No. 887,483. PATENTED MAY 12, 1908.

J. LEDWINKA.

ELECTRICALLY PROPELLED VEHICLE.

APPLICATION FILED AUG. 3, 1907.

5 SHEETS—SHEET 1.

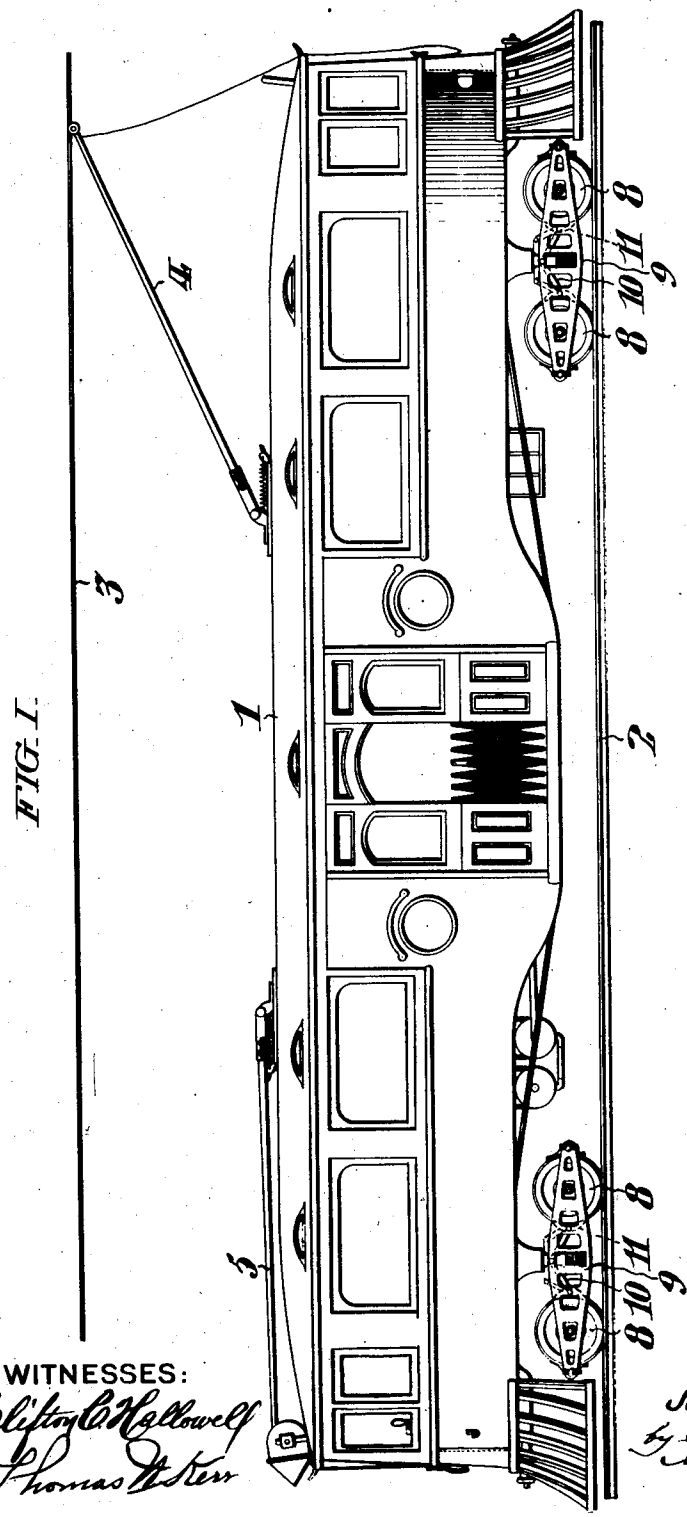



FIG. 1.

WITNESSES:

Clifton C. Hallowell

Thomas Akers

INVENTOR:

JOSEPH LEDWINKA,

by Arthur E. Page

Atty.

No. 887,483. PATENTED MAY 12, 1908.

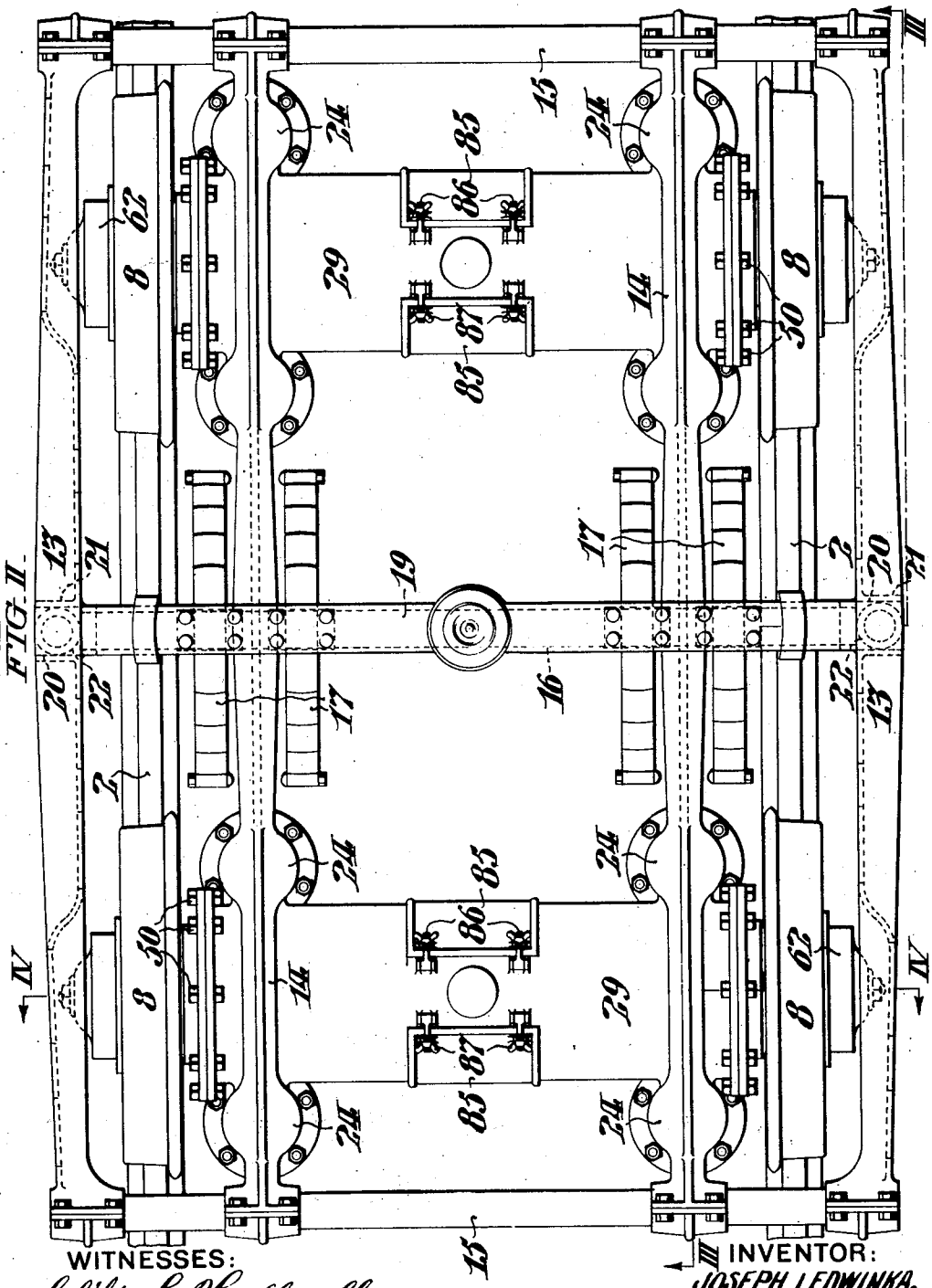
J. LEDWINKA.

ELECTRICALLY PROPELLED VEHICLE.

APPLICATION FILED AUG. 3, 1907.

5 SHEETS—SHEET 2.

FIG. II.




WITNESSES:

Clifton C. Hallowell

Thomas H. Kerr

INVENTOR:

JOSEPH LEDWINKA,

by Arthur E. Page

Atty.

No. 887,483. PATENTED MAY 12, 1908.

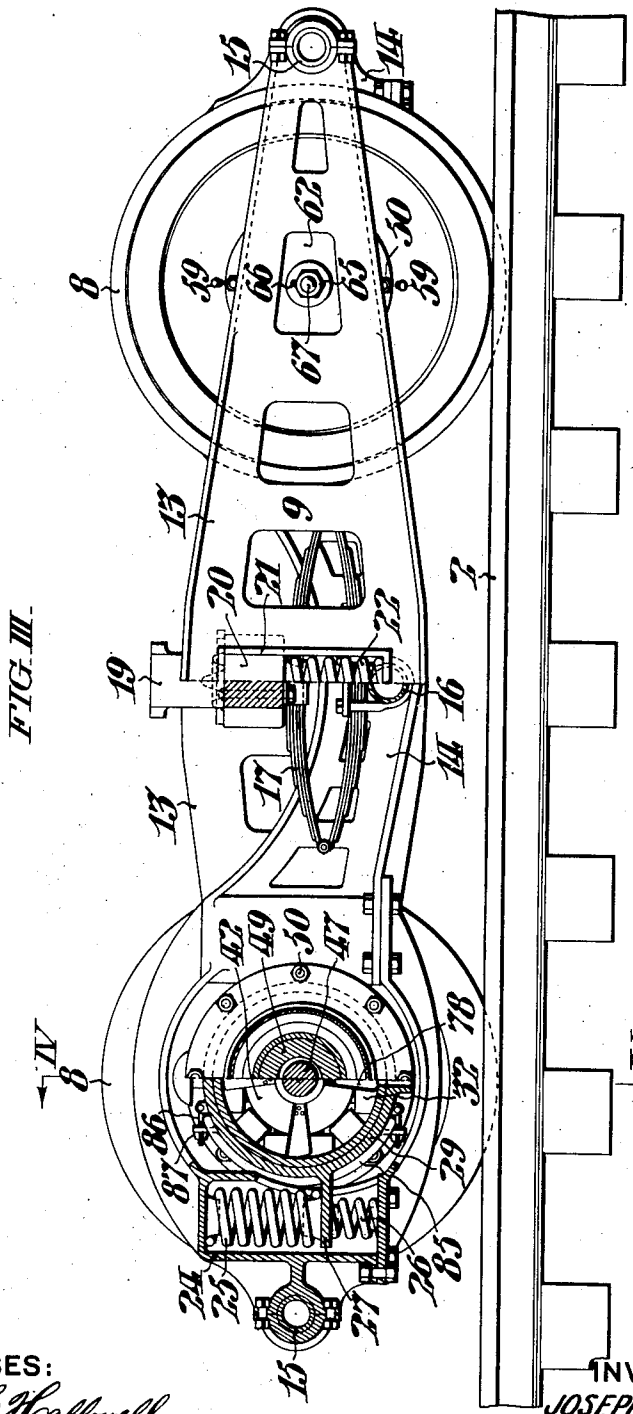
J. LEDWINKA.

ELECTRICALLY PROPELLED VEHICLE.

APPLICATION FILED AUG. 3, 1907.

5 SHEETS—SHEET 3.

FIG. III.




WITNESSES:

Clifton C. Caldwell

Thomas W. Kerr

INVENTOR:

JOSEPH LEDWINKA,

by Arthur E. Page

Atty.

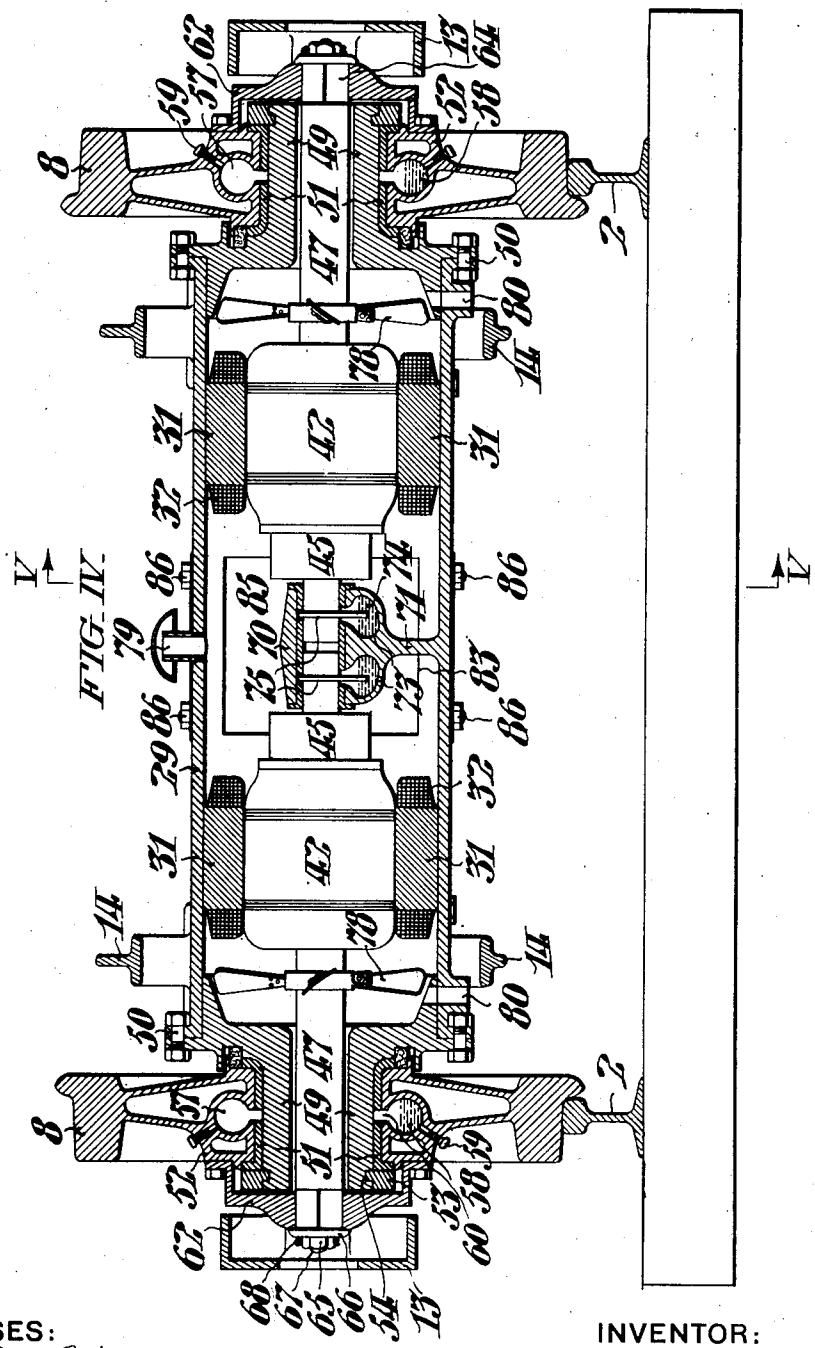
No. 887,483. PATENTED MAY 12, 1908.

J. LEDWINKA.

ELECTRICALLY PROPELLED VEHICLE.

APPLICATION FILED AUG. 3, 1907.

5 SHEETS—SHEET 4.




WITNESSES:

Clifton C. Hallowell

Thomas H. Kerr

INVENTOR:

JOSEPH LEDWINKA,

by Arthur E. Page

Atty.

No. 887,483. PATENTED MAY 12, 1908.

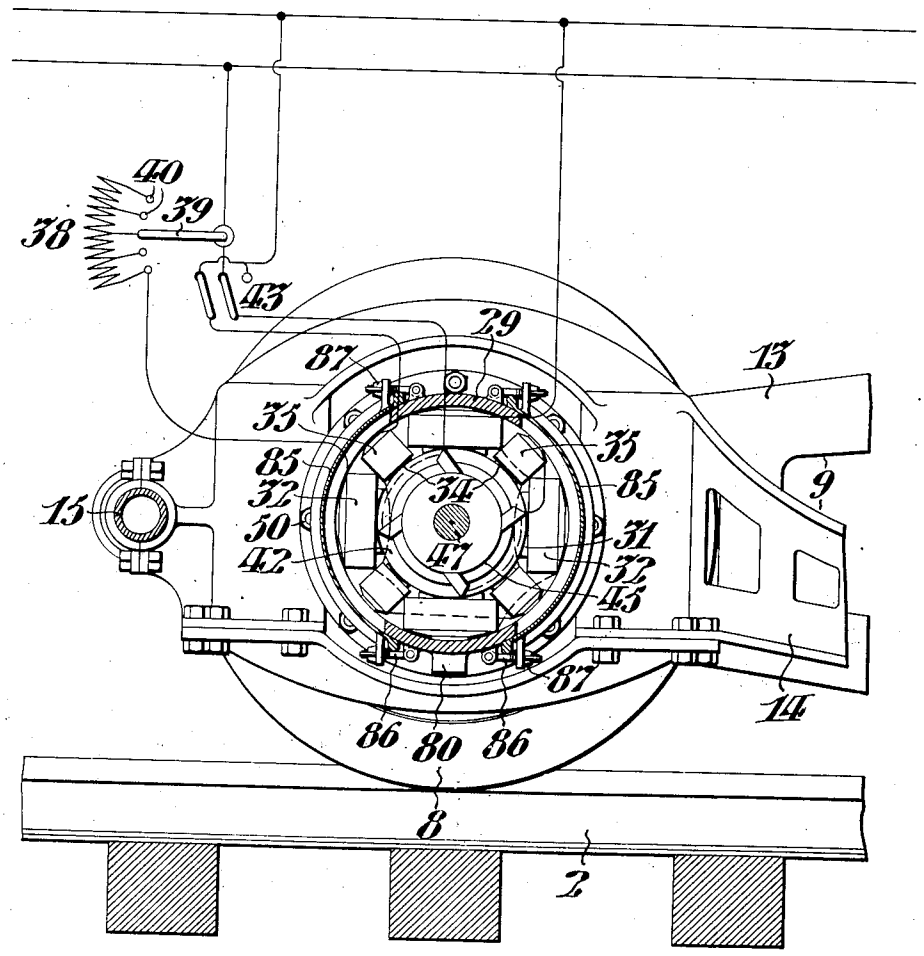
J. LEDWINKA.

ELECTRICALLY PROPELLED VEHICLE.

APPLICATION FILED AUG. 3, 1907.

5 SHEETS—SHEET 5.

FIG. V.




WITNESSES:

Clifton C. Hallowell

Thomas H. Kerr

INVENTOR:

JOSEPH LEDWINKA,

by Arthur E. Barry,

Atty.

# UNITED STATES PATENT OFFICE.

JOSEPH LEDWINKA, OF PHILADELPHIA, PENNSYLVANIA.

## ELECTRICALLY-PROPELLED VEHICLE.

No. 887,483. Specification of Letters Patent. Patented May 12, 1908.

Application filed August 3, 1907. Serial No. 386,860.

*To all whom it may concern:*

Be it known that I, JOSEPH LEDWINKA, of Philadelphia, in the State of Pennsylvania, have invented a certain new and useful Improvement in Electrically-Propelled Vehicles, whereof the following is a specification, reference being had to the accompanying drawings.

My invention relates to what I term a "driving unit" including two vehicle supporting wheels which are maintained in axial alinement but are relatively rotatable by respective independently controllable motors, and my improvement is particularly applicable to trucks for trolley railway cars.

My invention comprises the various novel features of construction and arrangement hereinafter more definitely specified.

In the drawings; Figure I, is a side elevation of a trolley car embodying my improvement. Fig. II, is a plan view of one of the car trucks shown in Fig. I. Fig. III, is a side view of said truck, partly sectioned on the line III, III, in Fig. II. Fig. IV, is a vertical sectional view of said truck, taken on the line IV, IV, in Figs. II, and III. Fig. V, is a vertical sectional view of said truck, taken on the line V, V, in Fig. IV.

Referring to Fig. I; the car 1, is constructed and arranged to traverse the tracks 2, which are included in an electric supply circuit with the overhead wire 3, with which connection is made from said car by means of the trolley poles 4, and 5, which are employed in alternation in accordance with the direction of traverse of the car. Said car is provided with eight supporting wheels 8, arranged in four pairs, each pair comprising what I term a driving unit, and two of said driving units being employed in each of the trucks 9, which may be provided with brake mechanism 10, of any suitable construction to operate the brake shoes 11.

Referring particularly to Figs. II, and III; it is to be understood that each of the trucks shown in Fig. I, comprises a rigid frame formed of the opposed side plates 13, and intermediate girders 14, connected by the cylindrical tubular end cross bars 15, and intermediate cross bar 16. The springs 17, which are seated on said intermediate cross bar 16, are interposed between the latter and the truck bolster 19, which has its opposite rectangular ends 20, fitted for vertical reciprocation in the slideways 21, in said plates 13, and, the effect of said springs 17, is supplemented by the springs 22, which are interposed between said plates 13, and said bolsters. Said girders 14, comprise casings 24, for the springs 25, 26, which respectively extend in said girders 14, above and below the lugs 27, projecting horizontally from the hollow cylindrical axles 29. Said axles 29, respectively connect each pair of wheels 8, in axial alinement and constitute motor field frames.

Referring to Figs. IV, and V; each of said motor field frames 29, is common to two inter-pole fields, each comprising a plurality of main polar projections 31, provided with coils 32, and, a plurality of auxiliary polar projections 34, provided with coils 35. As indicated in Fig. V; said main field coils 32, are connected in series relation with a resistance 38, which may be varied by movement of the lever 39, with respect to the contacts 40, and said main field coils 32, are in shunt relation with the windings of the armature 42, which is local thereto. The rheostat described constitutes preferable means for manually varying the strength of the main field of the motor to weaken said field in correspondence with any desired increase in the speed of rotation of the armature. Said auxiliary field coils 35, are included in a separate circuit in series relation with each other and with the local armature windings, and said circuit includes the double pole switch 43, whereby the direction of the current may be reversed with respect to said auxiliary field and armature, to reverse the rotation of the latter. It is to be understood that the function and effect of the interpolar arrangement described is to enable the motor to effect commutation during rotation in either direction, without sparking, with a variable load and at variable speed. All of the coils of the auxiliary field being connected in series with the armature, weakening of the field of commutation by an increased load is prevented, and the auxiliary poles produce the required compensatory field of commutation, independently of the main field, which as aforesaid must be weakened in correspondence with increase in the speed of rotation of the armature. Of course, the function or effect of the auxiliary field pole is independent of the direction of rotation of the armature, because if the latter is reversed, the current in the auxiliary field is also reversed. As shown in Fig. IV; said armatures 42, and their commutators 45, are rigidly carried on shafts 47, which are maintained in axial alinement in the axial field

frames 29, but are independently rotatable, being respectively connected in rigid relation with the opposite vehicle supporting wheels 8, to independently rotate the latter. As shown in Fig. IV; said axial field frame 29, is provided with opposite alined trunnions 49, detachably secured by bolts 50, and provided with bearings 51, detachably fitted in the hubs 52, of said wheels 8, and retained by the split collars 53, having flanges 54, engaging annular recesses in said trunnions 49. Each wheel 8, has an annular oil chamber 57, which may be charged with oil 58, through the openings which are normally closed by the plugs 59, said oil having access to the bearings 51, through openings 60.

Each wheel 8, is rigidly connected by its hub cap 62, with its respective armature shaft 47, the latter being conveniently provided with a tapered rectangular seat 64, so as to be rigidly but removably retained in said cap by means of the nut 65, and washer 66; said cut being fitted to the screw threaded end 67, of the shaft, on which it is normally retained by the cotter pin 68. The opposed inner ends of said armature shafts 47 are alined in the bearings 70, in the standards 71, which is in rigid relation with the said hollow axial field frame 29. Said bearing standard 71, has chambers 73, containing oil 74, which is supplied to the shafts 47, by the chains 75, which are rotated by frictional engagement with said shafts. As shown in Fig. IV; each of said armature shafts 47 is provided with an air circulating fan 78, and air is directed to and through said axial field frames 29, by the openings 79, and 80. As shown in Figs. II, IV, and V; said axial field frames 29, are provided with openings 83, local to the commutators 45, normally closed by the doors 85, best shown in Fig. V, which are connected with said frames 29, by the swing bolts 86, and nuts 87.

It is to be understood that each of the driving units above described, comprising a connected pair of independently rotary wheels 8, may be removed and replaced with respect to the truck frame with the same facility as an ordinary pair of car wheels rigidly connected by an axle. Moreover, each wheel 8, may be removed independently, without disturbing the remainder of the truck, by unscrewing its nut 65, removing its cap 62, and split collar 53; thus permitting the wheel to be slipped off its trunnion 49. If it is desired to also remove the armature 42; the bolts 50, may be removed so as to permit the withdrawal of the trunnion 49, and armature from the frame 29.

I do not desire to limit myself to the precise details of construction and arrangement above described, as it is obvious that various modifications may be made therein without departing from the essential features of my invention, as defined in the appended claims.

I claim:—

1. The combination with a motor field frame having nonrotatable trunnions at its respectively opposite ends; of wheels fitted to rotate on said trunnions; independent shafts respectively connected in rigid relation with said wheels, and mounted to rotate in said frame in axial alinement, in concentric relation with said trunnions; armatures respectively carried by said shafts; distinct and independently controllable magnetic fields for the respective armatures, comprising, main polar projections in said frame respectively local to said armatures, auxiliary polar projections in said frame respectively local to said armatures and interposed between said main polar projections, coils respectively arranged to energize said main polar projections and auxiliary polar projections, means connecting said main field coils in shunt relation to the armature windings, means connecting said auxiliary field coils in series relation to the armature windings, and, means arranged to adjustably vary the strength of the current in said main field independently of said auxiliary field, substantially as set forth.

2. The combination with a motor field frame having nonrotatable trunnions at its respectively opposite ends; of means detachably connecting said trunnions in rigid relation with said frame; wheels fitted to rotate on said trunnions; independent shafts respectively connected in operative relation with said wheels, and mounted to rotate in said frame in axial alinement, in concentric relation with said trunnions; armatures respectively carried by said shafts; distinct and independently controllable magnetic fields for the respective armatures, comprising main polar projections in said frame respectively local to said armatures, auxiliary polar projections in said frame respectively local to said armatures and interposed between said main polar projections, coils respectively arranged to energize said main polar projections and auxiliary polar projections, means connecting said main field coils in shunt relation to the armature windings, means connecting said auxiliary field coils in series relation to the armature windings, and, means arranged to adjustably vary the strength of the current in said main field independently of said auxiliary field, substantially as set forth.

3. The combination with a motor field frame provided with two distinct and independently controllable fields comprising polar projections; of nonrotatable trunnions at the respectively opposite ends of said frame; means, independent of said polar projections, detachably connecting said trunnions with said frame; wheels fitted to

rotate on said trunnions; independent shafts respectively connected in operative relation with said wheels and mounted to rotate in said frame, in axial alinement, in concentric relation with said trunnions; and, armatures respectively carried by said shafts in operative relation with said polar projections, substantially as set forth.

4. The combination with a motor field frame, of nonrotatable trunnions at the respectively opposite ends of said frame; means detachably connecting said trunnions with said frame; wheels fitted to rotate on said trunnions; independent shafts respectively mounted to rotate in said frame, in axial alinement, in concentric relation with said trunnions; means detachably connecting said wheels with said shafts; and, armatures respectively carried by said shafts in operative relation with polar projections within said frame, substantially as set forth.

In testimony whereof, I have hereunto signed my name at Philadelphia, Pennsylvania, this 23rd day of July 1907.

JOSEPH LEDWINKA.

Witnesses:
ARTHUR E. PAIGE,
ANNA F. GETZRFREAD.