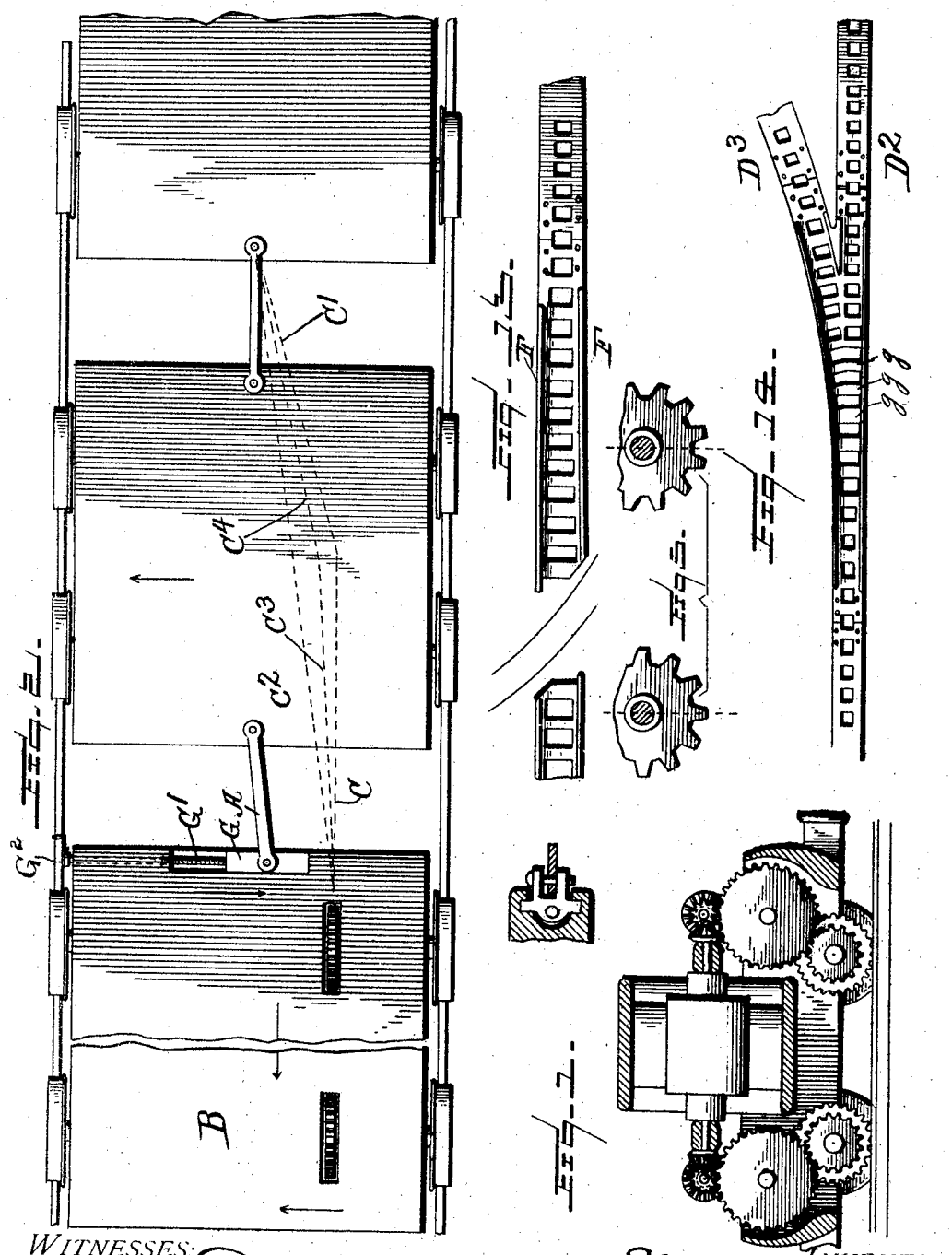
No. 772,679. PATENTED OCT. 18, 1904.

E. A. SPERRY.

ELECTRIC RAILWAY SYSTEM.

APPLICATION FILED NOV. 12, 1902.

NO MODEL. 3 SHEETS—SHEET 1.



WITNESSES:

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NO MODEL. 3 SHEETS—SHEET 2.

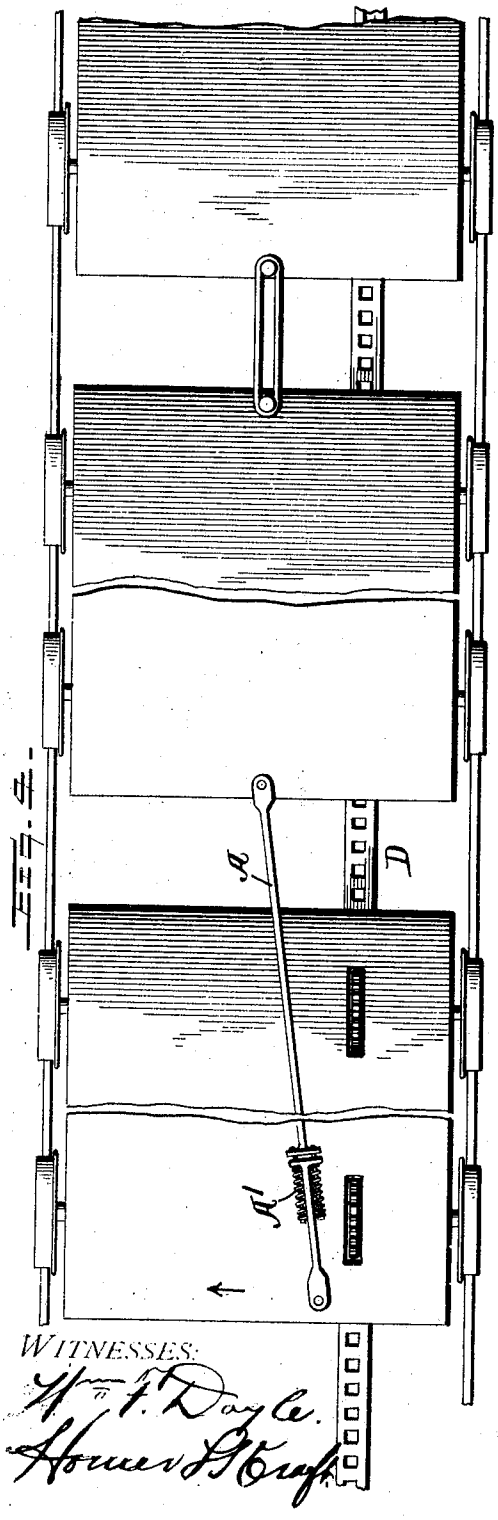


FIG. 4.

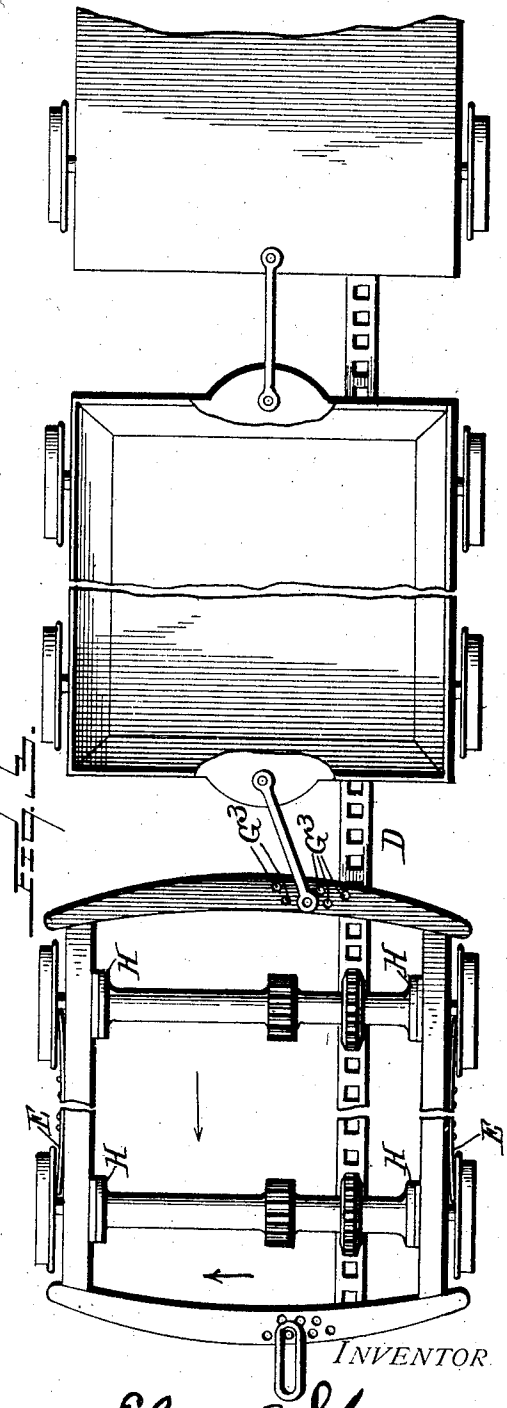


FIG. 5.

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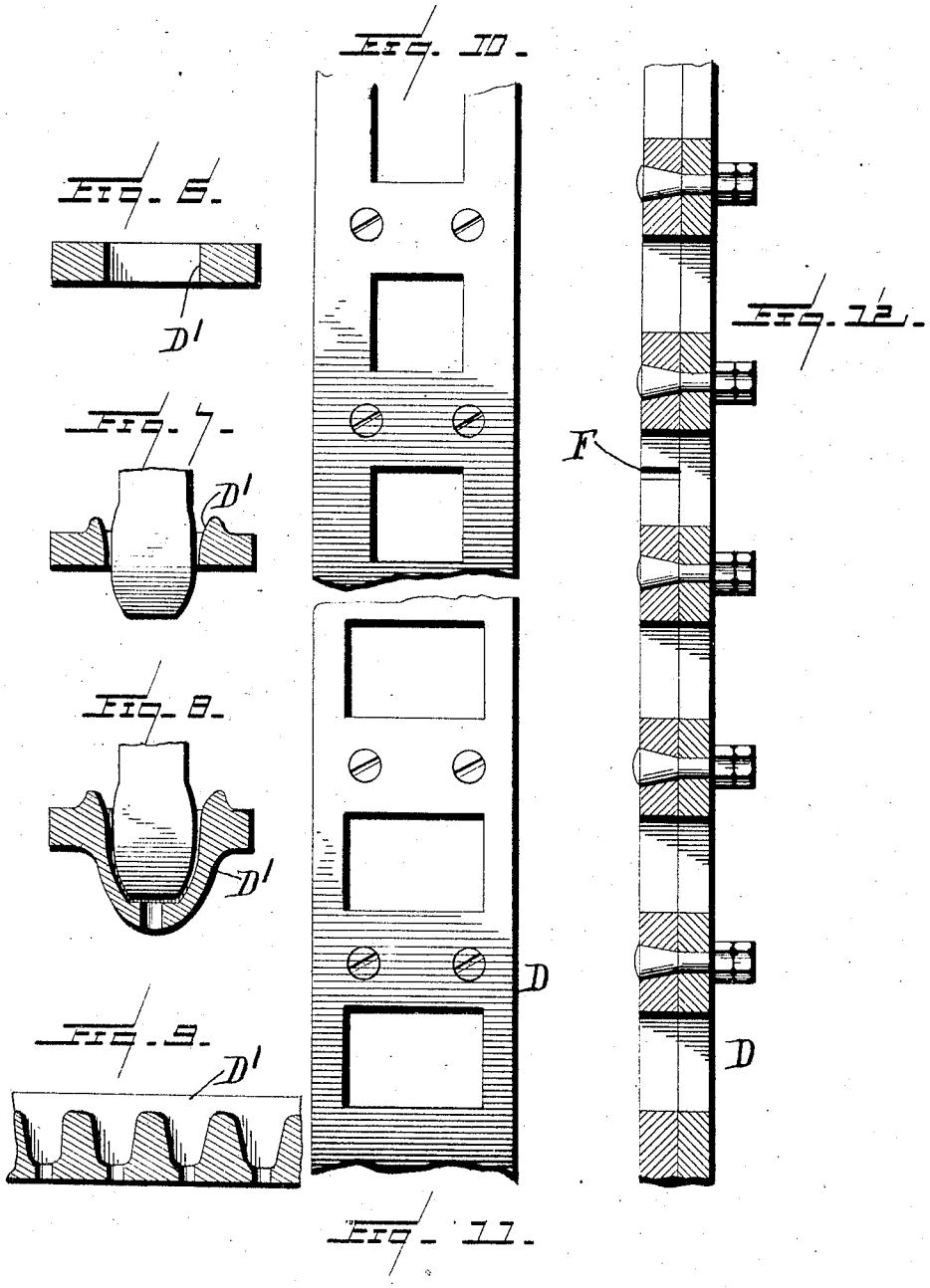
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ELECTRIC RAILWAY SYSTEM.

APPLICATION FILED NOV. 12, 1902.

NO MODEL. 3 SHEETS—SHEET 3.



WITNESSES:

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No. 772,679. Patented October 18, 1904.

UNITED STATES PATENT OFFICE.

ELMER A. SPERRY, OF CLEVELAND, OHIO, ASSIGNOR, BY MESNE ASSIGNMENTS, TO MORGAN ELECTRIC MACHINE COMPANY OF WEST VIRGINIA, OF CHICAGO, ILLINOIS, A CORPORATION OF WEST VIRGINIA.

ELECTRIC-RAILWAY SYSTEM.

SPECIFICATION forming part of Letters Patent No. 772,679, dated October 18, 1904.

Application filed November 12, 1902. Serial No. 130,998. (No model.)

To all whom it may concern:

Be it known that I, ELMER A. SPERRY, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented a certain new and useful Improvement in Electric-Railway Systems, of which the following is a specification.

My invention relates to electric-railway systems, and has for its object to provide a new and improved system and construction of this description.

My invention is illustrated in the accompanying drawings, wherein—

Figure 1 is a view of a car or locomotive in part section, showing one form of driving mechanism. Fig. 2 is a plan view with parts omitted, showing a locomotive and trailers hauled thereby. Figs. 3 and 4 are plan views with parts omitted, showing details of the truck-wheels and connections between the cars. Fig. 5 is a view showing the relation of sprocket-teeth engagement of rack with axles. Figs. 6, 7, and 8 show different forms of sections of the racks. Fig. 9 is a view showing a side elevation of the rack in the form of a casting. Fig. 10 is a view of a standard section for the straight rack. Fig. 11 is a view of a standard section for a curved rack. Fig. 12 is a longitudinal section showing joint. Fig. 13 is a view showing a gap in the rack. Fig. 14 is a view showing a frog and its connections.

Like letters refer to like parts throughout the several figures.

My invention more particularly relates to that class wherein a third rail is employed to connect the locomotive or car with the electric generator, such rail being used as a traction rack or rail coöperating with a driving mechanism on the locomotive for the purpose of propelling the car or locomotive by positive engagement. In a locomotive of this class it has been proposed to maintain the alinement by use of the flange-wheels resting upon the track. In the present invention I am enabled to maintain the alinement of the truck or wheel frame in whole or in part by the use of a construction comprising two or more positive engaging devices, such as sprockets, coöperating with a rack, such sprockets at a distance from each other, the rack and sprockets being provided with side-bearing arrangements whereby any side strains and side thrusts are taken in part or in whole on the rack as counterdistinguished from the track-rail or rails through the engagement of the ordinary flanged wheels. When the traction is provided for independent of adhesion between the wheel and track-rails, the locomotive should be and is as light as possible and is inadequate to hold the locomotive through the ordinary flange engagement against any large amount of side pull, especially where the rack is located at one side of the center or out of line with the general draft system employed on the road and used with the locomotive. When the rack is at the side, as shown in the drawings, the car tends to twist or "slew" around, especially if drawing heavy loads. A locomotive of this nature may be made to develop a draw-bar pull of one hundred and twenty-five per cent. of its total weight, and it will be at once seen that a flange operating simply by friction is insignificant as compared to the other forces present, and it has been found that it is much better to depend in the main for the alinement on the parts themselves which produce the strains and where the engaging faces may be vertical and where their surfaces may receive power or enforced engagement. With a flaring flange it is known that the action is only incidental and in no way positive.

In the present invention I am enabled to overcome the evil effect of the twisting tendency of the locomotive while in action in two ways—first, as above pointed out, by maintaining its alinement by means of engagement with the rack, and, second, by counteracting or neutralizing the twisting tendency itself.

By reference to Figs. 2 and 3 it will be seen, considering the locomotive by itself, that when this machine is driven in the direction of the arrow by the sprockets which are out of center the lower side (in the drawings) of the machine tends to get ahead of the upper side, giving a clockwise-twisting tendency to

the locomotive as a whole. When the locomotive is used to haul or push cars, this tendency is increased as the power exerted increases, and I have discovered that this tendency may be counterbalanced and practically neutralized by the angle at which the power is delivered to the trailer or trailers. I have also found that this angle should vary with the power transmitted; but as the twisting strain is negligible at low powers the maximum or average upgrade load may be employed as the governing factor.

In Figs. 2, 3, and 4 I have shown several arrangements of the draw-bar or connecting-link. The one shown in full lines, Fig. 2, at A is the preferred form as to angle. By this arrangement the clockwise tendency to twist on the part of the locomotive is neutralized by the draft, the angle of which is so adjusted as to exert about an equal anticlockwise-twisting effect upon the locomotive. It will be further seen that this equalizing resultant occurs in pushing as well as in pulling, and it will be seen that for the best results the draw-bar or appliance should have some length.

The adjusting feature in the two forms shown in the drawings allows of a single form of locomotive satisfying widely-varying conditions of grade and load. This obviates the necessity of providing a separate machine for each locality, as the angle which it is preferable to give the draw-bar or the particular hole in the draw-head which it is best to employ for smooth running under any particular condition of load and grade is readily ascertained and the parts adjusted accordingly.

In Fig. 2 I illustrate a draw-bar A and also the possible position of another in dotted lines at C of about equal angle, the one in dotted lines much longer than the other. In Fig. 4 an elastic medium consisting of the ordinary springs A′ A′ in a two-part draw-bar is employed to give smooth running to the trailers where the power emanates from the step-by-step action of a coarse gear or sprocket-teeth engaging the rack.

It will at once be seen that where the alinement of the system is to be maintained in whole or in part through the engagement with the rack D flanking faces D′ on the rack-teeth should be presented, so as to afford a side bearing to the gear or sprocket teeth. (See Figs. 6 to 11.) This can be either provided on the depressed portions of the rack-teeth or by perforations extending through a plate-like rack.

Owing to the necessary gaps or openings in the rack at crossings and the like, (shown in Fig. 13,) the truck is at times with but one engaging sprocket, and the lateral support at such times may fall wholly upon the thrust-bearing faces which are provided between the truck-frame and the car-wheels, between which a predetermined amount of lost motion is provided, any part of which can be taken up by the springs E, (shown in Fig. 3,) through the action of which the truck under normal conditions is centered.

Where two sprockets are employed as one of the means of alinement of the truck, the flanking-faces D′ of the rack are spread out on the curved track and are then wider apart (see Fig. 11) as compared with their standard width, as shown, for example, in Fig. 10.

To avoid twisting, the rack-sections are very securely joined, so as to be rigid against lateral bending movement, Fig. 12. At the gaps in the rack special flaring rack end pieces F are provided, having flanking-faces which are tapering from wide at the end to the standard or "curved" width, where it joins the rack proper. (See Fig. 13.) The section of this end piece can be seen in Fig. 7, showing also the raised lips. The frog-pieces for the rack are also of peculiar structure, the teeth or perforations being wide in the middle and tapering toward the ends, the straight arm D^2 tapering to the standard width, while the other arm, D^3, comes down to the "curve" width. (Illustrated in Fig. 14.)

The flanking-faces of the common or center teeth *g g g* (see Fig. 14) of the frog-pieces are at an angle to each other, and the working faces or engaging faces for pulling are also at an angle to each other on each longitudinal face to provide for better bearing-surfaces.

The tapering at the stem of the Y is preferably more gradual than the other two arms. The joint F between the rack-sections is preferably at or near the middle of a depression or perforation, (see Fig. 12,) whereby a solid pulling mass is found between each perforation, and at the same time the flanking-faces are present and sufficiently perfect to perform their function.

The draw-bar or connecting piece or link may be of any suitable form, preferably supplying within itself or between the sprockets and a trailer a resilient medium (shown in Fig. 4) and for the purpose hereinbefore pointed out. The preferred form, however, consists of the comparatively short draw-bar or connecting-piece, provided with means for adjusting its angle. Any means for adjusting this angle may be employed; but I prefer to use the simple device of the adjustable piece G, actuated by the screw G′ through handle G^2, (see Fig. 2,) or a plurality of points of attachment consisting of the "staggered" holes G in the draw-head, (see Fig. 3,) preferably located in the region between the rack and the center of the track.

The rack is placed at one side of the center of the track for the purpose of providing a path for men and animals. Especially is this necessary where the track is used as an entry or highway, which is almost universally the case in mining operations.

The angle of the draw-bar or connecting-piece or its point of attachment may be varied

to suit the special requirement. This position should be such that under all conditions the strain or average strains delivered to the draw-bar of the locomotive is such as to counterbalance the twisting effect of the out-of-center traction mechanism to the best effect while running.

That the rack may do its part of the work of centering and holding the truck it is desirable that the revolving sprocket should be provided with thrust-bearings, as between the sprocket and the truck or their connected parts, as shown, for example, at H, Fig. 3. The lateral working faces of the sprocket-teeth are clearly shown in Figs. 7 and 8.

I find that working, especially under heavy loads, is accomplished much smoother if the gears of the sprocket centers are not an even pitch multiple apart. An odd multiple of one-half the pitch is found preferable for this purpose. This is illustrated in Fig. 5.

In the case of the locomotive the vertical arrows illustrate the twisting tendency when the locomotive is propelled in the direction of the horizontal arrow. In the first place, supposing the draw-bar or connecting-piece to be in line with the driving-sprockets and to project directly to the rear, as indicated in dotted lines by draw-bar C, Fig. 2, the strains in this instance would fall directly in line with the draft-producing sprockets, and no twisting effect would result from the action of the draw-bar. Here we find a case where an out-of-center draft system may be so coupled to its trailers or working load that no twisting tendency of consequence is present, and by altering the angle slightly the trifling amount of twisting effect remaining can be entirely neutralized. If this draw-bar C should be anchored to the first car and projected back to the draw-head of the second car at an angle, as shown at C′, the side thrust would be taken by the first car in the direction of its arrow. Again, if a long draw-bar C^2 were employed extending to the draw-head of the second car at an angle, as shown, a twisting tendency would be developed on the locomotive, but in the opposite direction to that developed by the sprockets, which it would tend in a measure to balance, and there would be no side strain on the first car. If, however, we shift the point of contact with the first car to an intermediate point between draw-bars C and C^2, as indicated by the draw-bars C^3 and C^4, there would still be a slight side action on the first car in the line of its arrow and also a slight twisting tendency on the locomotive. Again, if we use the regular draw-bar, as shown in full lines, between the locomotive and the first car and join it to a locomotive draw-head which is capable of adjustment transversely, as by the screw and crank, as shown, it will at once be seen that any desired angle may be imparted to the draw-bar, which thus may be utilized to counteract to a nicety the twisting effect of the out-of-center-draft system when working in conjunction with a center-draft system of trailers or working load.

I have illustrated in detail a particular construction embodying my invention; but it is of course evident that this construction may be greatly varied and that some of the parts may be omitted and others used with parts not here shown without departing from the spirit of my invention.

By means of this invention the operation of electric-railway systems, particularly in such places as mines and tunnels, and especially where grades exist, is very greatly simplified and made much cheaper and more efficient and satisfactory and permits the adaptation to circumstances and conditions not commercially possible in the ordinary electric-railway system. The arrangement of the draft mechanism, the rack-engaging devices, and the special features of the rack, including frogs, cross-overs, &c., herein illustrated permits of an efficient and reliable operation of an electric railway under economic conditions and insures certainty and efficiency of action wholly absent in the ordinary electric-railway systems.

I claim—

1. In an electric-railway system, a road-bed consisting of sleepers and a two-rail track, a traction-rack located to one side of the center of the road-bed, a car-truck having wheels resting upon the rails, a plurality of sprockets or drive-gears engaging the rack for propelling the car and means located between two of such sprockets and the truck for preventing lateral movement between the truck and sprocket.

2. In an electric-railway system, a road-bed, consisting of sleepers and a two-rail track, a traction-rack located to one side of the center of the road-bed, the rack provided with means for lateral support of the sprockets, a car-truck having wheels resting upon the rails, a plurality of sprockets or drive-gears engaging the rack for propelling the car, and means located between two of such sprockets and the truck for preventing lateral movement between the truck and sprocket for the purpose specified.

3. In an electric-railway system, a road-bed, consisting of sleepers and a two-rail track, a traction-rack located to one side of the center of the road-bed, the rack provided with teeth or equivalent projections, the said teeth provided with lateral flanks or faces, a car-truck having wheels resting upon the rails, a plurality of sprockets or drive-gears engaging the rack for propelling the car and means located between two of such sprockets and the truck for preventing lateral movement between the truck and sprocket for the purpose specified.

4. In an electric-railway system, a road-bed

consisting of sleepers and a two-rail track, a traction-rack located to one side of the center of the road-bed, the rack provided with teeth or equivalent projections, the said teeth provided with lateral flanks or faces on each side of the depressed portion of such teeth, a car-truck having wheels resting upon the rails, a plurality of sprockets or drive-gears engaging the rack for propelling the car, and means located between two of such sprockets and the truck for preventing lateral movement between the truck and sprocket for the purpose specified.

5. In an electric-railway system, a road-bed, consisting of sleepers and a two-rail track, a traction-rack located to one side of the center of the road-bed, said rack consisting of metal sections, perforated with rectangular holes having straight side faces, a car-truck having wheels resting upon the rails, a plurality of sprockets or drive-gears engaging the rack for propelling the car, and means located between two of such sprockets and the truck for preventing lateral movement between the truck and sprocket for the purpose specified.

6. In an electric-railway system, a road-bed, consisting of sleepers and a two-rail track, a traction-rack, located to one side of the center of the road-bed, said rack consisting of metal sections, perforated with rectangular holes having straight side faces, parallel to the road-bed and in vertical plane, a car-truck having wheels resting upon the rails a plurality of sprockets or drive-gears engaging the rack for propelling the car and means located between two of such sprockets and the truck for preventing lateral movement between the truck and sprocket.

7. In an electric-railway system, a road-bed having track-rails, a traction-rack, a car-truck having wheels resting upon the rails, a sprocket or drive-gear mounted upon the truck and engaging the rack for propelling the car, and means for preventing lateral movement of the propelling-gear relative to the car-truck, for the purpose set forth.

8. In an electric-railway system, a road-bed having track-rails, a traction-rack, and means for securing said traction-rack against lateral deflection, a car-truck having wheels resting upon the rails, a sprocket or drive-gear engaging the rack for propelling the same, a support for said gear or sprocket, said support having bearings at the ends thereof against opposite sides of the truck-frame to prevent lateral movement of said sprocket or gear with reference to the truck-frame, for the purpose set forth.

9. In an electric-railway system, a road-bed, consisting of sleepers and a two-rail track, a traction-rack located at one side of the center of the road-bed, a rack provided with means for lateral support of the sprockets, a car-truck having wheels resting upon the rails, a plurality of sprockets or drive-gears engaging the rack for propelling the car, the sprockets provided with means for lateral engagement with the rack, and means located between two of such sprockets and the truck for preventing lateral movement between the truck and sprocket for the purpose specified, substantially as described.

10. In an electric-railway system, a road-bed, consisting of sleepers and a two-rail track, a traction-rack located at one side of the center of the road-bed, a rack provided with means for lateral support of the sprockets, a car-truck having wheels resting upon the rails, a plurality of sprockets or drive-gears engaging the rack for propelling the car, the sprocket-teeth provided with lateral wearing-faces, and means located between two of such sprockets and the truck for preventing lateral movement between the truck and sprocket for the purpose specified, substantially as described.

11. In an electric-railway system, a road-bed, consisting of sleepers and a two-rail track, a traction-rack located at one side of the center of the road-bed, the rack provided with means for lateral support of the sprockets, a car-truck having wheels resting upon the rails, a plurality of sprockets or drive-gears engaging the rack for propelling the car, the sprocket-teeth provided with lateral tapering ends, and means located between two of such sprockets and the truck for preventing lateral movement between the truck and sprocket for the purpose specified, substantially as described.

12. In an electric-railway system, a road-bed, consisting of sleepers and a two-rail track, a traction-rack located to one side of the center of the road-bed, a car-truck having wheels resting upon the rails, a plurality of sprockets or drive-gears engaging the rack for propelling the car, and lateral running bearings between the truck and the sprockets for providing against end thrust, and means located between two of such sprockets and the truck for preventing lateral movement between the truck and sprocket for the purpose specified, substantially as described.

13. In an electric-railway system, a road-bed, consisting of sleepers and a two-rail track, a traction-rack located to one side of the center of the road-bed, a car-truck having wheels resting upon the rails, a plurality of sprockets or drive-gears engaging the rack for propelling the car, and lateral running bearings between the truck and each lateral face of the sprockets for providing against lateral thrust in each direction, and means located between two of such sprockets and the truck for preventing lateral movement between the truck and sprocket for the purpose specified, substantially as described.

14. In an electric-railway system, a road-bed, consisting of sleepers and a two-rail track, a traction-rack located at one side of the center of the road-bed, a car-truck having wheels

resting upon the rails, a sprocket or drive-gear engaging the rack for propelling the car, and a trailer or trailers hauled by such car and an elongated device extending to or beyond the central region of the car for connecting thereto.

15. In an electric-railway system, a road-bed, consisting of sleepers and a two-rail track, a traction-rack located at one side of the center of the road-bed, a car-truck having wheels resting upon the rails, a sprocket or drive-gear engaging the rack for propelling the car and a trailer or trailers hauled by such car, a coupling for connecting thereto, one end of said coupling being located at a point out of the vertical plane of the rack and extending therefrom toward the center of the road-bed.

16. In an electric-railway system, a road-bed, consisting of sleepers and a two-rail-track, a traction-rack located at one side of the center of the road-bed, a car-truck having wheels resting upon the rails, a sprocket or drive-gear engaging the rack for propelling the car, and a load hauled by the electric car consisting of a train of individual cars, the same being centrally connected to each other and connected to the electric car out of center, substantially as described.

17. In a traction system, a locomotive having a traction device out of the center of the locomotive, a draw-bar extending to the load or trailer to be hauled, the draw-bar so connected to the locomotive that the strain exerted therethrough corrects or neutralizes in whole or part the twisting tendency of the locomotive as a whole resulting from the out-of-center traction device.

18. In an electric-railway system, a road-bed, consisting of a two-rail track, a traction-rack, the said rack having gaps or openings as specified, a car-truck having wheels resting upon the rails, a plurality of sprockets or drive-gears engaging the rack for propelling the car, and a special end piece for the rack at such opening, said end piece being of greatest width adjacent the gap or opening.

19. In an electric-railway system, a road-bed, consisting of a two-rail track, a traction-rack, the said rack having gaps or openings as specified and provided with teeth or equivalent projections, the teeth provided with lateral flanks or faces, the said flanks being wider near the openings, a car-truck having wheels resting upon the rails, a plurality of sprockets or drive-gears engaging the rack for propelling the car, substantially as described.

20. In an electric-railway system, a road-bed, consisting of a two-rail track, a traction-rack, the said rack having gaps or openings as specified and provided with teeth or equivalent projections, the teeth provided with lateral flanks or faces, the said flanks being wider near the openings and contracting as they leave such openings to the normal width of the rail-flanks, a car-truck having wheels resting upon the rails, a plurality of sprockets or drive-gears engaging the rack for propelling the car, substantially as described.

21. In an electric-railway system, a road-bed, consisting of a two-rail track, a traction-rack, the said rack provided with means for lateral support of the sprockets, the said means being further separated on curved rack than on straight, a car-truck having wheels resting upon the rails, a plurality of sprockets or drive-gears engaging the rack for propelling the car, substantially as described.

22. In an electric-railway system, a road-bed, consisting of a two-rail track, a traction-rack, the said rack provided with teeth or equivalent projections, the said teeth provided with lateral flanks or faces, the said flanks or faces being closer together in the straight portion of the rack than in the curved portions, a car-truck having wheels resting upon the rails, a plurality of sprockets or drive-gears engaging the rack for propelling the car, substantially as described.

23. In an electric-railway system, a road-bed, consisting of a two-rail track, a traction-rack, the rack provided with teeth or equivalent projections, the said teeth provided with lateral flanks or faces, a Y-shaped frog-piece for the rack provided with perforations, flanking faces for the perforations widely separated in the middle and narrower at the ends of frog-piece, a car-truck having wheels resting upon the rails, a plurality of sprockets or drive-gears engaging the rack for propelling the car.

24. In an electric-railway system, a road-bed, consisting of a two-rail track, a traction-rack, the rack provided with teeth or equivalent projections, the said teeth provided with lateral flanks or faces, a Y-shaped frog-piece for the rack provided with perforations, flanking faces for the perforations widely separated in the middle and tapering narrower toward the ends, a car-truck having wheels resting upon the rails, a plurality of sprockets or drive-gears engaging the rack for propelling the car, substantially as described.

25. In an electric-railway system, a road-bed, consisting of a two-rail track, a traction-rack, the rack provided with teeth or equivalent projections, the said teeth provided with lateral flanks or faces, a Y-shaped frog-piece for the rack provided with perforations, flanking faces for the perforations widely separated in the middle and tapering narrower to standard width on the straight arm, a car-truck having wheels resting upon the rails, a plurality of sprockets or drive-gears engaging the rack for propelling the car, substantially as described.

26. In an electric-railway system, a road-bed, consisting of a two-rail track, a traction-rack, the rack provided with teeth or equivalent projections, the said teeth provided with lateral flanks or faces, a Y-shaped frog-piece

for the rack provided with perforations, flanking faces for the perforations widely separated in the middle and tapering narrower to wider than standard width on the curved arm, a car-truck having wheels resting upon the rails, a plurality of sprockets or drive-gears engaging the rack for propelling the car, substantially as described.

27. In an electric-railway system, a road-bed, consisting of a two-rail track, a traction-rack, the rack provided with teeth or equivalent projections, the said teeth provided with lateral flanks or faces, a Y-shaped frog-piece for the rack provided with perforations, flanking faces for the perforations widely separated in the middle and tapering narrower by more rapid gradations on the curved arm than on the stem of the Y, a car-truck having wheels resting upon the rails, a plurality of sprockets or drive-gears engaging the rack for propelling the car, substantially as described.

28. In an electric-railway system, a road-bed, consisting of a two-rail track, a traction-rack, the rack consisting of perforated sections, the joints between the sections occurring in a perforation, a car-truck having wheels resting upon the rails, a plurality of sprockets or drive-gears engaging the rack for propelling the car, substantially as described.

29. In an electric-railway system a road-bed, consisting of a two-rail track, a traction-rack, a car-truck having wheels resting upon the rails, a plurality of toothed sprockets or drive-gears engaging the rack for propelling the car the distance longitudinally between the sprocket centers being a fractional multiple of the gear-pitch.

30. In an electric-railway system, a road-bed, consisting of a two-rail track, a traction-rack, the rack provided with teeth or equivalent projections, the said teeth provided with lateral flanks or faces, the said rack also consisting of perforated sections, the joints between sections occurring in a perforation and flanking faces for the perforations at the joints, a car-truck having wheels resting upon the rails, a plurality of sprockets or drive-gears engaging the rack for propelling the car, substantially as described.

31. In an electric-railway system, a road-bed, consisting of a two-rail track, a traction-rack, the rack provided with teeth or equivalent projections, the said teeth provided with lateral flanks or faces, the three-arm frog-piece for the rack intersections with perforations at the center having flanking faces out of the parallel, a car-truck having wheels resting upon the rails, a plurality of sprockets or drive-gears engaging the rack for propelling the car, substantially as described.

32. In an electric-railway system a road-bed consisting of a two-rail track, a traction-rack, a three-armed frog-piece for the rack intersections, perforations at the center having two bearing-faces for the sprocket and at an angle to each other, said faces occurring on the same side of the perforation, a car-truck having wheels resting upon the rails, a plurality of sprockets or drive-gears engaging the rack for propelling the car, substantially as described.

33. In an electric-railway system a road-bed consisting of a two-rail track, a traction-rack, a three-armed frog-piece for the rack intersection carrying perforations for joining three portions of rack consisting of an integral piece, a car-truck having wheels resting upon the rails, a plurality of sprockets or drive-gears engaging the rack for propelling the car, substantially as described.

34. In an electric-railway system a road-bed consisting of a two-rail track, a traction-rack, the rack provided with teeth or equivalent projections, the said teeth provided with lateral flanks or faces, a three-armed frog-piece for the rack intersections provided with perforations having flanking-pieces raised above the general level of the rack, a car-truck having wheels resting upon the rails, a plurality of sprockets or drive-gears engaging the rack for propelling the car, substantially as described.

35. In an electric-railway system a road-bed consisting of a two-rail track, a traction-rack, a car-truck having wheels resting upon the rails, a plurality of sprockets or drive-gears engaging the rack for propelling the car the distance longitudinally between the sprocket centers being an odd multiple of one-half the gear-pitch, substantially as described.

36. In a traction system the combination of a motor-car and a trailer, a driving mechanism on the motor-car at one side of the center thereof and means for counteracting the twist due to the side displacement of the driving mechanism.

37. The combination with a motor-car and a trailer of a stationary rack located at one side of the center of the motor-car and a driving connection between the motor-car and the rack and means for counteracting the lateral twist produced by the driving mechanism.

ELMER A. SPERRY.

Witnesses:
JOSEPH C. SHEEHY,
WM. E. NEFF.