each end of said frame, and a pole piece at each end projecting from a cross bar adjacent to the axle, the vertical height of the frame and pole pieces being less than that of the wheels, substantially as described. 60

3. An electric motor having its field magnets wound with a multiplicity of parallel conductors, the strand through which the circuit is first completed and last broken in 65 turning the current on and off, being of higher resistance than the adjacent ones, in combination with a switch arranged to connect two or more of said conductors in parallel, substantially as described.

4. An electric motor having its field coils 70 wound with a multiplicity of parallel conductors, the strand through which the circuit is first completed and last broken being of higher resistance than the others, and a switch located on the positive side of the field mag- 75 nets and adapted to close the circuit through one or more of said conductors, substantially as described.

5. The combination with an electro magnet, of a receptacle surrounding the same, a 80 pipe communicating at each end with the top and bottom of said receptacle respectively, and forming a closed circuit therewith, and a fluid insulant filling said receptacle and 85 pipe, substantially as described.

6. The combination with an electro magnet, of a receptacle surrounding the same, a 90 short pipe communicating at each end with the top and bottom, respectively, of said receptacle, and running parallel with and outside of said receptacle, and a fluid insulant filling said receptacle and pipe, substantially as described.

7. A motor truck comprising two axles, a 95 motor mounted between them, a pinion on the motor shaft, and a large spur gear meshing with said pinion, and connected with the car wheels, said pinion and gear being in line with the wheels, whereby the lower edge of the gear can be brought down near the ground 100 without danger of striking obstructions, substantially as described.

In witness whereof I have hereunto set my hand this 23d day of August, 1892.

JOHN C. HENRY.

Witnesses:

JOHN M. C. MARSH,

WM. W. GILBY.