No. 814,245. PATENTED MAR. 6, 1906.

P. K. STERN.

RAILWAY AND RAILWAY CAR.

APPLICATION FILED APR. 8, 1905. 5 SHEETS—SHEET 1.

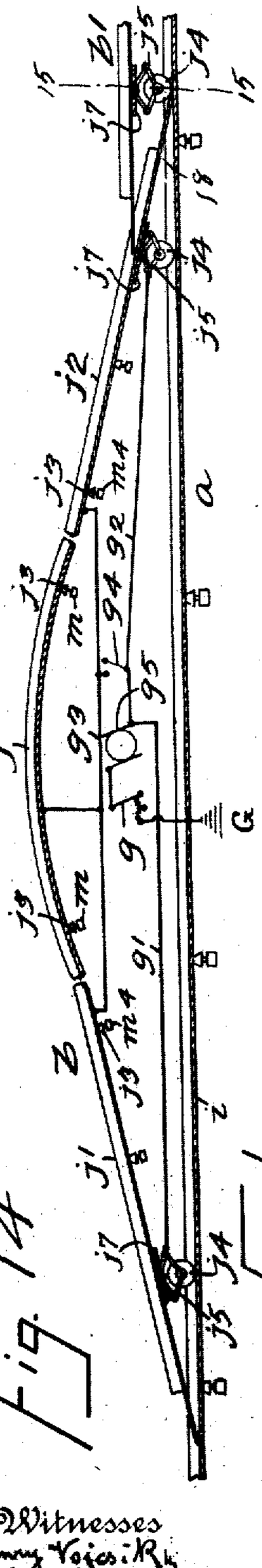


Fig. 14

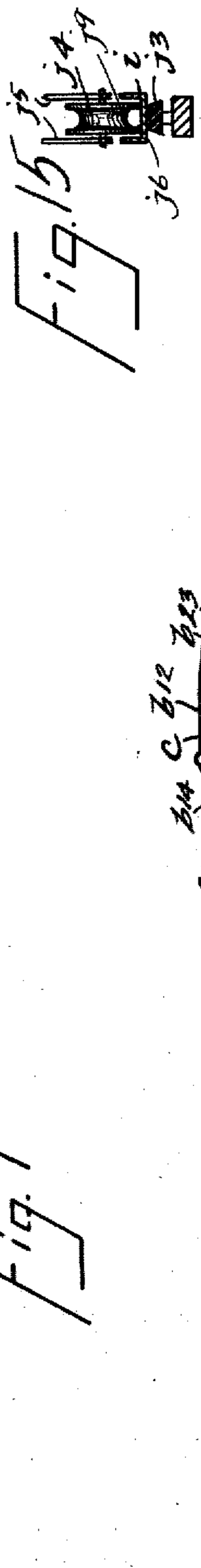
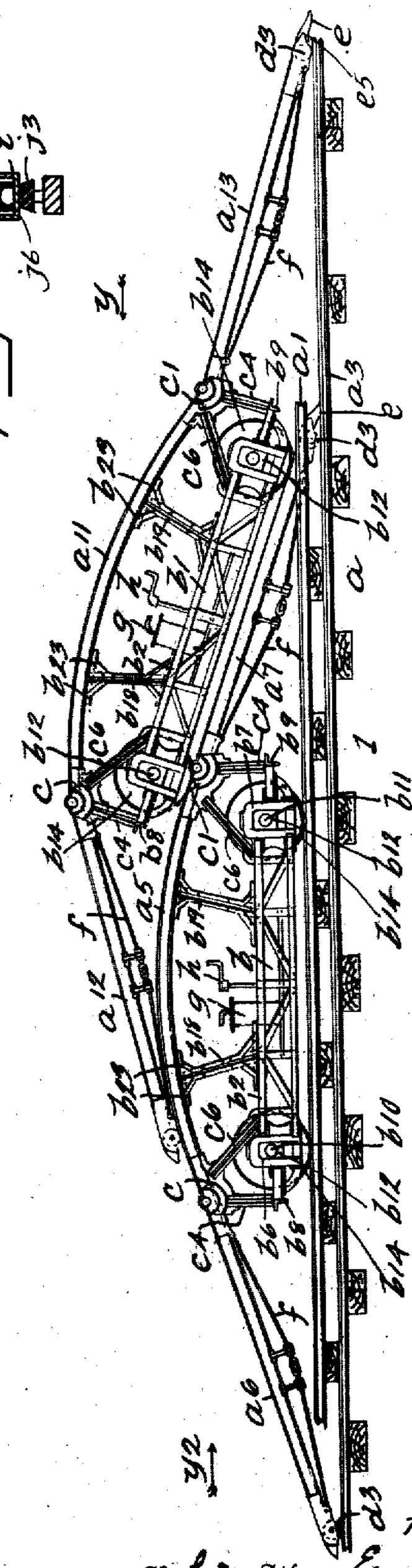


Fig. 1



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6 SHEETS—SHEET 2

Fig. 2

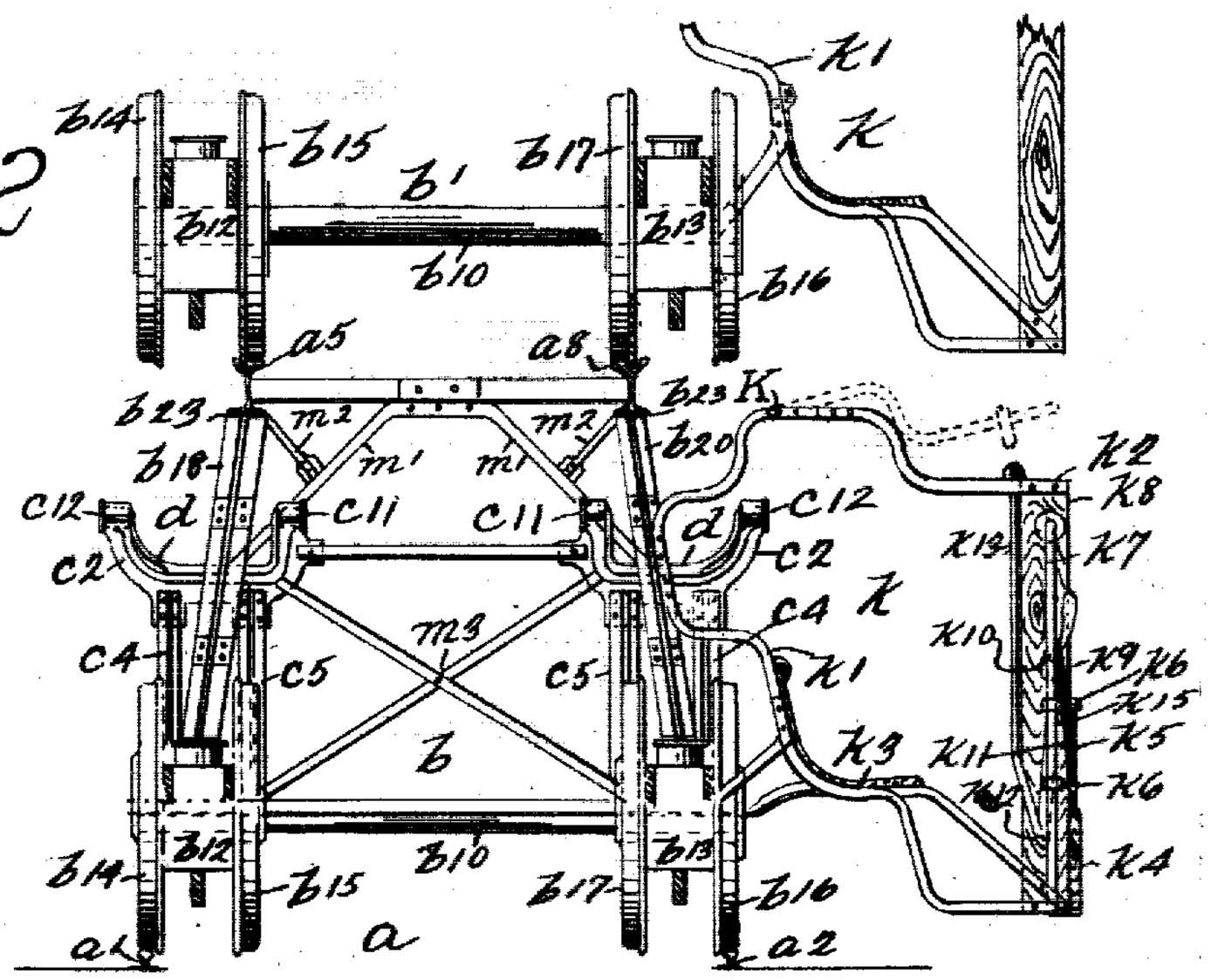
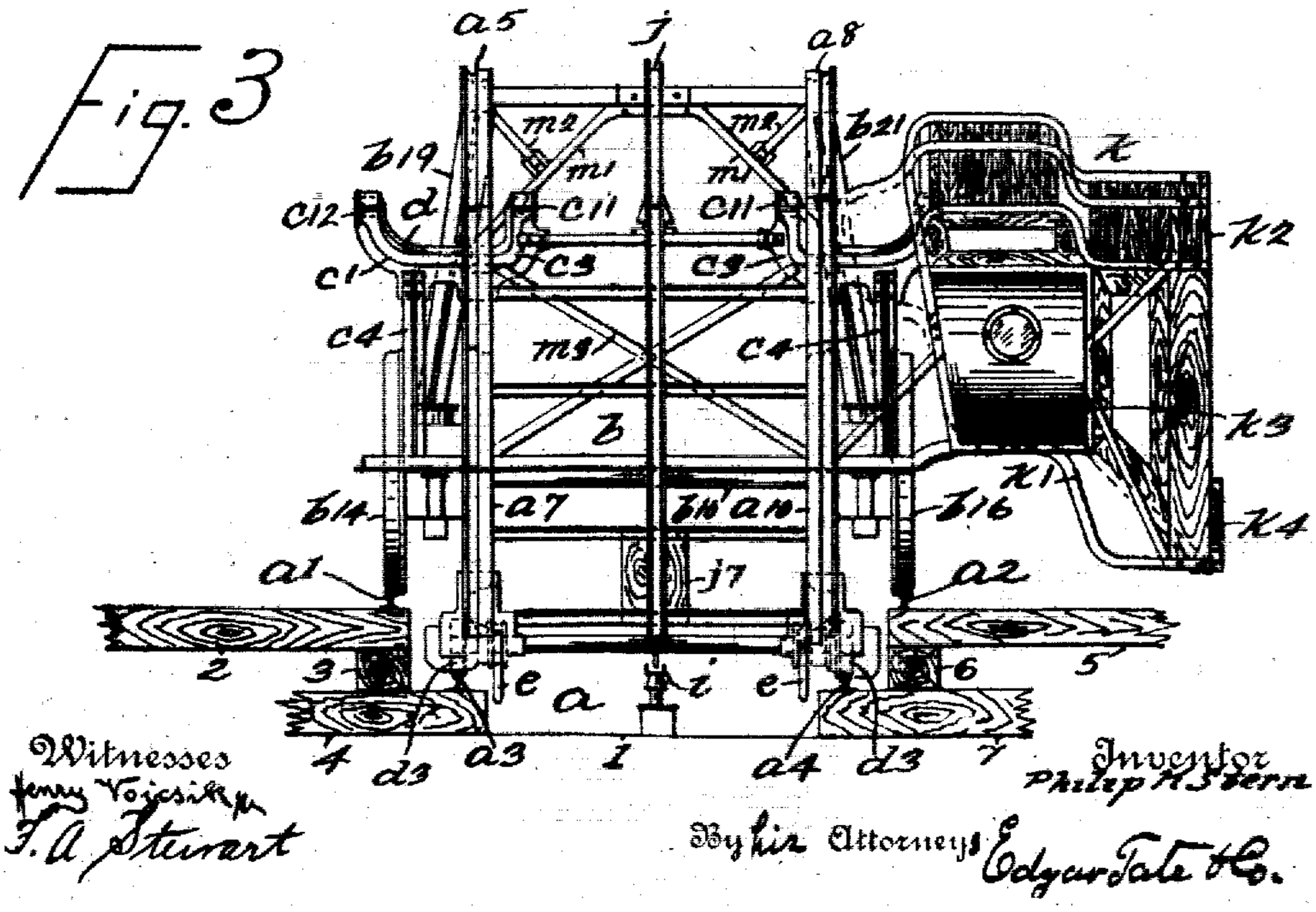


Fig. 3



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APPLICATION FILED APR. 8, 1905. 5 SHEETS—SHEET 3.

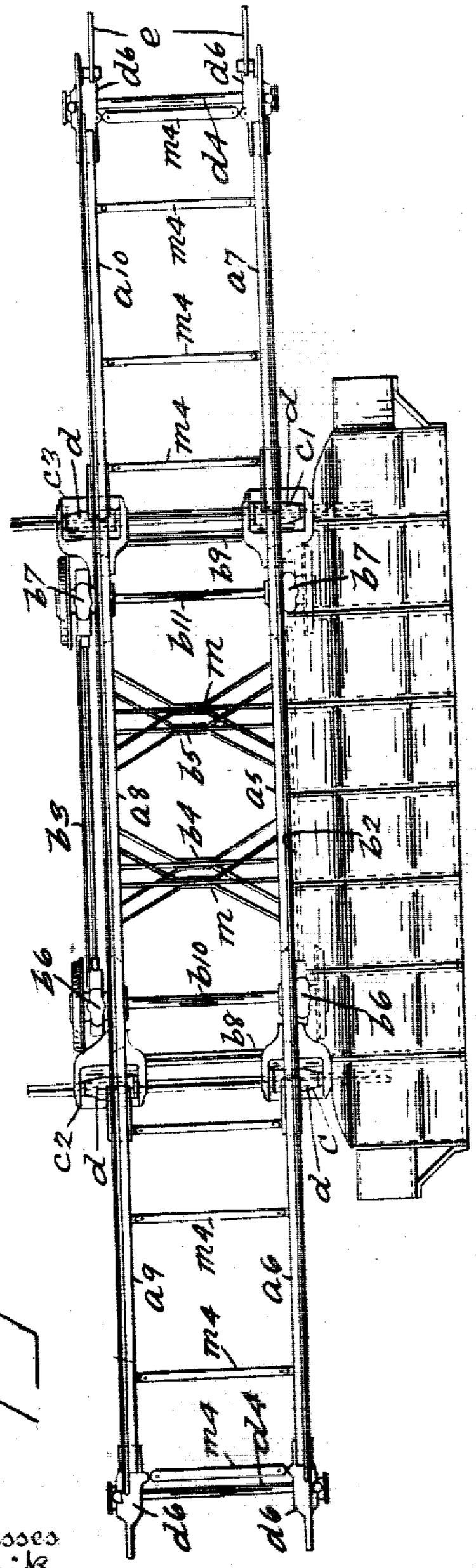

Fig. 4

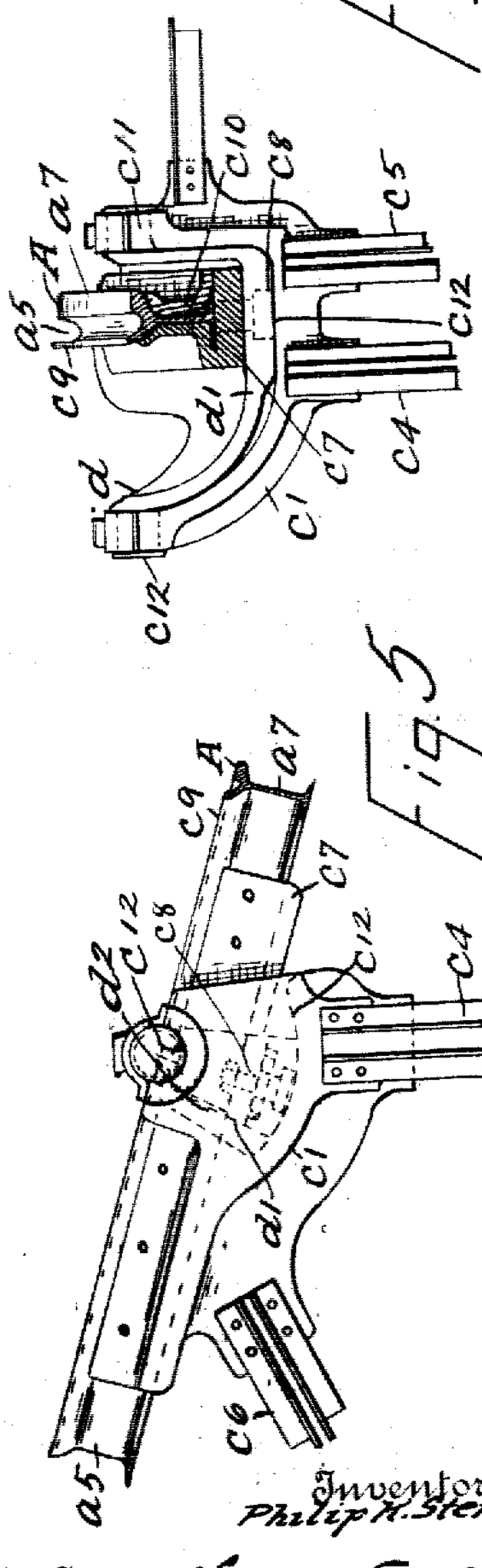

Fig. 6

Fig. 5

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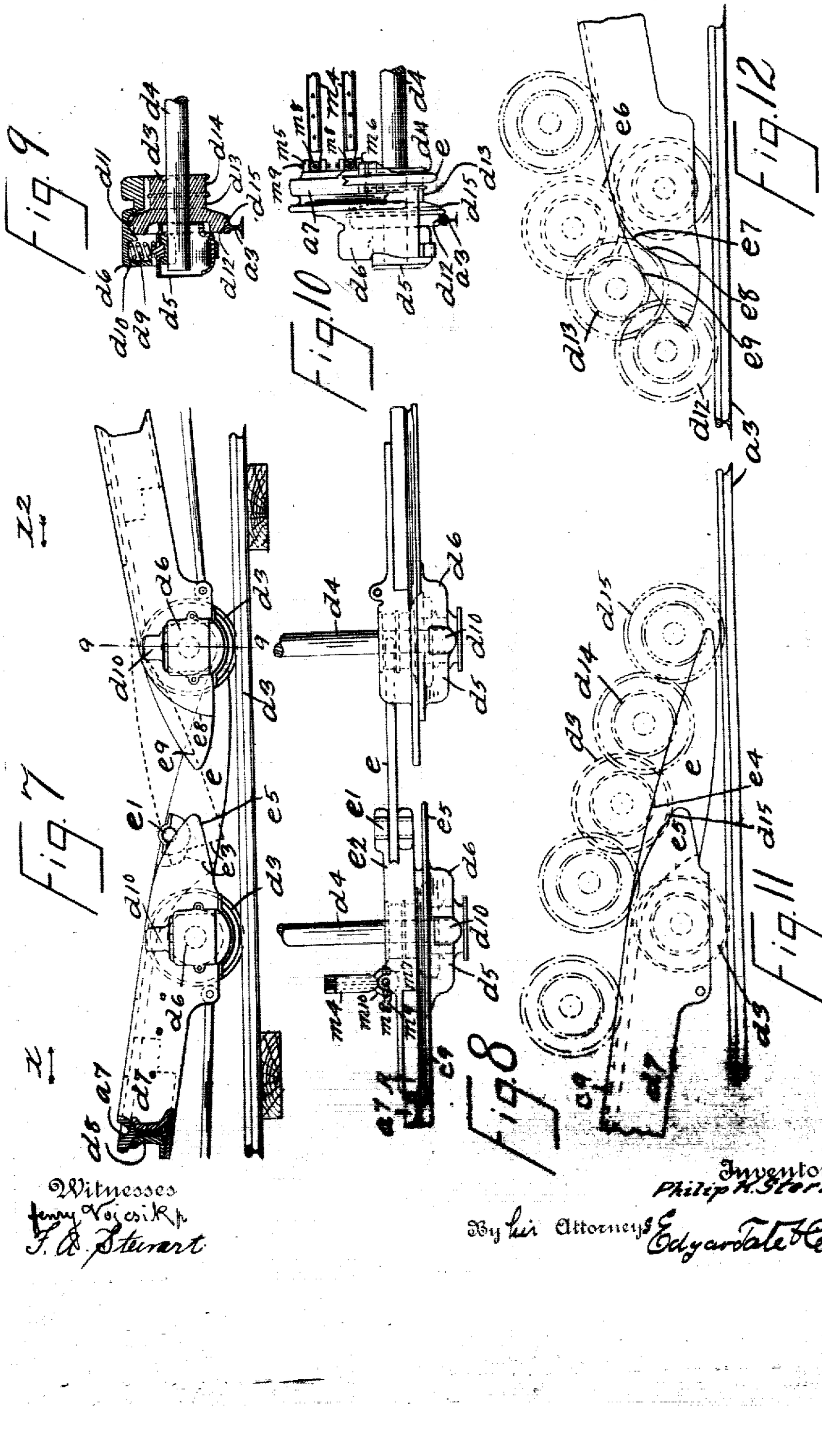
5 SHEETS—SHEET 4



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RAILWAY AND RAILWAY CAR.

APPLICATION FILED APR. 8, 1906.

5 SHEETS—SHEET 5.

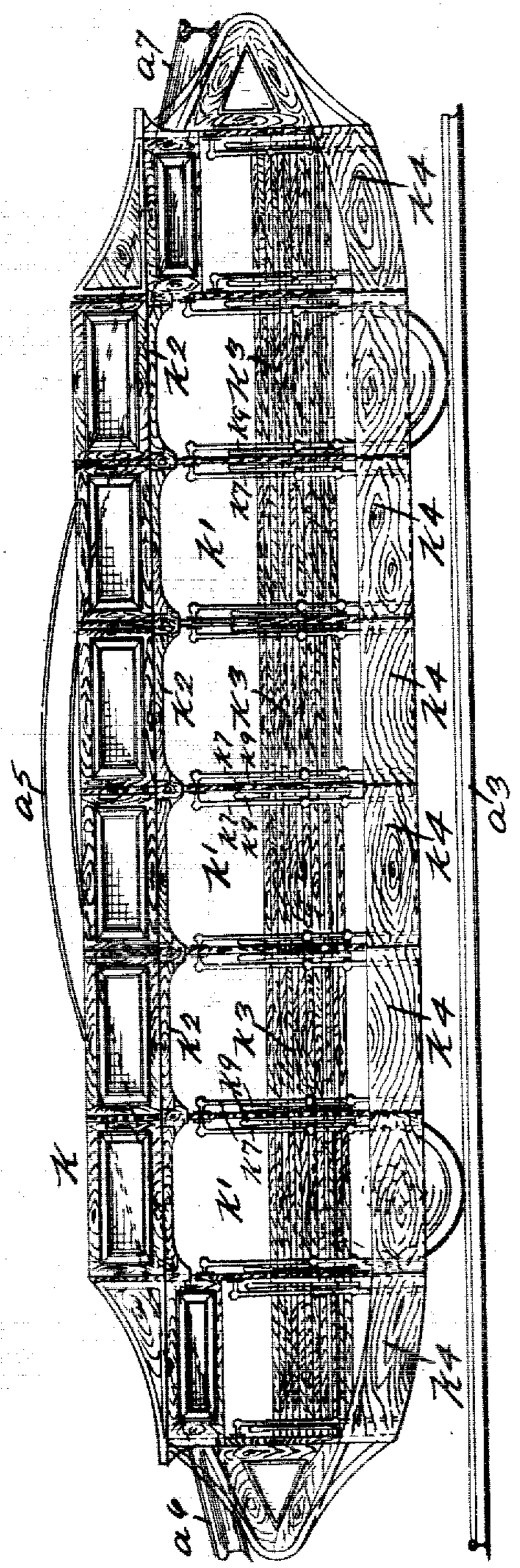

Fig. 13

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UNITED STATES PATENT OFFICE.

PHILIP K. STERN, OF NEW YORK, N. Y.

RAILWAY AND RAILWAY-CAR.

No. 814,245. Specification of Letters Patent. Patented March 6, 1906.

Application filed April 8, 1905. Serial No. 254,442.

To all whom it may concern

Be it known that I, PHILIP K. STERN, a citizen of the United States, residing at New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Railways and Railway-Cars, of which the following is a specification, such as will enable those skilled in the art to which it appertains to make and use the same.

My invention in "railways" relates to new and useful improvements in cars and the track therefor, whereby transportation of the former may be duplexed therein. It also has reference to means for distributing power to the motive-power apparatus of the cars along the route or line of travel; and the object of my invention is to provide a more simple, more positive, and more reliable means for the unobstructed transportation and traversing of cars while in transit in the same or opposite directions in a common track or line of travel.

The chief features characteristic of my invention whereby I am enabled to duplex the transportation of cars on a single line of railway lies in the novel construction of my mobile over-turnout tracks and the switching provisions at their extremities and the manner in which they establish an unbroken connection with the main line or track over which they are adapted to be conveyed and the track and car-truck construction mutually coacting, as will be readily understood by the accompanying drawings and specification relating thereto.

Other minor features will appear in studying the different details and their correlations with the car-truck and track system.

I attain these objects by the construction of and operation of the devices, as shown and described in the accompanying drawings and specification relating thereto, and by the various novel features referred to in the claims concluding.

With brief reference to the drawings, Figure 1 is a side elevational view of the running-gear and over-turnouts of two cars in conjugation and a fragmentary side elevational detailed view of one side of the track construction therefor in accordance with my invention. Fig. 2 is an intermediate cross-sectional elevational view of the running-gear of a car and suspension car-body and a fragmentary end elevational view of a superimposed car, axle, and wheels and suspension car-body, illustrating the clearances of the two cars in traversing. Fig. 3 is an end elevational view of the running gear and over-turnouts and one of the suspension car-bodies, together with a section of the track, in accordance with my invention. Fig. 4 is a top plan view of the same. Fig. 5 is an enlarged side elevational detailed view of one of my over-turnout joints and its support and a fragmentary detailed view of the connecting-track. Fig. 6 is an end elevational view of the same, illustrating the rocker of the aforesaid joint in its supported position on the pedestal therefor and also an oblique and elevational sectional view of the arch-rail terminals and the manner of securing the same to said pedestal. Fig. 7 is an enlarged side elevational detailed view of the terminal of the over-switching rails of the over-turnout in conjugation with corresponding members of an opposing car, illustrating the manner by which the over-turnout terminal of an over-riding car is piloted from grade by the opposing terminal of the under or subtending car or, conversely, from the over-switch to grade depending upon whether one of the cars in conjugation is ascending or descending. Fig. 8 is a top plan view of the same, illustrating more clearly my improved switching provision and a fragmentary detail of the jointed tie connection. Fig. 9 is is a sectional end elevational detailed view of certain parts involved in the switching extremity of the over-turnout construction, taken on the line 9 9 of Fig. 7, and through a pilot-wheel and journal-box and the pilot-yoke and the buffer-spring pocket therein and a cross-sectional view of the pilot-wheel rail, the pilot-wheel journal being taken in side elevation in accordance with my invention. Fig. 10 is an end elevational view of the same, illustrating the downwardly-sloping grooved channels and the pilot-switch illustrated in plan in Fig. 8. Figs. 11 and 12 are diagrammatical views of the opposing rail-terminals of my improved over-turnout tracks, illustrating the different positions of the coacting parts during the piloting operation, as referred to in Fig. 7. Fig. 13 is a side elevational enlarged detailed view of a suspension car-body in accordance with my invention. Fig. 14 is a side elevational and diagrammatic view of the over-switching means for communicating the electrical energy to over-riding vehicles depicted in the end elevational view of Fig. 3. Fig.

15 is an end elevational view of a double-treaded trolley-wheel in position on a section of the insulated electrical third-rail or channel.

In the several views similar characters of reference indicate identical parts throughout, wherein—

a is the track or line of travel in which the cars of the system of my improved railway are adapted to be transported in duplex relation. The track *a* comprises a double railway consisting of two different gages and grades, one a relatively broader gage, consisting of a pair of parallel and longitudinally-extending rails a' and a^2, secured laterally and supported from the road-bed 1 by a suitable tie-and-foundation construction 2 3 4 and 5 6 7 in such manner as to elevate said rails a' and a^2 above the road-bed in the establishment of a grade, and a parallelly-disposed lower or subgrade railway consisting of similar or preferably lighter rails a^3 and a^4, secured to and carried by the ties 4 and 7, respectively, as illustrated, so as to constitute a narrower gage than that of the former, the construction of the track being such that one side thereof consists of a double line of rails situated at different grades carried by the extremities of the ties 2 and 4, respectively, and an oppositely-situated pair of rails a^2 and a^4, carried by the opposing terminals of similarly-disposed ties 5 and 7, the construction being such as to form a central pit or ditch between the two sets of rails aforesaid, as clearly illustrated in the cross-sectional view of the roadway in Fig. 3. I shall throughout the specification occasionally refer to the first of these tracks or track *a* as that of a "duplex track" or as a "common track" or "main track," and the second, or that involving the rails a' and a^2, as the "car-track" or "truck-track" and the grade thereof as "grade," and that of the third, involving the rails a^3 and a^4, as the "pilot-track" and the grade thereof as the "subgrade" and the rails of the respective tracks by corresponding terms.

Playing in the duplex track *a* and upon the rails disposed therein, as aforesaid, are my improved over-turnout tracks and switches a^5, a^6, a^7, a^8, a^9, and a^{10} and a^{11}, a^{12}, and a^{13}, &c., carried by their respective cars or trucks *b* and b'. In Figs. 1 and 2 I have illustrated but two of these cars; but it is obvious that as many thereof may be employed as may be demanded by the requirement of traffic over the route or line of railway aforesaid. As illustrated, the car-trucks *b* and b' are of that class known as the "single-truck" type, having a somewhat elongated wheel-base, and comprise principally a truss-framework of preferably steel structural forms, such as that commonly employed in structural-iron work and the like—to wit, the longitudinal side trusses b^2 and b^3, the lateral horizontal X-braces b^4 and b^5 for each of the trucks, the yokes or wheel-pedestals b^6 and b^7, secured to the opposite extremities of each of said trusses b^2 and b^3, and the terminal cross-ties b^8 and b^9, connecting the pair of trusses b^2 and b^3 and their terminal pedestals aforesaid, as illustrated, and the wheels and axles and journal-boxes therefor. The wheels, as well as the rails upon which they are adapted to play, as will be observed, are likewise duplexed, having their gages corresponding with the truck-track or the treads of the rails a' a^2 and the over-turnout track and switches therefor a^5 a^6 a^7 a^8, &c., as aforesaid. A pair of axles b^{10} and b^{11} for each of the trucks *b* and b', &c., are provided with the usual rectangular journal-boxes, of that class known as the "locomotive" type, as b^{12} b^{13}, for each axle. These, as are illustrated, are mounted between the wheels upon the bearing or journal extremities of the axles and are adapted to play vertically in their respective yokes or pedestals in the well-known manner familiar to engineers and those who are skilled in the art to which my invention appertains.

Firmly pressed on or otherwise secured to the terminals of an axle, as b^{10}, at their opposite bearing or journal extremities are the running-wheels b^{14} and b^{15} and b^{16} and b^{17}, respectively, with their flanges at the corresponding terminals of the axle opposing, as illustrated in detail in Fig. 2. These are of the usual railroad type and require no further description. Suffice to say, however, that a pair of axles b^{10} and b^{11} for each truck *b* and b' of my improved duplex railroad are provided with four wheels per axle in lieu of the usual two wheels in vogue and in railroad practice, with the exception, however, of the double-treaded wheels employed on cable-railroads or wheels of this type applied to trucks of mountain-railroad cars. The wheels b^{14} and b^{15} b^{16} and b^{17}, thus mounted upon the axle b^{10}, constitute a double wheel-gage, one of which being measured by the distance taken between the treads of the wheels b^{14} and b^{16}, the other and the narrower gage being measured by the treads of the wheels b^{15} and b^{17}, which correspond to the over-turnout-track gage, this gage being measured by the distance separating the aforesaid over-turnout tracks laterally, which, as will be observed in Fig. 3, is narrower than that of the gage of the pilot-track.

Referring briefly to one of my improved over-turnout tracks, it will be seen by the drawings that the same is constructed in the manner of an arch carried by a car-truck, as *b*, and spans the same longitudinally and is carried by independent trucks and at its extremities by the pilot-wheel rails. The central span or arch, as a^5 a^8, is carried wholly by the truck aforesaid and is supported by vertical and radial columns rising from the aforesaid trusses of the truck-frame in the manner following. Upon the side trusses, as b^2 b^3,

turning of curves. It will be observed by the drawings that the continuity of the over-turnout track system is preserved notwithstanding the jointed connections between the pilot-rails and the arch and the skids and the arch aforesaid. I provide this continuity or unbroken connection between the rail-sections by fixing the axis of rotation of the rocker d at a point lying in the plane of the surface or tread A of the rails at their aforesaid jointed and swivel connection. By this means I am enabled to maintain a close-jointed connection and obviate any considerable hammering of the rail-terminals at this junction due to traffic. I have illustrated these joints in Fig. 5 at d^2 in broken or dotted lines, as well as the swivel-plate and king-pin connection.

As aforesaid, the lower or free ends of the switching system of the over-turnout track—that is, the pilot-rails or skid-rails aforesaid—are each provided with a pilot-truck consisting of a pair of plural-treaded pilot-wheels, as d^3, secured to the opposite extremities of a pilot-wheel axle d^4, a journal-bearing box d^5, and a yoke or wheel-pedestal d^6 for each of the pilot-wheels and axle therefor. These wheel-yokes or pedestals d^6 are, as will be observed, four in number, two of which are carried by the terminals of the pilot-rails a^7 a^{10} and the other two by the terminals of the skid-rails a^6 a^9. These are secured to their respective rail-terminals upon the principles illustrated in Fig. 7. The yoke d^6 has an integral cast-angle-bar-supporting plate d^7 to receive the table or foot of the rail, as illustrated in cross-section in Fig. 7, and is provided with an angle-bar or fish-plate d^8. The rail being inserted in the cast extension d^7 of the yoke d^6 in the position illustrated in Fig. 7, the angle-plate d^8 is next applied and the several parts are connected in the well-known manner of making bolted joints in track construction. To relieve the bearings of the pilot-wheel trucks of undue strain and hammering due to the consequent collision of the car-trucks in their over-switching operation, I provide the journal-boxes d^5 with buffer-springs d^9. These are retained in a vertical position by the spring-pockets d^{10} in the yoke d^6.

As it is customary in single-truck street-railway car-trucks to provide for the inequalities of the road and the rounding of curves to permit of a limited movement of the wheels with respect to the yokes, I have provided the annular space d^{11} within the yokes d^6 of a somewhat greater diameter than the pilot-wheel d^3, so as to permit of an up-and-down movement of the yoke and at the same time a limited vertical and horizontal oscillating movement. I shall occasionally refer to a pair of pilot-wheels d^3, mounted upon their axle d^4 and their concomitant already described, as that of a "multiple-gage truck" or "switching-truck."

The plural-treaded pilot-wheel d^3 I prefer to construct integrally of a low-grade steel or iron casting, as is customary in railroad practice. These comprise the plurality of treads d^{12}, d^{13}, d^{14}, and d^{15}. The pilot-wheel d^3 has its largest tread diameter measured across the tread d^{12} and d^{15}, the former of which is adapted to run on the pilot-wheel rail a^3 or on the opposite extremity of the axle d^4. The similarly-disposed pilot-wheel, as d^3, has its corresponding tread, as d^{12}, running on the pilot-rail a^4, as illustrated in Fig. 3. It will be observed by this illustration the position of the pilot-wheels with respect to the axle upon which they are mounted are such that the smaller diameters d^{13} d^{14}, or as I shall frequently refer to them hereinafter as that of "hubs," face or oppose one another, while the treads of the larger diameter d^{12} are turned in an outward direction with respect to each other.

At the terminal extremities of a pair of pilot-yokes I provide switches, as e. These are adapted to swing vertically in bearings e' in a bifurcated ear e^2, formed in the pilot-yoke d^6. The said switch e is adapted to swing upwardly in the direction indicated by the broken lines in Fig. 7, but is restricted from falling below the position illustrated in the several views of the same by the back-stop or jam e^3.

At the instance of clearness in describing the operation of my improved over-switching system by the over-turnout track already described I will refer to that extremity of a car or truck carrying the pilot rails and switches e, as the "front" end of the car, and the opposite extremity thereof, or that carrying the skid-rails, as the "rear" of the car.

In Figs. 7 and 8 I have indicated the terminals of two of my over-turnout tracks in conjugation. In these views let it be assumed that the one in which the pilot rails and switches e are illustrated is moving forwardly with its car or truck moving in the direction indicated by the arrow x, and the other, or the one of which the skid is illustrated, is backing up and moving in the direction of the arrow x^2, in which instance the two cars or trucks will be moving in a direction toward each other, one of which, however, will be running forwardly and the other one will be running backwardly, resulting in a collision between the pilot-switch e and the pilot-wheels d^3 of the skids. At the instant of conjugation with said wheels said switch e will enter under the hub of the wheels d^3 of the backwardly-moving car, and since, as before stated, the diameter of the tread portions d^{14} of the pilot-wheel d^3 is less than that of d^{12}, which supports the skid-rails on the pilot-wheel rails a^3 a^4, the pilot-truck will be first switched up the grade of the pilot-switches e by the hubs aforesaid, carrying with it the skid of the rearwardly-moving

are mounted and secured the radial columns b^{18} b^{19}, which are inwardly inclined toward an oppositely-situated and similarly-supported pair of columns b^{20} b^{21}, the upper and lower extremities of which are spread, so as to form, respectively, pedestals and caps. The arch a^5 a^8 of the over-turnout track is secured to its respective aforesaid columns b^{18}, b^{19}, b^{20}, and b^{21} by riveting or bolting the same to the table or foot of the rail, as indicated at b^{28}, as will be clear by an inspection of Fig. 2. It might be well to state here that the rails of the over-turnout track system consist of guard-rails of that class employed in street-car lines, and particularly located at curves, the form of which will be clear by the fragmentary and sectional elevational view in Fig. 6. The purpose of the said guard-rails will be referred to later in describing the operation of the over-switching incident depicted in Fig. 1. The terminals of the arch a^5 a^8 of the over-turnout track are secured to and carried by the rocker-pedestals c, c', c^2, and c^3, which I prefer to construct of steel castings. These in turn are supported by the upper extremities of the vertically-disposed parallel columns, as c^4 and c^5, arranged in pairs, and the lower extremities of the said parallel columns are supported by the truck-frame through the transverse connecting-tie system, as b^8 b^9, &c. The method of securing these columns to the truck-frame and pedestals will be understood by the drawings and require no further description. Suffice to say that the entire structural work throughout is secured in a manner well known to structural-iron workers—namely, by either rivets or bolts, or both. To take up the thrust of the arch a^5 a^8 of my improved over-turnout tracks and at the same time support the inner projecting extensions of the pedestals, I provide oblique columns, as c^6, which have their upper extremities secured to their respective pedestals and their lower extremities secured to and carried by the truss-framework aforesaid of the truck. The remaining portions of one of my improved over-turnout tracks involving the rails a^7 and a^{10} I shall occasionally refer to as the "pilot-rails," and the remaining portions a^8 and a^9 of the over-turnout track will be frequently referred to as the "skid" or "skid-rails."

The upper terminals of the pilot-rails a^7 and a^{10} swing in the manner of a universal joint upon its supporting-pedestal c' c^3, so as to have both a vertical and horizontal rotary movement, the latter movement being comparatively limited, while the former is considerably less restricted. To effect these movements of the pilot-rails, I provide at the upper extremity thereof a swivel-plate and king-pin connection c^7 and c^8, as illustrated more clearly in Figs. 5 and 6. The member c^7 of the aforesaid connection consists, preferably, of a cast angle-bar and foot-plate formed in a manner to snugly fit the rails between the guard c^9 and the table thereof and is clamped with the rails by means of an angle-bar or fish plate, as c^{10}, with bolts, as is customary in railway-track construction. The aforesaid member c^7, together with the terminal of the pilot-rail and fish-plate c^{10}, secured thereto, is carried and swung in bearings c^{11} c^{12} by the pedestal c' upon a cradle or rocker d, said rocker having a segmentally-formed shoe d'. To permit of the aforesaid horizontal movement of the pilot-rail (as described in different positions) on the rocker d, I provide the member c^7 with a lower bearing-surface, likewise that portion of the rocker in contact therewith, to permit of a swiveling action between the member c^7 and the upper surface of the shoe d' of the rocker d and couple the member c^7 and rocker d by means of the king-pin c^8.

It will be understood by those who are skilled in the art to which my invention appertains that the pilot-rails as a^6, a^7, a^9, and a^{10}, will be permitted to have a limited lateral movement upon their respective rockers through their respective swivel-plate and king-pin connections aforesaid, the limitation of which movement is due to the member c^7 of the pilot-rail against the adjacent vertically-extending portion of the rocker, as will be clearly indicated in the enlarged detailed views, Figs. 5 and 6. It will also be noted that the two vertical columns c^4 and c^5 will have imposed upon them the major part of any load which is thrust upon the shoes d' of the rockers d as a car is mounting the pilot-rails thereof.

In order to effectively provide for the transfer of any load that might be imposed upon the pilot-rail a^7 and in turn upon the rocker d to the supporting-columns c^4 and c^5, as aforesaid, I fit the lower segmental bearing-surface c^{12} of the pedestal c' to the shoe d' of the rocker d, so that these two members will effect a bearing-contact throughout the range of the swinging motion of the rocker d. In Fig. 1 I have shown these pedestal and rocker connections carrying the upper extremities of the pilots and skids of an over-riding car at the different angles which the said parts assume as a car is passing over the over-turnout track of a subtending-vehicle. It will be clear by this illustration that a considerable range of movement with respect to the arch, as a^{11}, of the over-riding car will be necessary in order to maintain the terminals of these members in their proper positions and as shown in the figure. The limited lateral movement of these members permits of the required amount of flexibility in the length of the superstructure comprising the over-turnout-track system aforesaid to adjust itself to the lateral inequalities of the track over which the same is adapted to be conveyed and permits within certain limits the

car until the said pilot-wheel shall have reached a point e^4, Fig. 11, whereupon the pilot-wheel truck will be lifted to a higher grade by virtue of the frog e^5 entering under the larger-diameter tread d^{15} of the pilot-wheel d^3. As will be observed in Fig. 8, the frog e^5 is in the same straight line with the guard c^9 of the rail a^7 and forms a continuous connection therewith. After the ascending pilot-truck has mounted the summit of the grade of the frog e^5 the treads d^{15} of the pilot-wheels d^3 will track on the guards c^9 of the rail a^7, and said truck will pass the arch of the over-turnout track, as indicated in Fig. 1, and continue on its journey, descending the skid until it arrives at a position indicated in Fig. 12 at a point e^6. Here it meets a downwardly-sloping frog e^7 and descends the same to a point e^8 on the same wheel-tread until it meets the second downwardly-sloping frog e^9, which engages the wheel-tread d^{13} of the same wheel d^3 and continues its journey down the grade of the frog e^9 until it is deposited on the pilot-wheel rail a^3, resuming its original position on the pilot-wheel rail prior to conjugation. In the meanwhile, however, the over-riding truck b' will be switched from grade to the pilot-rails of the over-turnout track under consideration by a change of treads and gages. This is effected by the terminals of the pilot-rails a^7 and a^{10} entering under the treads of the narrower-gage running-wheels b^{16} and b^{17}, respectively, while the truck b' is still on grade, whereupon the movement of the cars or trucks b and b' being continued in opposing directions and toward each other will cause the truck b' to ascend the pilot-rails a^7 and a^{10} upon its narrow-gage running-wheels b^{16} and b^{17} in a manner so as to establish an unbroken gradient or rise from grade over the supergrade and back again to grade, substantially as and in the form of a wave or undulation. It will be observed in the illustration, Fig, 1, that the truck b', together with its skid of the over-turnout track system, has been switched in this manner from grade and the truck-track a' a^2 to the supergrade or over-turnout track of the truck or car b, and in the position indicated let it be assumed that the car b', moving in the direction of the indicating-arrow y, is running backwardly and the truck b is running in a forward direction, as indicated by the arrow y^2. The over-turnout track b will have piloted or switched the truck b' onto its over-turnout track and the rear running-wheels of the truck b' will have ascended the grade of the subtending over-turnout and have reached the point in the over-turnout track of the truck b where the narrow-gage running-wheels of the truck b' will be on the terminals of the arch-rails a^5 and a^8. The front running-wheels by this time will just have been transferred from grade to supergrade on the pilot-rails a^7 and a^{10} by a change of gages—that is, the narrower wheel-gages b^{15} and b^{17} of the truck b' will take the gage of the pilot-wheel tracks a^7 and a^{10}, and thus effect an unbroken passage of the truck b' from grade to supergrade, as aforesaid.

It will be clear from the aforesaid description of my improved over-turnout-track system of switching that the cars and track are of special construction and are so constructed as to carry out a system of duplex transportation in a single path or line of travel into execution. The loop or over-turnout track aforesaid, which has either of its extremities terminating at the main tracks, spans the cars which carry the same with them in their transit over the route in a manner so as to shunt the remaining cars which are playing to and fro in the route or line of travel about the cars and back on the main track, and although I have shown and described a special track and truck construction wherein a plurality of tracks having their treads and the treads of the truck corresponding are employed for the purpose of carrying out my invention I do not desire to be limited in this particular respect to the special construction of either the tracks, cars, or the over-turnout track carried thereby, or the system of shunting around the cars, as many minor changes may be made in the details of construction, whereby the cars may be shunted by each other on a single track or line of travel without departing from the spirit of my invention or sacrificing its advantages. An essential feature, however, in carrying my invention into practice will be found in the novel manner in which I provide the terminals of the over-switching means with a support from the road-bed, so that as the same enters under the corresponding tread of the car-truck at the initial of the switching operation the load or weight due to the said car-truck will not fall upon the free terminal of the switching means, but will be borne upward by the support which is received by virtue of and through the pilot-truck and pilot-rails and their support by the road-bed. It will also be observed by the position of the cars in Fig. 1 that the length of the wheel-base or car-trucks is sufficient to extend for a distance on the pilot-rails from the truck-track to the supporting-columns, as c^4, and therefore the weight of the car b' and its over-turnout tracks will at no time be wholly imposed upon the pilot-rails a^7 and a^{10}. In order, however, to support the span of the pilot or skid rails aforesaid between their respective pedestal and wheel-truck bearings, I provide a truss f for each of the pilot and skid rails. As the truck b' further ascends the over-turnout track of the truck b, its pilot-truck carried by its pilot-rails a^7 a^{10} will be backing up and switched by the pilot-truck of the pilot-rails of the truck b over the aforesaid superstructure or over-turnout track in a similar manner to that al-

ready described and illustrated in Figs. 7, 8, and 11, and after the said pilot-truck has traversed the over-turnout track of the truck *b* aforesaid and has reached the terminal truck of car *b* it will be deposited on the pilot-wheel rails in a manner depicted in Fig. 12 and as already described. In the meanwhile, however, the pilot-switch *e* will be swung upon its bearing *e'* by contacting with the upper surface of the skid-yokes of the skid-rails a^6 a^9, as illustrated in broken lines in Fig. 7, as previously referred to. This switching movement of the switch *e* enables an unbroken transfer of the pilot-truck aforesaid from the superstructure of the car *b* and onto the pilot-wheel rails without concussion or jarring which would otherwise result if the pilot-switch *e* were rigid, since in this instance the pilot-truck of the over-riding car would be dropped for some height after the terminal of the pilot-switch *e* had left the upper surface of the subtending skid. By providing the joint *e'*, however, for the pilot-switch *e* the gravitation of the pilot-truck and the rails and their concomitants carried thereby will break continuity of the projecting terminal at the joint *e'* of the said pilot-truck to allow the switching provision illustrated in Fig. 12, as previously described.

It is obvious that in lieu of the cars or trucks moving in opposite directions, as already stated, they may be running in the same direction and at different velocities, to wit: the truck b^7 may be moving in the same direction as the truck *b*—that is, running backwardly, but *b'* moving at a considerable higher velocity—in which instance it is obvious that the same switching of the car or truck *b'* over the over-turnout track of the car or truck *b* will be effected in a similar manner to that already described. It is obvious that the same over-switching already described in my improved duplex railway system would be effected if one of the cars, as *b*, carrying the over-turnout track should be held braked at a station or at any point along the track *a*. It is also obvious that any suitable form of motive-power apparatus which will revolve the running-wheels and axles b^{10} and b^{11}, as aforesaid, having sufficient horse-power capacity will suffice to carry the cars with their over-turnout over the route or track *a* in the manner aforesaid, or the said cars may be operated by any of the other well-known means of communicating motor-power in vogue at the present time. In the case illustrated I have indicated the controlling means, to wit: the usual electrical controller *g* and brake-staff *h*, centrally located in the car-trucks in Fig. 1, and have illustrated in Fig. 3 a cross-section of an electrical third-rail track *i*, located centrally within the gage of the pilot-wheel track a^3 a^4 and a corresponding over-turnout electrical track *j* for continuing the third-rail system of distribution over the superstructure of the over-switching system.

In Figs. 3, 14, and 15 I have illustrated a system of electrical distribution for over-switching the electrical energy from the main track or electrical third rail or channel *i* over the subtending cars. This consists of a span or arch *j* and lateral extensions *j' j²*. These lateral extensions are carried by the pilots and skids on insulators j^3 upon the cross-ties m^4, and the arch-truck *j* is carried by similar insulators j^3 upon the X-braces *m* of the central span or arch comprising the rails b^2 and b^3 of the over-turnout-track system. At the terminals of said laterally-extending electrical over-switching means *j j²* I also provide trolley-wheels j^4, one for each extremity of the said lateral extensions *j' j²*. These trolley-wheels are carried by a system of expanding and contracting levers j^5 to permit of freedom of up and down movement during the over-switching operation. These trolley-wheels, together with the said system of contracting and expanding levers j^5, are carried by platforms j^7, which in turn are carried by the car-ties m^4. In the position illustrated in Fig. 14 I have indicated a trolley-wheel carried by the car *b'* and have here depicted the terminal of the electrical switch extremity *j'* of the car *b'* in conjugation with the electrical over-switching member j^2 of the car *b*. At the instant of conjugation, as represented in Fig. 14, the trolley-wheel of the car *b'* has entered into collision with the projecting terminal or tongue j^8 of the member *j'* of the over-electrical switching system of the truck *b* and has entered under the hub j^9 of the trolley-wheel aforesaid coacting therewith, and, as will be understood, as the car *b'* progresses in its movement over the car *b*, as depicted in Fig. 1, said trolley-wheel of the car *b'* will be superimposed upon the over-electrical switching system of the car *b* and will be switched over the entire electrical switching channel or track in a similar manner, as before described, in the over-switching of the car *b'*, as described, in connection with Fig. 1, and back to grade upon the insulated electrical channel *i*. The hub j^9 of the trolley-wheel j^4 constitutes the tread for running on the extended tongue j^8 of the laterally-extended electrical switching member j^2 or *j'* of narrower gage than the tread consisting of the flanges j^6, and it will thus be understood that the switching of the electrical system is likewise effected by the change in treads of the trolley-wheel and the electrical over-switching track. In Fig. 14 I have also illustrated diagrammatically the electrical connections and electrical distributions carried by the cars *b b'*, &c., of the system. These comprise a conductor *g'* and g^2, establishing communication with the oppositely-situated trolley-wheels; a conductor g^3, electrically connecting the laterally-extended

electrical over-switching rails j' j^2, and a branch electrical conductor connecting the arch j of the electrical over-switching rail with the conductor g^3 and a switch g^4, establishing electrical communication with the trolley-wheels aforesaid through the electrical conductors g' and g^2. These latter conductors are electrically connected with the motor system, as g^5, of the car upon which they are located, the same being connected with the ground G through the controller g, as is customary in electrical railway practice. The switch g^4 is adapted to feed the aforesaid electrical over-switch comprising the members j, j', and j^2 and will be sufficiently clear by the illustration to require no other description.

In consequence of limiting the altitude of the grade of the over-turnout track and at the same time providing a comfortable means for the convenience of the passengers I provide a suspension car-body k of a somewhat restricted height consisting of, preferably, a metal framework k', supported and carried by the truck-trusses b^2 and columns b^{20} and b^{21} for each of the cars, as is clearly shown in Figs. 2 and 3. In Fig. 13 I have shown a car-body subdivided into eight sections having a seating-section between two adjacent sections for two passengers. At the upper portion or roof of each of the said sections I provide a door or gate k^3, which may be swung upwardly on hinges K to permit of the ingress and egress of the passengers without having to stoop as they enter and take a seat on the longitudinal bench k^3. At the time a footboard k^4, one of which is provided for each of the sections, as illustrated in Fig. 13, has provision for lowering the same, which provision is illustrated in Fig. 2, to wit: the hanger k^5, secured to the footboard k^4, the sliding bearing-rings k^6, carried by the hanger k^5, playing vertically on the guide-rod k^7, secured to their pilasters k^8 of the sections k', as illustrated. To each pilaster k^8 is pivoted a gate-lever k^9, which is swung on the axis k^{10}. Said lever has a longitudinal-extending portion k^{11}, which is pivoted at k^{12} to a connecting-rod k^{13}. Said connecting-rod in turn is connected to the gate k^2 by means of a bracket k^{14}. In Fig. 2 I have shown the gate k^2 partially raised and the connecting-rod k^{13}, and in the dotted position is shown broken at its upper extremity, since in the position of the gate-lever k^9, as shown, the gate k^2 would be closed. Pivoted to the gate-lever k^9 at a point above the axis k^{10} is the footboard-lever k^{15}, the opposite extremity of which is pivotally connected to the lower bearing-ring k^6, whereby upon rotating the gate-lever upon its axis k^{10} in an outward and downward direction the gate k^2 will be lifted by the connecting-rod k^{13} to a height equal to the stroke of the gate-lever extension k^{11}, and at the same time the footboard k^4 will be lowered also, by virtue of the footboard connecting-rod k^{15}, until the upper edge of the footboard k^4 is brought into a line of register with the floor k^5 of the car-body—that is to say, the stroke of the upper portion of the gate-lever k^9 from the pivot will be sufficient to effect a full stroke of the footboard k^4. It will be observed by Fig. 13 that a pair of these gate-levers are provided for each of the sections k' and for each of the footboards k^4. In the drawings I have illustrated but one of these car-bodies on a car; but it is obvious, however, that each side of the car may be similarly provided with car-bodies.

To laterally brace and tie the superstructure, whereby the gage of the over-turnout track aforesaid and switch will be maintained, I provide the arch-truss of the rails a^5 a^8 aforesaid and their supporting-columns with transverse X-braces m, secured to the web of the rails at their opposite extremities. This disposition of the X-braces is illustrated in plan in Fig. 4, and to brace the aforesaid arch laterally to prevent racking I provide a pair of brackets m', carried by said X-braces, as illustrated in Figs. 2 and 3, the lower extremities of which are secured to the columns b^{18}, b^{20}, b^{19}, and b^{21}, respectively, as shown. To further brace the brackets m', I provide a system of struts m^2, which have their upper extremities secured to their respective columns aforesaid and the lower extremities to their respective brackets m'. To secure that part of the superstructure carried by the car against gyration or twisting, I provide a pair of terminal X braces or stays m^3, which have their upper extremities secured to their respective pedestals and the lower extremities to their respective supporting-columns c^5.

To maintain the gage of the pilot and skid rails, I provide a series of universal jointed ties, as m^4, connected at their opposite extremities to the web of the rails. In Figs. 8 and 10 I have illustrated the manner of constructing these universal joints so that the two opposite rails of the skid-track or the pilot-track may have an up-and-down movement with respect to each other, while at the same time they will be restrained from twisting inwardly by virtue of the weight which is imposed upon them by the overriding truck falling within their point of support by and through the pilot-wheel rails a^3 a^4 and each of their buffer-springs d^9. Secured to and carrying the pilot or skid rails, as shown in plan in Fig. 4, are an upper and lower pair of ears, as m^5 and m^6. In Figs. 8 and 10 I have shown these as formed integrally with the pilot-yoke castings. Within said ears are swiveled a pair of washers m^7, one for the upper and one for the lower pair of ears, said washers being provided with trunnions or bosses m^8 and are perforated centrally to receive a coupling-pin m^9. Carried by the

trunnions or bosses of the washers m^7 are the forks m^{10}. These in turn are connected with the terminals of the ties m^4 in the manner illustrated in Fig. 10 by bolts, the arrangement of these jointed members being such that each of the terminal ties, as illustrated in Fig. 10, will have a slight rotary motion about the coupling-pin m^9 and at the opposite extremities and a vertically-swinging motion on the trunnions or bosses m^8, substantially operating in the manner and as a universal joint.

It will be observed from the illustrations, reference being had to Figs. 8, 9, and 10 and to the plan view of Fig. 4, that the load due to an overriding car would be imposed upon the pilots of the under car inside of their points of support, which would have a tendency toward twisting them inwardly, and to obviate this difficulty and at the same time provide for freedom of movement of the two pilot-rails with respect to each other I have provided the universal jointed system just described. The resistance of the twisting tendency offered by the construction aforesaid may be readily followed by considering the conditions of the superimposed car while on the pilot yokes or skids of the under car. The effect will be to impose a downwardly-thrusting movement upon the tread of the rails a^7, due to the weight of the car-wheels of the upper car acting vertically downward upon the pilot-yokes or skid-yokes, in which case a counter resistance acting upwardly would be met by the thrust of the buffer-spring d^9, which will be communicated thereto through the pilot-wheels d^3 and thence to the journal of the axle d^4, and finally upon the pilot-wheel rails a^3 and a^4. This twisting tendency, however, of the yokes and pilot-rails connected therewith will be restrained by the tension member of the lower tie m^4 (see Fig. 10) and by the upper similar tie which takes the compression, thereby forming substantially what is known in statics as a "resisting-coupling."

Although I have described the superimposed or over-turnout track, with which each of the cars b and b' is provided, composed of separate detail parts, pilot-rails, skid-rails, and other details, it will be seen that these superimposed over-turnout tracks on each car consists of a central arched portion composed of two rails, the two end portions connected therewith so as to swing in a vertical plane and also capable of slight lateral movement at the free ends thereof, one of the end parts being for the purpose of this description preferably called a "pilot" and the other a "skid," each of said end parts being also provided with a truck having wheels at the free ends thereof and each being also provided at the free end thereof with frogs and one of the said parts being provided at its free end with a pivoted switch which, in the form of construction shown, consists of two parts, and both of said ends, in effect, serving as switches to switch one car off of the main track onto the superimposed track or over-turnout track and from said superimposed track or over-turnout track onto the main track, said main track, in the construction shown, consisting of two separate supplemental tracks or ways of different gages, the rails of one track or way being also lower than the rails of the other track or way, and while I have also described the separate car-trucks or cars as of specific form or construction it will be apparent that various changes in and modifications of these features of construction, as well as in other details of construction herein shown and described, may be made without departing from the spirit of my invention or sacrificing its advantages, and although I have shown and described my improvement as applied to single cars only it will be apparent that the same may be applied to a number of cars connected in the form of a train, the only difference being that in this case the central or arched portion of the over-turnout or superimposed tracks would extend over all the cars of the train and be provided with joints similar to those at the upper extremities of the pilot and skid connections,

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

1. In a railway transportation system, a track having a double gage, a car adapted to be transported along said track, an over-turnout track carried by the car, and switches carried by the said over-turnout track, substantially as shown and described.

2. In a railway transportation system, a double-gage track having a relatively broad-gage railway and a relatively narrower-gage railway, cars to be transported on the said broad-gage railway, over-turnout tracks carried by said cars, switches carried by the said over-turnout tracks and said narrower-gage railway, substantially as shown and described.

3. In a railway transportation system, a railway, and a plurality of cars movable in the same or in opposite directions thereon, said cars being provided with superimposed over-turnout tracks comprising a central arch portion, and end portions connected therewith so as to swing in a vertical plane, said end portions being provided at their outer ends with trucks and frogs, substantially as shown and described.

4. In a railway transportation system, a railway, and a plurality of cars movable in the same or in opposite directions thereon, said cars being provided with superimposed over-turnout tracks comprising a central arch portion, and end portions connected therewith so as to swing in a vertical plane, said end portions being provided at their outer ends with

trucks and frogs and one of said end portions being also provided with a pivoted switch, substantially as shown and described.

5. In a railway transportation system, a car provided with a superimposed over-turnout track, comprising a central portion over the top of the car, and end portions connected therewith so as to swing in a vertical plane and also capable of slight lateral movement, the outer ends of said end portions being provided with trucks and frogs, and one of said end portions being also provided at its outer end with a pivoted switch device, substantially as shown and described.

6. In a railway transportation system, a car provided with a superimposed over-turnout track having end portions adapted to swing in a vertical plane, said car being also provided with side body portions adapted to contain passengers, substantially as shown and described.

7. In a railway transportation system, a car provided with a superimposed over-turnout track having end portions adapted to swing in a vertical plane, said car being also provided with side body portions adapted to contain passengers, and having side doors and means for opening and closing the same, substantially as shown and described.

8. In a railway transportation system, a railway composed of two supplemental tracks, and cars the axles of which are provided with two sets of wheels one of which is adapted to travel on one of said tracks, said cars being also provided with a superimposed over-turnout track comprising a central portion, and end portions connected therewith so as to swing in a vertical plane and provided at their outer ends with trucks and frogs one of which is provided with a switch device, one set of the wheels on the axles of the cars being also adapted to travel on the superimposed over-turnout track, substantially as shown and described.

9. In a railway transportation system, a main railway composed of two supplemental tracks of different gages one of which is placed below the other, and cars provided with superimposed over-turnout tracks having end portions connected therewith so as to swing in a vertical plane, said end portions being provided at their outer ends with trucks having wheels adapted to travel on one of said tracks and the axles of said cars being also provided with two wheels at each end, one set of which is adapted to travel on the said superimposed over-turnout tracks, substantially as shown and described.

10. In a railway transportation system, a main railway composed of two supplemental tracks one of which is of narrower gage than the other and placed below the other, and cars adapted to travel on said main railway, the axles of said cars being provided with two sets of wheels one of which is adapted to travel on the broader-gage track, said cars being also provided with superimposed over-turnout tracks having pivoted end members adapted to swing in a vertical plane and provided with end trucks, the wheels of which are adapted to travel on the narrower-gage track, the wheels of said trucks being also adapted to travel on the superimposed over-turnout tracks, substantially as shown and described.

11. In a railway transportation system, a main railway composed of two supplemental tracks, one of which is narrower than the other and placed within and below the other, and cars adapted to travel on said main railway, the axles of said cars being provided with two sets of wheels one of which travels on one of said tracks, said cars being also provided with superimposed over-turnout tracks, comprising a central portion and a pivoted pilot at one end and a pivoted skid at the other end thereof, said pilot and said skid being provided with trucks having wheels adapted to travel on the narrower-gage track and said wheels being also adapted to travel on the superimposed over-turnout tracks of the separate cars, substantially as shown and described.

12. In a railway transportation system, a main railway composed of two supplemental tracks, one of which is narrower than the other and placed within and below the other, and cars adapted to travel on said main railway, the axles of said cars being provided with two sets of wheels one of which travels on one of said tracks, said cars being also provided with superimposed over-turnout tracks, comprising a central portion and a pivoted pilot at one end and a pivoted skid at the other end thereof, said pilot and said skid being provided with trucks having wheels adapted to travel on the narrower-gage track and said wheels being also adapted to travel on the superimposed over-turnout tracks of the separate cars, and the outer ends of said pilot and said skid being provided with frogs, and the outer end of the pilot being also provided with pivoted switch devices, substantially as shown and described.

13. In a railway transportation system, a car provided with a superimposed over-turnout track, comprising a central top portion having a pilot pivoted at one end thereof and a skid pivoted at the other end thereof, said pilot and said skid being adapted to swing in a vertical plane, and being provided at their outer ends with trucks, each of which is provided with frogs, substantially as shown and described.

14. In a railway transportation system, a car provided with a superimposed over-turnout track, comprising a central top portion having a pilot pivoted at one end thereof and

a skid pivoted at the other end thereof, said pilot and said skid being adapted to swing in a vertical plane, and being provided at their outer ends with trucks, each of which is provided with frogs, and the outer end of the pilot being also provided with pivoted switch devices, substantially as shown and described.

15. In a railway transportation system, a main railway composed of two tracks one of which is of narrower gage than and placed within and below the other, and cars adapted to travel on said main railway, the axles of the cars being provided with two sets of wheels one of which is adapted to travel on the wider-gage track, said cars being also provided with superimposed over-turnout tracks having a pivoted pilot at one end and a pivoted skid at the other, the said pilot and said skid being provided at their outer ends with wheels adapted to travel on the narrower-gage track and also adapted to travel on the superimposed over-turnout tracks, substantially as shown and described.

16. In a railway transportation system, a main railway composed of two tracks one of which is of narrower gage than and placed within and below the other, and cars adapted to travel on said main railway, the axles of the cars being provided with two sets of wheels one of which is adapted to travel on the wider-gage track, said cars being also provided with superimposed over-turnout tracks having a pivoted pilot at one end and a pivoted skid at the other, the said pilot and said skid being provided at their outer ends with wheels adapted to travel on the narrower-gage track and also adapted to travel on the superimposed over-turnout tracks, and said pilot and said skid being also provided at their outer ends with frogs and the pilot with pivoted switch devices, substantially as shown and described.

17. In a railway system, a main track provided with cars adapted to be transported therealong, over-turnout tracks and switches carried by the cars and looped about said cars in the manner of a bridge, said cars being provided with trucks having a double tread, one of said treads being adapted to run on the main gage and the other of said treads being adapted to run on the over-turnout track, substantially as shown and described.

18. In a railway system, a main track provided with cars adapted to be transported therealong, over-turnout tracks and switches therefor carried by the cars and looped about said cars in the manner of a bridge substantially forming an undulation in the main track, said cars being provided with trucks having a double tread, one of said treads being adapted to run on the main gage and the other said tread being adapted to run on the over-turnout track, substantially as shown and described.

19. In a railway system, a system of over-switching embracing a main track and gage, running-switches, the switches being provided with trucks of different treads, one of said treads being adapted to track on the main gage and the other tread thereof being adapted to track on the switches, said switches being adapted to be carried from the main track upon their trucks over another switch in the main line by changing from one of the said treads of said truck to the other tread of said truck, substantially as shown and described.

20. In a railway system, a system of over-switching, comprising a main track and gage, running-switches, said switches being provided with trucks of different treads, one of said treads being adapted to track on the main gage and the other tread thereof being adapted to track on the switches, said switches being adapted to be carried from the main track upon their trucks over another switch and descending thereafter to the main track by the changing from one of said treads of said truck to the other tread of said truck, substantially as shown and described.

21. In a railway transportation system, a main track provided with a system of cars adapted to be transported therealong and to be switched one over another, over-turnouts and switches carried by the cars for switching said cars and having their switches engaging the treads of the car-trucks prior to the passing of said cars one over another, and means for supporting said switches from the road-bed at a position substantially vertically under the tread of the over-switching trucks at the initial point of the switching operation aforesaid, substantially as shown and described.

22. In the herein-described system of over-switching cars while in transit, skids carried by the cars adapted to gage with the track, and a system of frogs carried by the terminal of said skids adapted to establish a register with the track, substantially as shown and described.

23. In a system of over-switching cars operating along a line of railway, a system of superimposed tracks carried by the cars having frogs and switches coacting with the main track, means carried by the cars for engaging the said switches and frogs and a jointed connection between the said superimposed tracks and the said switches and frogs permitting freedom of motion, substantially as shown and described.

24. In a railway system, a main track, cars and mobile over-turnout switches therein, plural-treaded trucks, carrying the cars and said switches, and having respectively a

main tread and a switch-tread, said trucks being adapted to carry and convey the cars and said switches along the main track, upon said main tread and over respective, over-turnout switches upon said switch-tread, substantially as shown and described.

In testimony that I claim the foregoing as my invention I have signed my name, in presence of the subscribing witnesses, this 5th day of April, 1905.

PHILIP K. STERN.

Witnesses:
F. A. STEWART,
C. J. KLEIN.