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D. M. RICHARDS & I. HALE.

RAILWAY CAR.

No. 348,058. Patented Aug. 24, 1886.

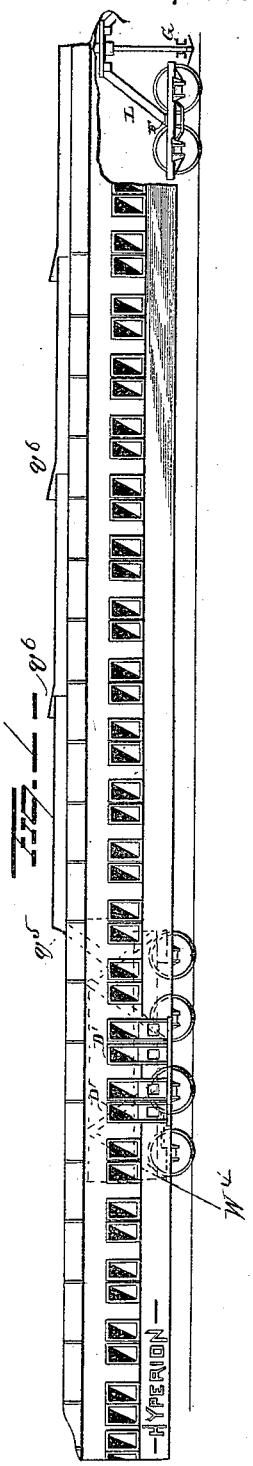

Fig. 1.

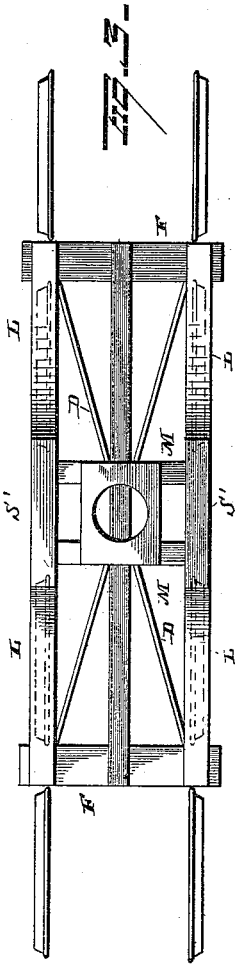

Fig. 3.

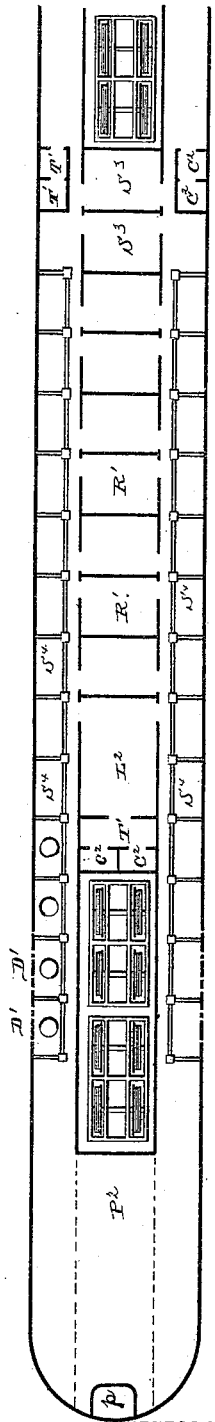

Fig. 2.

WITNESSES

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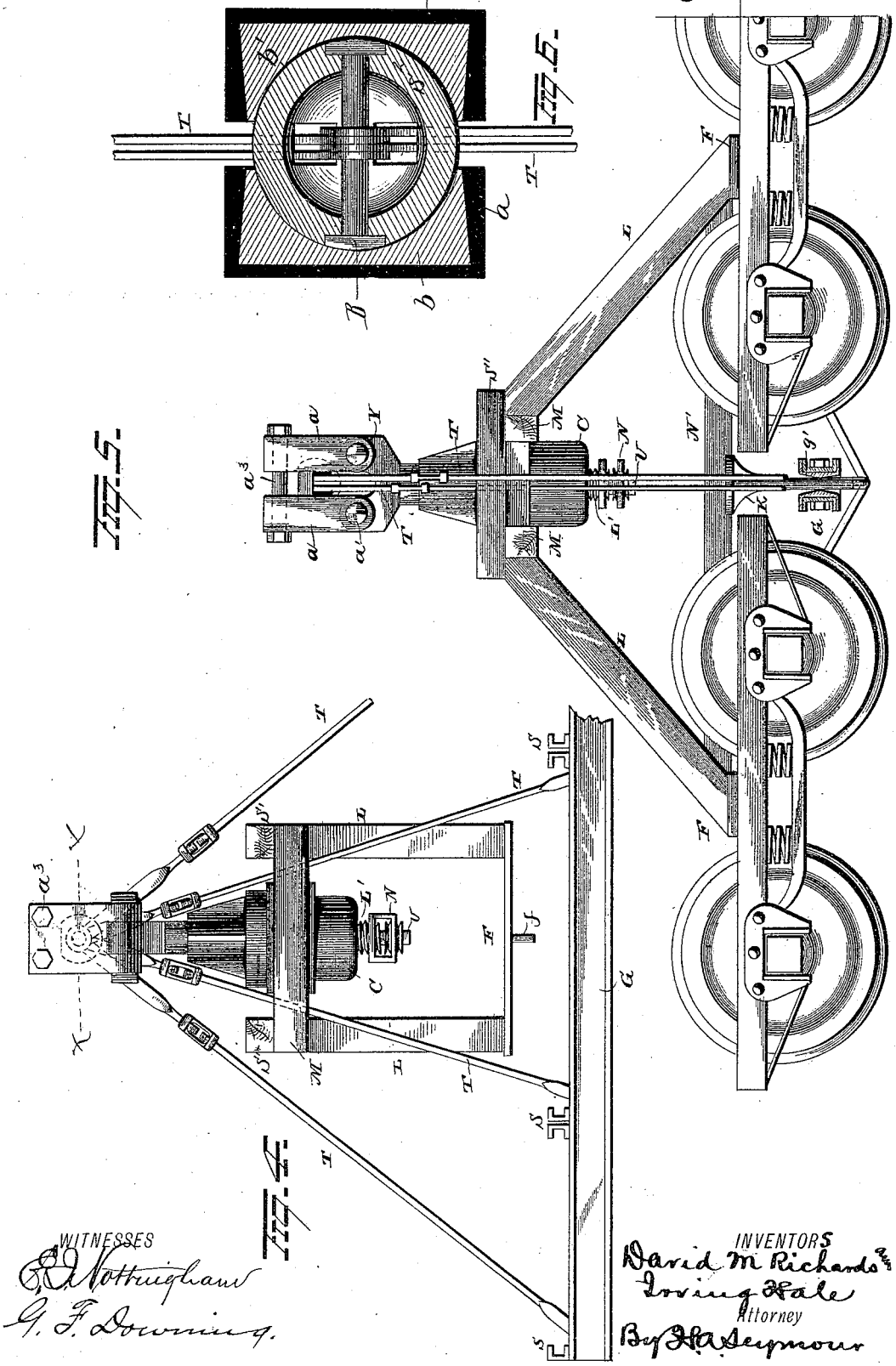
D. M. RICHARDS & I. HALE.

RAILWAY CAR.

No. 348,058. Patented Aug. 24, 1886.



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(No Model.) 7 Sheets—Sheet 3.

D. M. RICHARDS & I. HALE.

RAILWAY CAR.

No. 348,058. Patented Aug. 24, 1886.

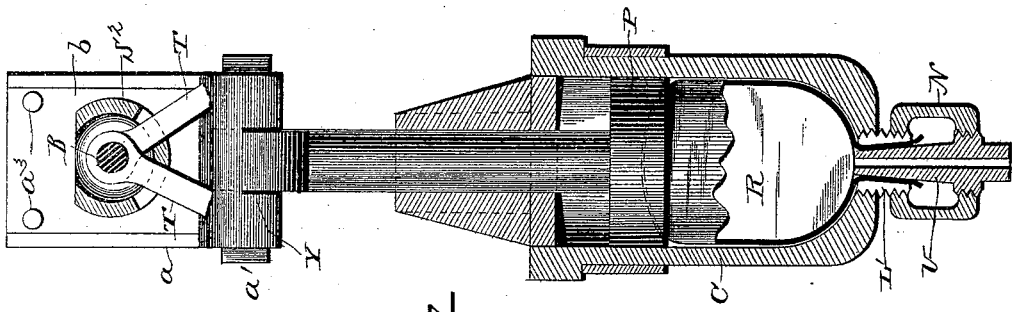

Fig. 5.

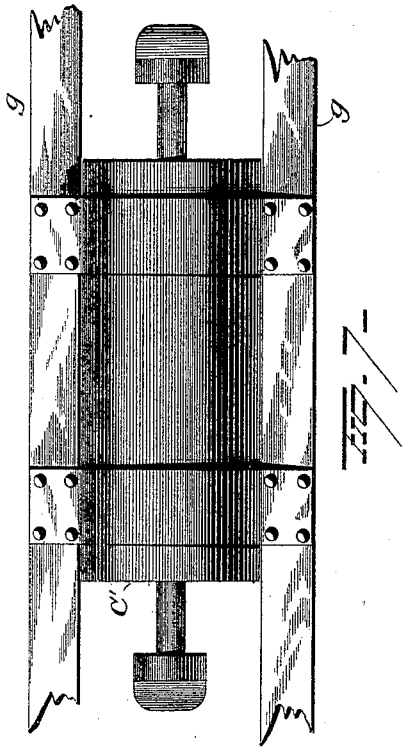

Fig. 7.

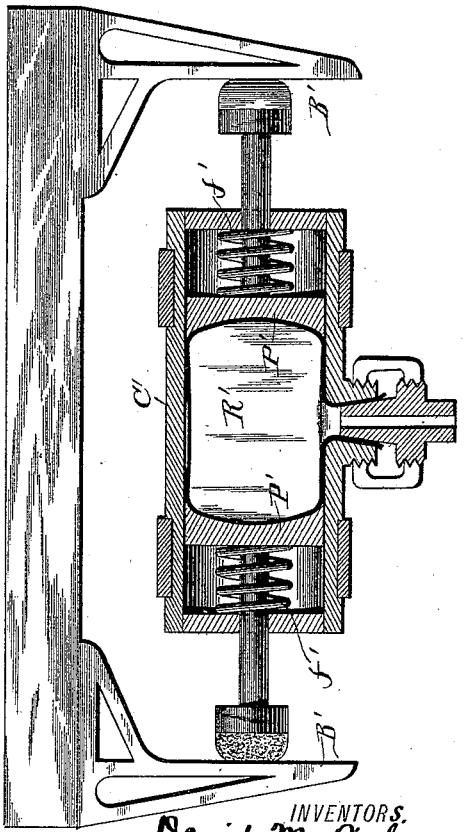

Fig. 8.

WITNESSES

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RAILWAY CAR.

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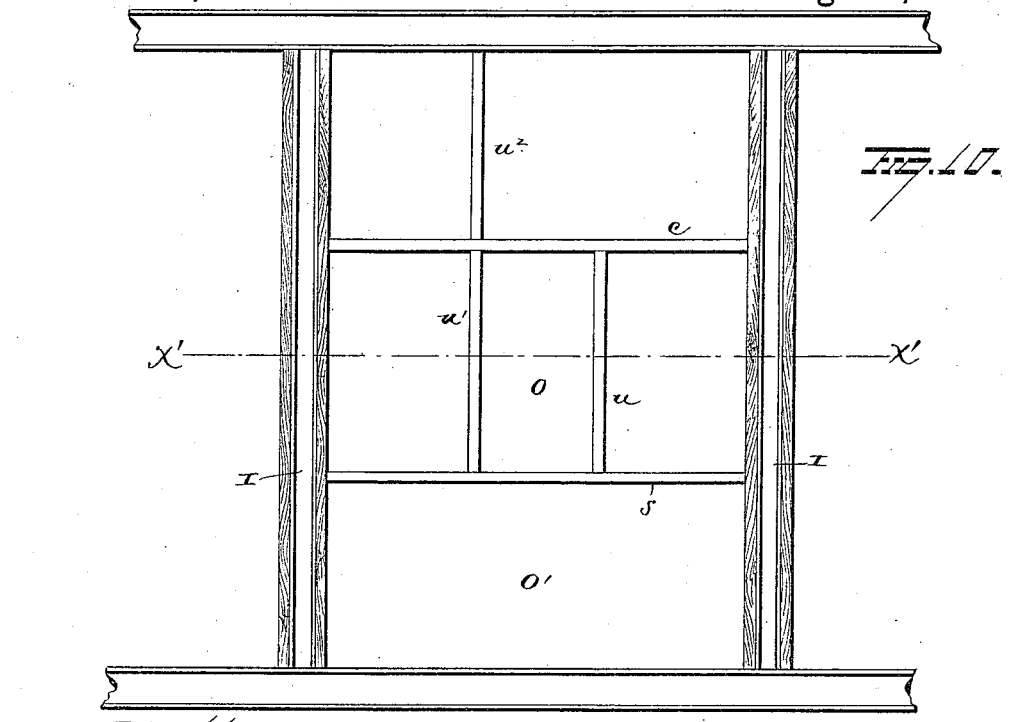

Fig. 10.

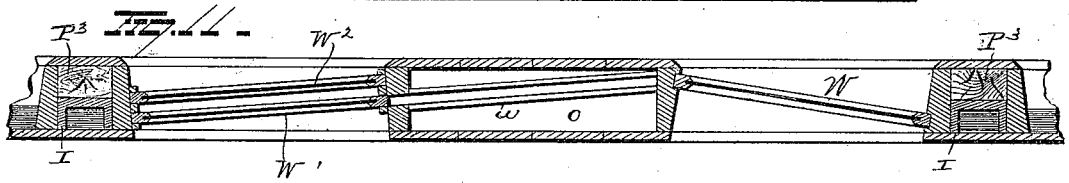

Fig. 11.

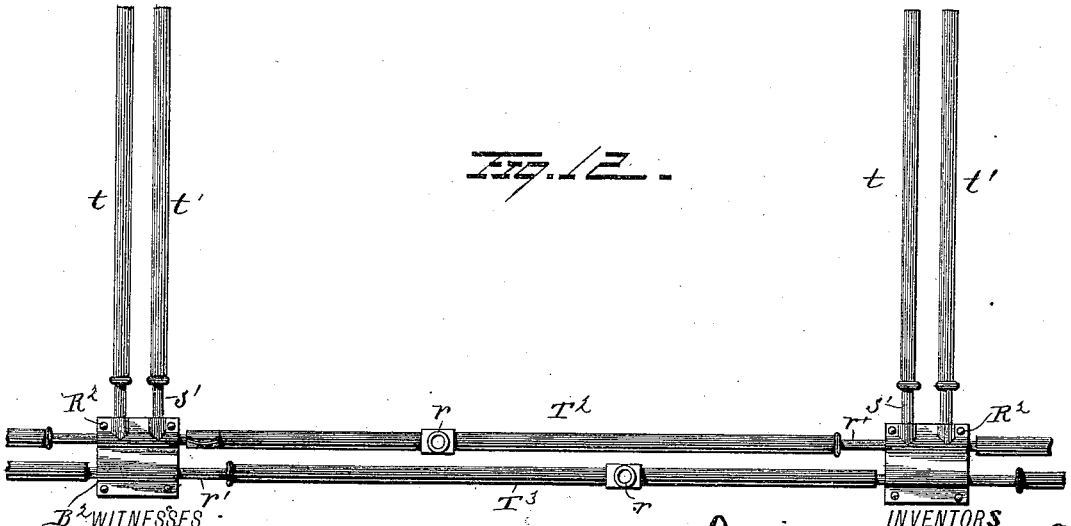

Fig. 12.

WITNESSES

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RAILWAY CAR.

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Fig. 13.

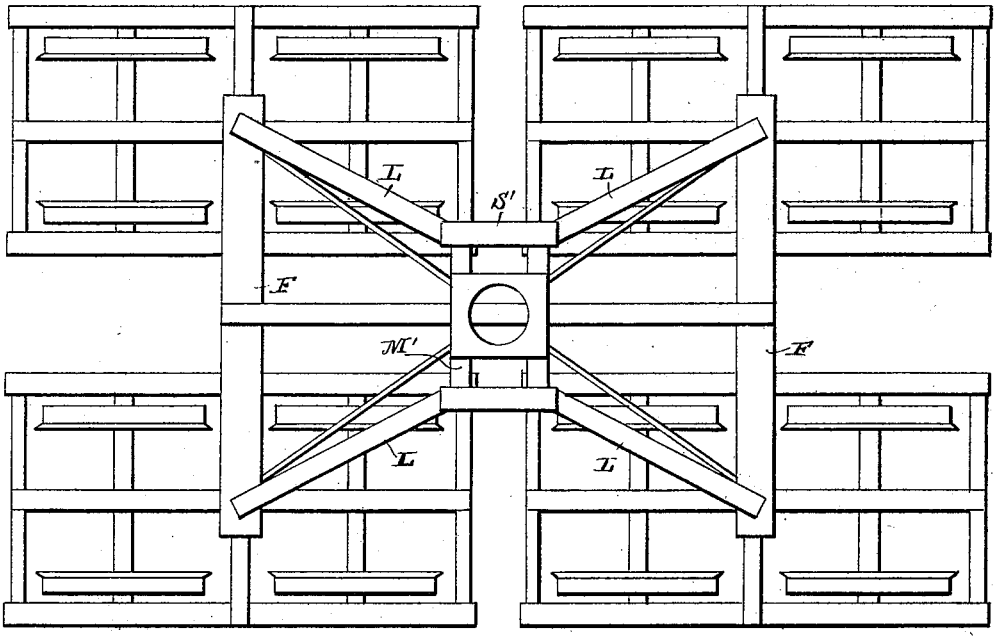
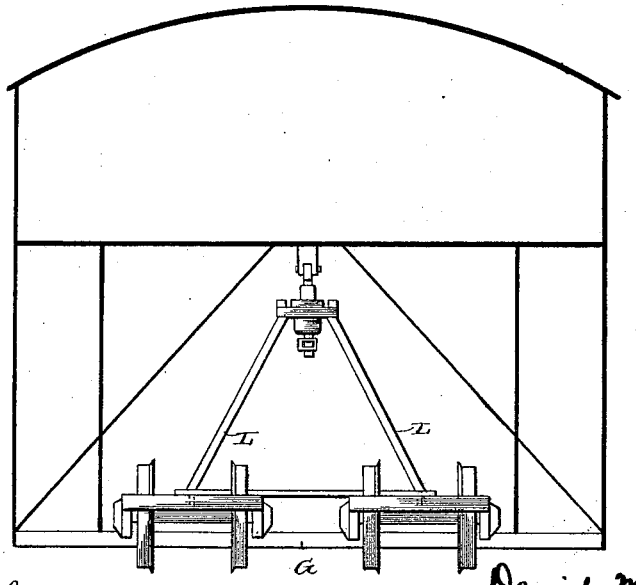


Fig. 14.



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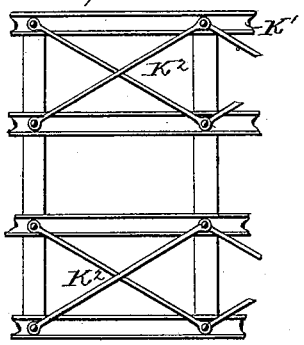
D. M. RICHARDS & I. HALE.

RAILWAY CAR.

No. 348,058. Patented Aug. 24, 1886.

Fig. 15.



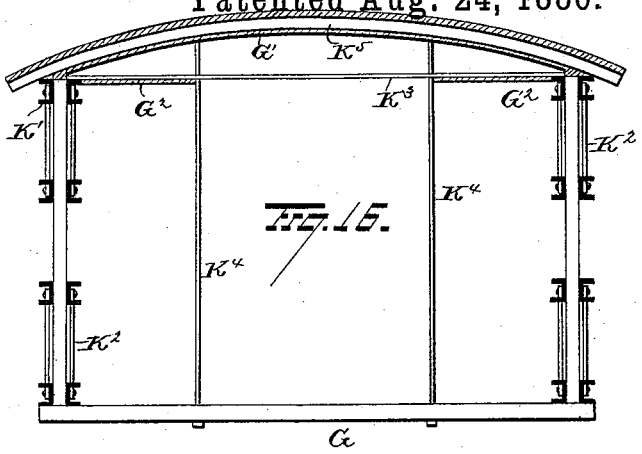


Fig. 16.

Fig. 17.

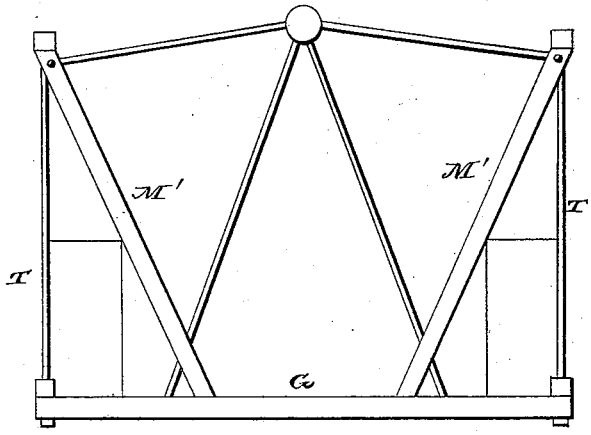
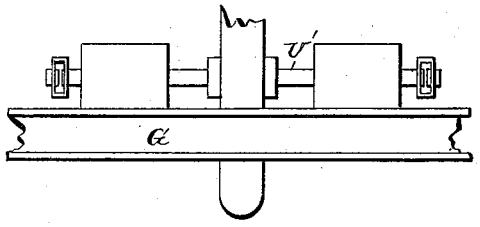


Fig. 18.



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RAILWAY CAR.

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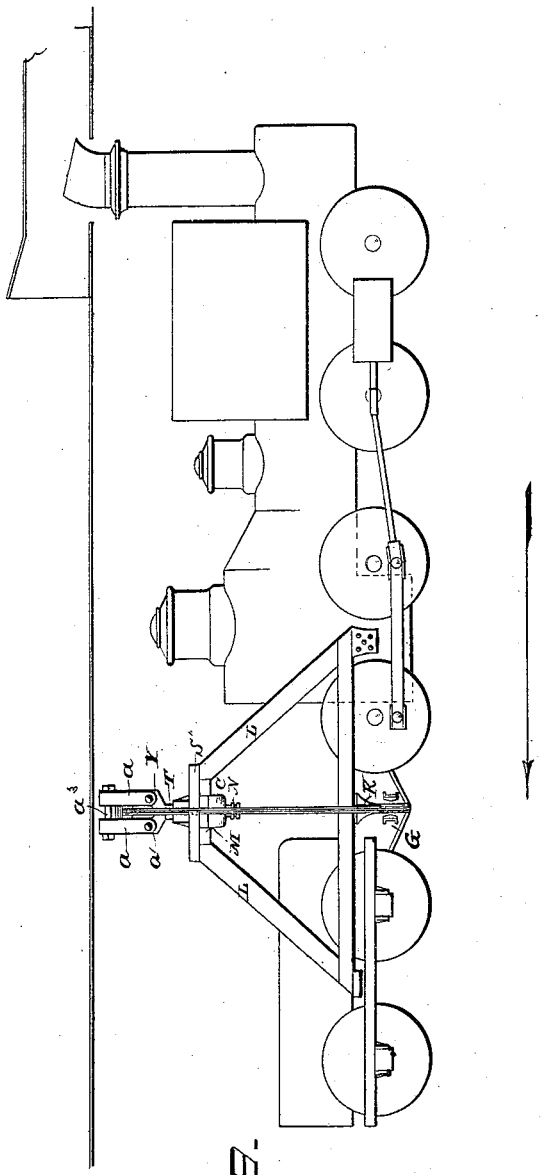

Fig. 67.

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UNITED STATES PATENT OFFICE.

DAVID M. RICHARDS, OF DENVER, COLORADO, AND IRVING HALE, OF WHITESTONE, NEW YORK.

RAILWAY-CAR.

SPECIFICATION forming part of Letters Patent No. 348,058, dated August 24, 1886.

Application filed February 18, 1886. Serial No. 192,393. (No model.)

To all whom it may concern:

Be it known that we, DAVID M. RICHARDS, of Denver, in the county of Arapahoe and State of Colorado, and IRVING HALE, of Whitestone, in the county of Queens and State of New York, have invented certain new and useful Improvements in Railway-Cars; and we do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

Our invention relates to an improvement in railway-cars.

In a train of cars as hitherto constructed and propelled the locomotive is separate from the load it pulls, and must therefore be given sufficient weight to furnish the requisite traction, and in order to provide for the heaviest load up the steepest grade and the worst condition of rails the engine is given a great weight, which, when the load is lessened and grade less steep and track in good condition, becomes so much dead weight to be carried. The resistance which the air exerts upon a train moving at a high rate of speed is also a very important factor in the expense of running a train; yet no attention is paid to this matter in the ordinary train, the cars having flat fronts and being coupled together in such a manner as to leave spaces between them, greatly increasing the resistance with every additional car. The loose couplings also allow the rocking and swaying motions which the cars exert upon one another, and thereby materially increase the resistance, especially in long trains. The separation of the cars also renders it difficult to satisfactorily light and heat them. Again, the common method of mounting the cars so that their floors are above the tops of the wheels necessitates the use of very small wheels, or rendering the car top-heavy. The advantage of larger wheels in lessening the frictional wear and heating is thus lost. The capacity of a small car is also much less in proportion to its weight than that of a larger car, and the frame-work has not hitherto been constructed of such material and arranged in such a manner as to obtain the greatest strength and capacity with a minimum weight.

The cars as hitherto constructed and connected are dangerous to couple; it is disagreeable for passengers to pass from car to car; the passengers are cramped for room; the seats are not shaped to admit of a comfortable reclining position; the ventilation is imperfect; as the engine is in front and outside of the cars, the opening of a window is liable to admit smoke, cinders, and dust; the view to the front is cut off by the cars and engine; in sleeping-cars the compartments are too cramped and not sufficiently private, and the tilting and jarring of the cars is unpleasant.

The general object of our invention is to provide a combined chair-car, dining-car, and sleeping-car of large capacity, adapted to replace a train of ordinary day-cars and sleepers, which shall be so adapted as to best cleave the air, and which shall be free from dust, smoke, or cinders, so annoying in ordinary trains.

More particularly, the object of our invention is to decrease resistance, and consequently the cost of running. This we accomplish by using a single large car, thus securing increased interior capacity per ton of dead weight; by placing part of weight on the wheels to which the power is applied, thus utilizing this weight to give traction and allowing engine and working parts to be made as light as possible consistent with strength; by mounting car on large wheels, obtaining their acknowledged advantages; by giving car such a form as to reduce resistance of air; by avoiding couplings, thus preventing the rocking effect of cars upon each other and other evils attendant upon loosely-connected trains.

A further object is to increase comfort of passengers. This we propose to accomplish by mounting car on air-cushions and giving it a lateral pendular swing restricted within narrow limits by pneumatic or other buffers, thus decreasing jar and swaying; by avoiding inconvenience and danger of passing from one car to another; by affording commodious sleeping-apartments, dining-room, parlors, toilet-rooms, &c., and by arranging parlors so as to afford a free view to front and rear; by placing engine in rear or by providing a pipe

to carry the discharge from the smoke-stack to the rear, relieving passengers from smoke and cinders; by such disposition of windows as will give protection against drafts and dust; by such an arrangement of seats as will give each passenger a separate seat and each occupant of a sleeping-section a separate compartment containing a single reclining bed-chair, which compartment may be isolated from the rest of the car or thrown open at will of occupant; by rendering possible by the single large car a simpler and more effective system of heating, lighting, and ventilation.

With these ends in view our invention consists in certain features of construction and combinations of parts, as will be hereinafter described, and pointed out in the claims.

In the accompanying drawings, Figure 1 is a view of the car in side elevation, partly in section. Fig. 2 is a top plan view of car-floor. Fig. 3 represents a plan view of one of the trucks and means for supporting the car thereon. Fig. 4 is a transverse vertical section through truck and car-supporting frame. Fig. 5 is a side elevation of same. Fig. 6 is an enlarged horizontal section through line *x x*, Fig. 4. Fig. 7 is a plan view of pneumatic buffer. Fig. 8 is a longitudinal vertical section of same. Fig. 9 is a transverse vertical section through center of truck and car-supporting frame, showing details of air-cushion and support. Fig. 10 is a view in elevation of one panel of outside wall of car. Fig. 11 is a horizontal section of same, taken through line *x' x'* of Fig. 10. Fig. 12 is a plan view of the rods for supporting curtains to shut off sections from the rest of the car. Figs. 13, 14, 15, 16, 17, and 18 represent modifications; and Fig. 19 is a detached view showing the manner of mounting the car and car-supporting frame in part on the drive-wheels of the locomotive.

The car represented in Figs. 1 and 2 is mounted on four four-wheeled trucks, the front pair of trucks being located between the middle and front end of the car, and the rear pair between the middle and rear end or at the rear end of the car. In the latter case the rear truck is entirely behind the car, and its wheels serve as the front and drive wheels of the locomotive, the boiler and cylinders of which are to be so disposed as to allow a portion of the car-supporting frame to rest on the drive-wheel truck. In the case where the rear pair of trucks is located between the middle of the car and the rear end thereof, the locomotive W' (shown in dotted lines in Fig. 1,) is placed upon either the front or rear pair of trucks, its smoke-stack extending through an opening in the roof of the car, and discharging its smoke, gas, and cinders into a pipe laid on the roof of the car, which conducts it to the rear of the train. The car surrounds the engine-house and is entirely separate from it, enough play being allowed to permit the swing of the car.

The frame-work of the car consists of four (more or less) longitudinal iron or steel trusses, the lower chords of which are represented in cross-section at S, Fig. 4. The trusses rest on a pair of cross-girders, G, one located between each pair of trucks. If the engine is located at the rear of car, the rear ends of the trusses terminate over the rear girder; but if the engine is within the car—a construction which we deem preferable—the girders will each be located at such distances from the ends of the trusses that the latter will sustain the greatest amount of weight. The theoretical point at which they should be located is about one-fifth of the length of the car from each end. The outside trusses extend around the front end of car, which is circular or nearly so in plan, and form the frame-work of the walls of the car. The two interior trusses, which support most of the weight, form the frame-work of longitudinal partitions. The parts of these trusses which are covered with partitions are indicated in Fig. 2 by full lines and the naked parts by dotted lines. The parts of the interior trusses which project beyond the trucks toward the ends of the car may, however, be omitted, and in general would be, to leave the front and rear parlors free from obstructions. The outside trusses would be braced beneath the windows, to sustain the required weight. To the bottom chords of the four trusses are attached cross-beams, on which the car-floor is built. On the frame-work thus formed the car is constructed.

A rigid frame-work support rests on a pair of trucks, as shown in Fig. 5. It consists of four legs, L, which are arranged in pairs and extend obliquely from a bed-frame, M M S' S', to points between each two side wheels of the double truck, where they are secured to cross-transoms, F. The latter may be either rigidly secured to the truck-frames or they may be provided with centrally-located depending studs *f*, by means of which they can be pivotally secured to each truck, and thereby allow the trucks to swing horizontally independently of each other. The bed-frame, consisting of the cross-beams M M and stringers S', supports the cylinder C.

In the construction shown in Fig. 19 three four-wheel trucks are used to support the locomotive and the frame-work support, which latter carries or supports the front end of the car. The front truck shown in this figure carries the coal-box, the middle truck constitutes the drive-wheels of the locomotive, and the rear truck the truck-wheels of the locomotive. The frame-work support above mentioned rests on the front and middle trucks, substantially as above described, and the car body or frame is connected thereto by the universal joint. To equalize the weight on the trucks, the water-tank is preferably attached to the locomotive in a position over the rear truck. The bottom of this cylinder inside is rounded, and into it is screwed the hollow plug L', Fig. 9, the inside surface of which has a

slight taper. In the cylinder is the rubber bag R, with a tubular neck, which passes down through opening in hollow plug L′, and is held firmly in place by the hollow plug U, the outside of which is turned tapering to fit inside of plug L′. This plug U is inserted in the rubber tube, and is forced up by the double nut N, working on opposite or differential threads on L′ and U, thus compressing the rubber between outside of plug U and inside of plug L′, giving an air-tight joint, which may be improved, if necessary, by the application of some appropriate material to the outside of the joint. To the hollow plug U is attached a pipe, through which air can be forced into the rubber bag in cylinder. The piston P is dished on under side, and works with a snug but not necessarily air-tight fit in the cylinder C. The piston-rod at its upper end is forked, as shown at Y. Each branch of the forked portion Y supports an arm, *a*, hinged to the branch of the fork by a bolt, *a′*, extending through the latter and through two ears projecting from the end of the arm. Each arm *a* consists of a half-box, inclosing a half journal-box, *b*, of suitable metal, which is slid into the half-box *a* from above, and held therein against lateral displacement by means of its dovetail construction. The half-boxes *b* are provided with sockets *b′*, which inclose the hollow spherical journal S^2. The arms *a* are locked together about the spherical journals by means of bolts a^3. Through the center of the spherical journal S^2 a bolt, B, extends, its head and nut being countersunk in the sphere. On the bolt B, within a slot formed centrally through the spherical journal, are strung the upper ends of four tie-rods, T, more or less. The tie-rods extend from thence between the arms *a* down to points on the cross-girder G, preferably to points where the lower chords of the trusses cross the girder, and serve to support the girder, and hence the car. The construction of the other supporting-frame over the other pair of trucks is the same as that above explained, and the car is thus supported upon the pistons P, which in turn rest upon air-cushions supported upon the trucks. The particular form of universal joint above described is not, however, necessary to the practical working of the car, but is set forth at length to show one very satisfactory form. Air is forced into the rubber bags in the cylinders until the pistons, with their load, are supported near the top of their cylinders. The air is then permanently shut off by a cock in air-pipe. The rubber bag is of such size that when this is accomplished it shall be somewhat distended, not enough to unduly strain it, but to such an extent that when the piston is at the lowest point it will occupy, due to the jolting of the car, the bag will still be slightly distended, and hence will always press snugly against the sides of the cylinder and piston, preventing leakage, but bearing no strain other than that due to this slight distention. The cylinder is to be of such dimensions as to make the air-pressure per square inch moderate. In case of breakage or leak in cylinder, the forked portion of the piston-rod will rest on the upper end of the cylinder, which will be protected by a rubber or other suitable cushion, and the car will ride safely until the accident is repaired. By these arrangements the car is free to follow curves, the trucks turning freely under the supports, and the support itself turning freely around the sphere, by means of the universal joint explained above. The car also swings laterally and remains horizontal, or nearly so, at all times; but to prevent constant swinging and swaying, and to restrict the swing within narrow limits, the device shown in Figs. 7 and 8 is used.

Under the center of each truck extend two cross-girders, *g g*, which are attached to the lower chords of the interior trusses. Between these girders are secured the cylinder C′, similar to the cylinders which support the car, except that there are two pistons, P′. The rubber bag R′ is between the pistons, and the plugs through which the air is admitted are screwed into the bottom (convex surface) of cylinder as it lies horizontally between girders. A spiral spring, *f′*, is placed between each piston-head and end of cylinder, to prevent the piston flying back too suddenly when car swings in opposite direction. Each piston-rod is cushioned with rubber and abuts against a bracket, B′, projecting from under side of the middle cross-piece of truck-frame.

To communicate the motion of the trucks to the car without bringing a strain on the ball-and socket joint and without interfering with the lateral or rotatory motion of the car, the following construction is used: To the cross transoms F of the frame-work support is attached the tie-beam N′, which serves to take up horizontal strain on the frame-work. The frame is further braced by diagonal ties D, which are attached to beam N′. To the middle of the beam N′ is secured the king-bolt K, which extends downwardly through a beveled slot, *g′*, in the girder G, as shown in Fig. 5. The king-bolt K may be strengthened in its position by tie-rods leading to the corners of the frame-work. The motion of the truck is, by means of the king-bolt, transmitted directly to the lower portion of the car simultaneously with its transmission through the universal joint to the upper portion of the car, and yet, because of the elongated slot *g′*, allows the base of the car to swing laterally and the frame work support to tilt forwardly and backwardly and turn horizontally. This is one of several equivalent constructions which might be employed to accomplish the same purpose, and hence we do not wish to restrict ourselves to this exact device.

The shape which the forward end of the car should assume to obtain the least resistance from the air is an important item in the practical working of the car. Experiments have

hitherto shown that a prism having an ogival front end goes through the air with about one-half the resistance encountered by the same prism having an abrupt or flat front. The front end of the car should therefore be rounded or pointed in circular, elliptic, or ogival form, the form which would be the least expensive to construct and most convenient in use being the most practical, since the difference in resistance between the different curved forms is not sufficient to warrant any material increase of cost or inconvenience in room.

The following is one of several approved interior arrangements.

P^2 represents a general parlor, located at either the front or rear end of the car, or there may be parlors at both ends, furnished with arm-chairs, rockers, &c.

p is the pilot's seat, (if locomotive is on forward trucks, no pilot-house is necessary, as engineer can see through front windows of car,) separated from parlor by railing. By a system of electric alarms, supplemented for safety with a bell-cord, signals are transmitted to the engineer. To avoid possibility of error, the electric connections will be so arranged that every message received in the locomotive will be automatically repeated at the pilot's station, enabling him to know whether or not the message was received. If no return signal comes, he uses bell-cord. In case of necessity, by pressing a button, he reverses engine and throws on the air-brakes.

L^2 is ladies' parlor. S^3 S^3 are smoking-rooms. T' T' T' are toilet-rooms. C^2 C^2 C^2 C^2 are closets.

R′ are state-rooms. Each is provided with two reclining-chairs, which can be converted into a wide bed or two single beds, and with one or two upper berths. In the wall between state-room and main car is a folding wash-basin. Sliding doors give entrance on either side. If desirable, these state-rooms can be replaced by a dining-room. In this case the kitchen, and in any case the steam-heating apparatus, storage-batteries for electric light, &c., can be placed in a compartment constructed on the forward truck of the rear pair of trucks, but entirely distinct from the swinging car proper.

S^4 are sections, each containing one reclining bed-chair and no upper berth. By curtains each section may be isolated from rest of car at will of occupant.

The doors to car are shown at D′, on each side, near front and rear. Each door is double, one side for entrance, one for exit.

Figs. 10 and 11 represent, respectively, a side elevation and horizontal section, on line *y y* of Fig. 10 of one panel of the outside wall of the car, corresponding to one section.

To the iron uprights I of the truss-frame are attached the posts P^3, and to these are framed the window-sill *s* and window-cap *c* and the uprights $u\,u'\,u^2$. The outside and inside walls are flush with outside and inside of posts P^3, except the rectangles bounded by $s\,u'\,c\,P^3$ and $s\,u\,c\,P^3$, which are cut away to receive windows W W′ W^2. These are set obliquely, as shown. W and W^2 open vertically and W′ horizontally, as indicated by the cleats *w*. The oblique setting gives better view to front and rear, while the horizontal motion of W allows it to be opened an amount dependent on direction and force of wind without admitting wind or dust, protection being afforded by the shoulder formed by post P^3. The space O between windows inside may be occupied by a mirror. The inside wall, O′, below windows, is hinged, affording a receptacle for bedding.

Fig. 12 shows the arrangement of curtain-rods for each section. The tubular rods *t* and *t′* project from the walls, to which they are firmly bracketed. The ends rest in the boxes B^2, suspended from ceiling by rods R^2, which rods may also serve to sustain electric-light fixtures. The tubular rods T^2 and T^3 also rest in the boxes B^2, and are additionally supported by rods *r*. The portions *s′ r′* of the tubular rods slide in the rods, and can thus be removed from the boxes B^2, and the curtains, which are strung on *t* and *t′*, can be run onto T^2 and T^3 as far as suspending-rods *r*, when the sliding portions *sr* are replaced and the curtains fastened on inside.

To prevent curtains from being raised from outside, cords are attached to their lower edges, passed through rings in floor beneath them, and are fastened to other rings farther inside. The rings are hinged, and when not in use occupy recesses in floor. The double curtains between sections, the wide lap of curtains in front, and the mode of fastening insure complete privacy to the occupants of each section.

The lighting of the car by electricity, furnished either by dynamos run by the engine or by storage-batteries, or both, can be more conveniently accomplished than in trains of cars as now run. The same may be said of heating the car either by steam or otherwise.

The enlarged opening on the roof of the car, through which the smoke-stack of the engine would extend into the smoke-conduit, might be readily protected by means of a hood secured to the smoke-stack above the roof and extending outwardly and downwardly over and beyond the opening. A jet of steam might be advantageously employed in starting the draft of smoke to the rear. The preferred construction of the smoke-conduit is that shown in Fig. 1. The front end of the conduit is open, as shown at q^5, and at intervals throughout the length of the conduit it is provided with forwardly-flaring lips q^6, rising from the sides of the base of the conduit at the roof of the car, adapted to gather and conduct the air within the conduit, and thus increase the draft in the smoke-stack of the engine. The conduit might conveniently be formed in sections, each provided at its front end with a flaring mouth, in which the rear end of the preceding section is inserted. Coal and water might be conveniently carried on an addi-

tional truck attached to the locomotive, and with it inclosed within the engine-house inside and independent of the suspended car; or the number of wheels on which the locomotive and car-support rest might be sufficiently increased to allow the coal and water to be carried in bunkers on top of the boiler, as water is now carried on some locomotives.

Some of the many advantages of the above-described car may be stated as follows: The weight of the car being partially exerted upon the drive-wheels of locomotive, the traction is increased as the load increases, and the engine and car may be made as light as consistent with strength. The car having the proper shape at the front end, and there being no cross open spaces at intervals along the train, the resistance from the air is reduced to a minimum. The single long wide car admits of the employment of a steel-trussed frame-work, the main trusses lying in longitudinal partitions and the windows and doors occupying positions between members of the truss-frame. By inclosing the trucks by the car and suspending the car from supports on the trucks, the bottom of the car may be brought below the tops of the wheels or below the axles, and the wheels be made as large as desired. The suspension, balancing, and lateral swing of the car also admit of its retaining a horizontal or nearly horizontal position, and lessen the danger of overturning when unevenly loaded, since the car can swing so as to bring its center of gravity under or nearly under points of support. The means for ventilating, heating, and lighting the car are enhanced, and the smoke is conducted to the rear. The passengers are allowed to obtain greater privacy, and more commodious sleeping and sitting compartments are provided for, and the jarring and rocking of the car are reduced to a minimum.

The modification represented in Figs. 13 and 14 consists in arranging the car to run on a double track or four rails, instead of on a single track, or on a single track of wider gage than now used, and increasing the capacity of the car. Fig. 13 is a plan view of a truck and car-supporting frame of this character, and Fig. 14 is a partial vertical section of the car. The four legs L rest with their feet at the centers of the four trucks, and the cross-girder G extends transversely between the two pairs of trucks. The car is two stories in height, making the car about as high as it is wide. The upper chords of the interior longitudinal trusses form the floor-sleepers for the upper story, thus leaving the interior of the upper story free from obstructions and capable of being divided into rooms of grand dimensions; or it might form one long saloon. The interior trusses might be omitted, and the outside trusses braced above and below the windows in a manner somewhat like that shown in Fig. 15. The object of this modified construction would be to free the interior of the car from partitions, leaving it open and commodious. To allow the windows to slide up, the horizontal K′ over the window would be constructed of two channel-pieces with an opening between them, and the diagonal ties K^2 should be attached to the external faces of the horizontal in pairs. Where doors occur, a larger panel and suitable bracing should be employed. The omission of interior trusses would necessitate long floor-beams, and they might be efficiently supported, as shown in Fig. 16. A light strong roof-girder, K^3, of the bow-string type, connects the upper chords of the outside trusses at the tops of each pair of uprights, ties K^4 from the arched roof-support K^5 to the girders K^3, and thence to the floor-beams supporting the latter at points corresponding to the missing trusses. The portions of the girders K^3 and tie-rods K^4 not concealed by the ceiling could be inclosed in ornamental hollow brass casings, and these might serve as curtain-supports. The inside ceiling of the car, in both the principal and modified constructions, is attached to the curved roof-supports K^5 between the planes of the interior trusses or ties, K^4, as shown at G′, and between the planes of the interior trusses and the walls it is attached to the girders K^3, as shown at G^2. The space between the inner terminals of the ceilings G^2 and the ends of the ceiling G′ is adapted to ventilating purposes, and is shielded from rain and dust by the arched extended roof and eaves.

The method of suspending the main cross-girder G from the spherical journal by four tie-rods leading from the journal to the cross-girder, while affording a strong and simple support, is nevertheless open to the objection that the outside tie-rods must be avoided by the passengers in walking along the passages between the truck-house and walls of the car. The following construction (shown in Fig. 17,) might be adopted and would be entirely feasible. The two exterior tie-rods might extend from the ends of the main girder perpendicularly to the ends of a pair of struts, M′, which extend from points at or near the feet of the interior tie-rods obliquely outwardly to points in the upper chords of the outside trusses. From the ends of the struts M′ the outer tie-rods extend to the ball-journal. The ends of the girder G, with their load, are thus suspended from the ends of the struts M′, and the struts are bound to the center. The double-piston buffer might be replaced by a two-cylinder buffer, as shown in Fig. 18, the cylinders being secured to the main cross-girder G, and a single piston, U′, in each cylinder engaging the king-bolt on opposite sides. The air-plugs in this case would naturally be inserted in the ends of the cylinders, as in Fig. 4.

It is evident that numerous changes might be resorted to in the construction and arrangement of the several parts without departing from the spirit and scope of our invention. For example, a number of trucks greater or less than four might be employed, and the trucks might have more than four wheels.

More than one air-cylinder might be employed to cushion the piston which sustains the car, and springs or rubber cushions might be employed in the place of air. The support and universal joint might be of other forms, and the interior arrangements modified as experience might dictate. Hence we do not wish to limit ourselves strictly to the construction herein set forth; but,

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

1. A railway-car adapted to rest in part upon the drive-wheels of its locomotive, and at the same time swing independently of the locomotive, substantially as set forth.

2. A railway-car adapted to surround its locomotive, rest partially upon the drive-wheels of the locomotive, and swing horizontally and laterally independently of the locomotive, substantially as set forth.

3. In a surface-track railway-car, the combination, with a set of trucks and car-supporting frames placed on the trucks, of universal joints located within the car-body and connecting the car and the supporting-frames, substantially as set forth.

4. In a surface-track railway-car, the combination, with a set of trucks and car-supporting frames on the trucks, of universal joints located within the car-body above its center of gravity, and connecting the car with the supporting-frames, substantially as set forth.

5. In a surface-track railway-car, the combination, with a set of trucks and a car-body, of car-supporting frames resting on the trucks and passing upwardly into the body of the car, and universal joints connecting car-supporting frames and car-body at points above the center of gravity of the body.

6. In a railway-car in which the car and its locomotive bear upon the same truck, the combination, with a car-supporting frame placed on the truck, of a universal joint adapted to connect the car with the truck independently of the locomotive, substantially as set forth.

7. In a railway-car, the combination, with a set of trucks and car-supporting frames resting on the trucks, of pistons secured to the car by universal joints, said pistons being adapted to rest on yielding cushions secured to the supporting-frames, substantially as set forth.

8. In a railway-car, the combination, with a set of trucks, cylinders secured to the trucks, and elastic air-tight bags inclosed in the cylinders, of car-supporting pistons adapted to rest on the air-tight bags when the latter are inflated, substantially as set forth.

9. In a railway-car, the combination, with a set of trucks, cylinders secured to the trucks, and pistons moving within said cylinders, of a car and universal joints connecting the car and piston-rods.

10. In a railway-car, the combination, with an elastic air-tight bag adapted to form a cushion for a car-supporting piston, of a hollow plug adapted to enter the mouth of the bag through the cylinder, and a double nut adapted to force the plug into the mouth of the bag and form an air-tight joint, substantially as set forth.

11. In a railway-car, the combination, with the car and its truck, of a cylinder secured to the car, projections attached to the truck, a pair of elastic-faced pistons working in the opposite ends of the cylinder and adapted to engage the truck projections, a pneumatic cushion located between the pistons, and springs located between the pistons and ends of the cylinder, whereby the lateral swing of the car is gradually checked, substantially as set forth.

12. In a railway-car, the combination, with the car-body suspended on the truck at a point above the axles of the truck, of a king-bolt adapted to work loosely in a slot, substantially as described, formed in a portion of the car-body below the point of support, for the purpose substantially as set forth.

13. In a railway-car, the combination, with a pair of cross-girders suspended in swinging adjustment from frame-works on the trucks, of longitudinal steel trusses resting on the cross-girders and forming the frame-work of the car, substantially as set forth.

14. The combination, with trucks and a car having its forward end rounded or pointed and a universal joint connecting said car with the trucks, of a locomotive bearing upon one of the car-trucks, substantially as set forth.

15. The combination, with a car-body adapted to replace a train of cars, and having its ends rounded or pointed, so as to cleave the air, of a locomotive located within said car and resting in part upon wheels which support one end of the car.

16. In a railway-car, a wall-panel corresponding to a seat-section, provided with an oblique vertically-sliding front and rear window and with a horizontally-sliding front window, for the purpose substantially as set forth.

17. The combination, with a car-body adapted to replace a train of cars, of a locomotive within said car-body and so situated as to leave space available for passengers between it and each end of the car-body, substantially as set forth.

18. A surface railway-car in which the floor of the car is below the tops or axles of the wheels, and having gangways between the outer sides of the wheels and the walls of the car, substantially as set forth.

19. In a railway-car adapted to replace an entire train and having a locomotive inclosed within it, the combination, with a smoke-conduit leading from the smoke-stack of the engine rearwardly along a car, of openings at intervals along the conduit adapted to admit air and increase the draft, substantially as set forth.

20. The combination, with a car and its propelling-engine, the said car and engine presenting but a single external structure, of a smoke-conduit leading rearwardly along the roof of the car, said conduit being composed of sections having flaring mouths, substantially as set forth.

In testimony whereof we have signed this specification in the presence of two subscribing witnesses.

DAVID M. RICHARDS.
IRVING HALE.

Witnesses:
E. Y. TEN EYCK,
JOHN G. FOLSOM.