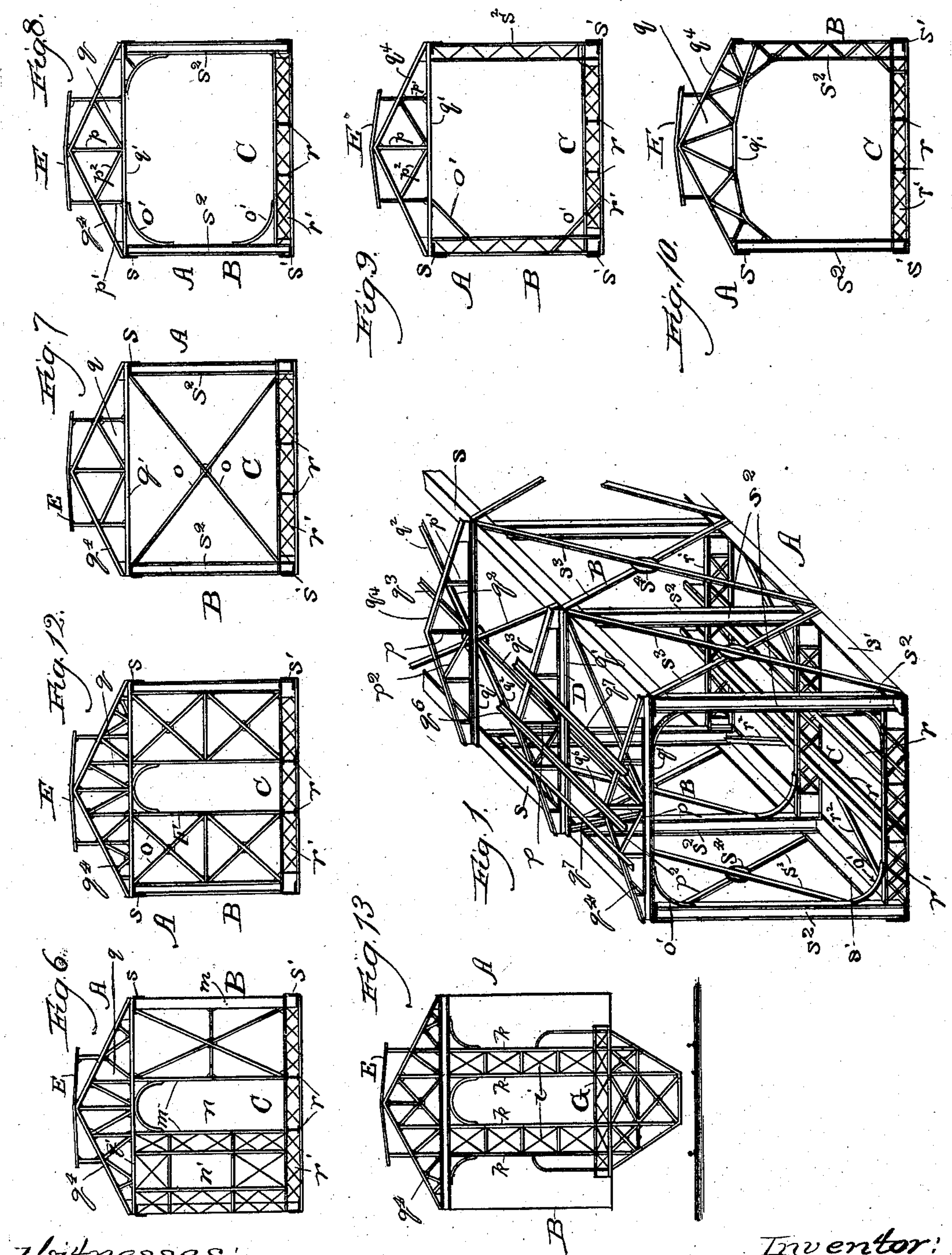
(No Model.) 2 Sheets—Sheet 1.

M. A. ZÜRCHER.

FRAME FOR RAILWAY CARS.

No. 384,225. Patented June 5, 1888.



Witnesses:

Chas. E. Gaylord.

J. H. Dyrenforth

Inventor:

Max A Zürcher,

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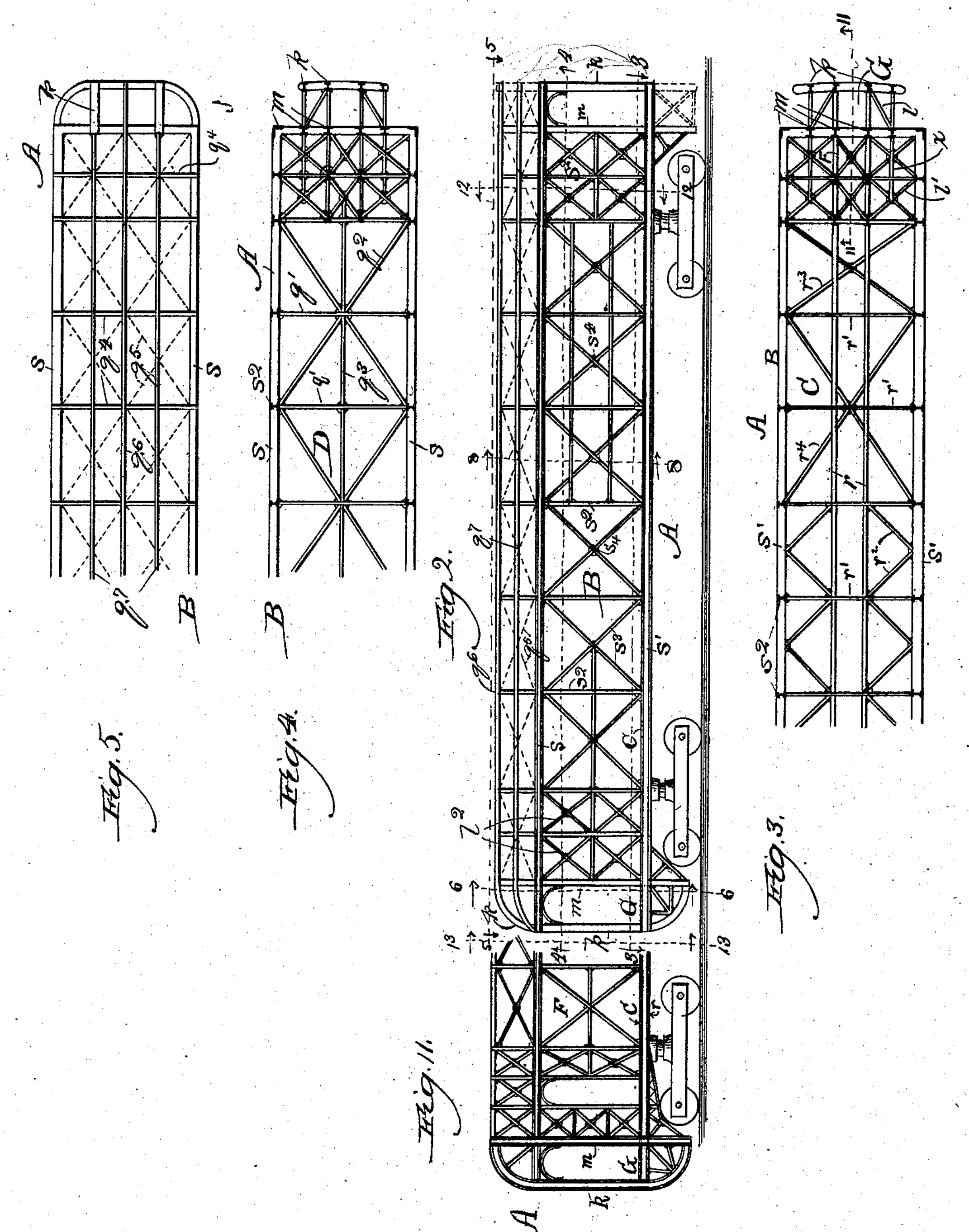

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UNITED STATES PATENT OFFICE.

MAX A. ZÜRCHER, OF PHŒNIXVILLE, PENNSYLVANIA.

FRAME FOR RAILWAY-CARS.

SPECIFICATION forming part of Letters Patent No. 384,225, dated June 5, 1888.

Application filed October 7, 1887. Serial No. 251,776. (No model.)

To all whom it may concern:

Be it known that I, MAX A. ZÜRCHER, a citizen of the United States, residing at Phœnixville, in the county of Chester and State of Pennsylvania, have invented a new and useful Improvement in the Construction of Railway-Cars, of which the following is a specification.

My invention relates to improvements in the construction of railway-car frames; and its objects are, first, to construct a skeleton car-frame entirely of durable materials, using for the main or absolutely essential members of such frame parts which shall have great strength, especially of nearly or equal resistance to compression and tension—such as wrought-iron, steel, and such metals as have similar characteristics—and shall be so related as to form a statical construction which shall resist abnormal stresses due either to the load carried by the car itself or to any extraneous forces which may be brought to bear upon the car-frame itself from any direction or cause whatever; second, to construct such a car-frame upon thoroughly scientific and theoretical principles from an engineering standpoint, in order to obtain the greatest degree of strength from the least weight of material; and, third, to provide a car-frame which shall be complete in itself, possessing especial strength for stress in all directions, and provided with means for connecting any two or more of such frames together, both at the upper and lower portions of the frames, thereby giving increased security. I accomplish all these objects by the improved car-frame hereinafter disclosed, and the combination of elements which go to make up the same, all as is particularly pointed out in the claims which follow this specification.

This railway skeleton car frame is in the nature of a hollow prism, whose external faces form the body thereof. Its two parallel faces of equal polygons are the car-body-frame ends, each completely and statically trussed and integrally connected to the other faces. The latter faces are parallelograms, which represent the longitudinal faces of the car-body, and each of these faces is in turn a complete and statically-constructed truss, with skeleton web members covering its entire face. Each two adjoining trusses have a common chord, and the whole body of the car-frame is therefore integrally connected together, so as to form a hollow statically-constructed prism of minimum weight and great strength. All of the longitudinal trusses are provided with skeleton, inclined, and normal web members, constructed either for tension or compression, or both, as the necessities of the case may demand, and they form, together with the chords, panels of such length as may be determined upon for the purpose required. The junction of any two adjacent panels in the same truss formed by chords and respective web members constitutes for each chord a panel-point—that is to say, the center lines or axes of these various members intersect in one common point, or practically so, in order to prevent any bending strains of a serious nature from exterior forces acting on or through that point.

To explain fully the previously-used term of a "statically-constructed" hollow prism, it is essential that the respective panel-points of two adjacent trusses having the same chord in common should intersect or lie in the same transverse plane of the car-frame body, thereby reducing the transverse stress which may occur to a minimum when acting upon said panel-points. This is always the case in opposite trusses. If symmetrically placed, their panel-points will coincide or lie in the same transverse plane to the car-frame body, but not necessarily vertical, as may be the case in single triangular trusses, where at the same time the several panel-points of all the trusses may lie in several intersecting planes, while for multiple intersection, triangular, and all rectangular trusses all the panel-points at the same location lie in a vertical transverse plane to the car-body, the latter being the most desirable construction, as will be readily seen when using interior transverse-vibration bracing, as hereinafter described.

Exterior forces or impacts acting obliquely against a panel-point of one truss would generate transverse strains in that truss; but in my construction the adjacent truss having the same chord in common and the panel-points of the two coinciding, it follows that the web members of both trusses will take up their components of strain and prevent thereby any transverse strains.

The foregoing constructions admit of the employment of the various common shapes of beams, angles, ties, as well as the special shapes of bars and plates, as will be readily understood.

With my improved car-frame I give this statically-constructed hollow prism representing the car-frame body additional strength by providing interior horizontal or inclined and interior vertical longitudinal trussing, especially at the ends, to render the car-frame proof against impacts in a longitudinal direction and give increased transverse and vertical strength. I also provide interior transverse-vibration bracing and overhead transverse roof-trussing to resist the various impacts in case of accident and pressure from loading. I also construct the overhead and platform portions in such a manner as to render the car additionally proof against telescoping or collapsing.

The several chords, struts, braces, and all main or absolutely necessary members to form a statical construction are secured in position with rivets, bolts, or pins, as may be required, in such a manner so that the axis of the above fastenings shall pass through the surfaces of the members to be joined perpendicularly or at right angles, and thus require the sectional area of the fastenings to be sheared before disconnection of a member can take place, while the heads or nuts have only to withstand the friction from the joined members, the same as is the present practice in first-class bridge trusses or girders.

It is obvious that the loosening of any one member does not loosen any other member of the same panel-point, which is sure to occur in a construction where, by securing one or more members taut, the whole value of its panel-point depends, as in a Howe truss; or the various members may be connected together by welding if suitable metals are used.

My invention will be better understood by referring to the accompanying drawings, in which—

Figure 1 is a broken perspective view showing my improved construction of a car-frame body. Fig. 2 is a side elevation of my improved railway-car frame. Fig. 3 is a part plan view of the floor portion of the same, including several designs of web construction. Fig. 4 is a plan view, looking upward, of a part of the interior horizontal or inclined overhead or upper deck longitudinal trussing along the bottom chords of the vertical transverse roof-trusses. Fig. 5 shows a portion of the exterior longitudinal roof-trussing in top plan along the rafters of the vertical transverse roof-trusses. Fig. 6 is an elevation of the end wall of the car-body, showing on one side a window-opening. Fig. 7 illustrates the interior transverse-vibration truss-bracing. Figs. 8, 9, and 10 are modifications of the same, the several views showing different details at each side. Fig. 11 is a longitudinal vertical section taken centrally on the line 11 11, Fig. 3, showing in elevation part of an interior longitudinal truss. Fig. 12 is a section on the line 12 12, Fig. 2, showing an elevation of the interior transverse-vibration bracing in connection with the interior longitudinal trussing, as shown in Fig. 11. Fig. 13 is an end elevation of my improved car-frame, showing the guard construction at the end of the platform.

A is my improved car-frame, of metal or any material possessing the required strength.

B B are the sides of the frame, forming the external vertical longitudinal side trusses, each composed of the top chords, S, bottom chords, S′, vertical web posts or struts, S^2, which serve also as struts or girders for the transverse-vibration bracing, as hereinafter described, and diagonal web members S^3, the intersections of which are also rigidly connected with or without the plates S^4. The web members are constructed so as to form tension or compression members, or both combined, as the various conditions may require. These external vertical longitudinal trusses B, as shown in Figs. 1 and 2, are called "single intersection rectangular trusses;" but a multiple intersection may be used instead. If the vertical posts S^2 are omitted, we have a "double intersection triangular truss." A single or multiple intersection may be used instead.

It is not necessary in the above triangular trusses that all the web members should form the same angle with the chords; neither that all the vertical web members S^2 should be omitted. A combination of parts of any of the herein-described trusses into one truss may be used as circumstances may require.

The bottom of floor-framing C of my construction is a horizontal exterior longitudinal truss composed of the chords S′, which also serve as bottom chords to the side trusses, B, the transverse struts or girders r' as web-posts, and the web-diagonals r^3 or r^4, or both. Into this truss is introduced one or more longitudinal stringers, r, and rigidly connected to by all members thereof, which serve as girders and columns, to increase the vertical strength of the floor and also to resist compressive and tensile or tractive strains. One or more of the several designs shown in Fig. 3 may be used singly or combined.

The transverse girders r', which form the bolsters over the trucks, require additional strength to sustain the load accumulated at those points, and may be of box shape.

The floor-framing may also be constructed of two or more trusses rigidly and integrally connected together to serve as one truss, wherein the bottom chords, S′, and the interior longitudinal members, r, serve as chords having web posts or girders r' and diagonals r^2, (as shown in Fig. 3,) r' acting as girders in a longitudinal direction. This method of construction may be used in any of the longitudinal trusses, and the central space may also form a truss with diagonals.

The two exterior inclined planes formed through the top chords or rafters, q^4, of the transverse vertical roof-truss q form for each plane an inclined longitudinal roof-truss, as shown in plan, Fig. 5. Each truss is composed of the top chord, S, of the adjoining side truss, B, and the central stringer, q^6, as composite chord to both inclined trusses. The rafters q^4 serve as web-posts, and the dotted lines q^5 as web diagonals, and q^7 as roof stringers, struts, or ties. The trussing may instead be arranged as shown in Figs. 3 and 4.

It is not necessary that the top chords, q^4, of the transverse roof-truss q should form two inclined planes only, as shown, but may be composed of more than two segments or planes, each completely trussed and integrally connected together, or it may form but one plane.

In the interior horizontal plane through the top chords, S, of the side trusses, B, I construct an interior longitudinal overhead or upper-deck truss, D, as shown in plan, Fig. 4, (looking upward,) the chords of the side trusses serving as chords for this upper deck also, and the bottom chords, q', of the transverse vertical roof-trusses q serve as web-posts, together with the web-diagonals q^2 and longitudinal struts or ties q^3. The latter, if used, form the body of the truss.

It is not necessary that the bottom chords, q', should be straight, as shown in Figs. 7, 8, and 9. They may be angular or arched, (see Fig. 10,) in which case there can be a series of longitudinal trusses which will or may have the various segments of the bottom chords, q', as web posts. This interior horizontal upper-deck truss D may be in part or wholly omitted in the central portion and combined only at the end portions, as the strength of the construction may require.

My improved transverse vertical roof-trusses q, Figs. 7, 8, and 9, being statically constructed, are strong enough to carry the roof load and to prevent collapsing in case of overturning. One truss is composed of the top chord or rafter, q^4, the bottom chord or tie, q', the web members p, p', and p^2, in Fig. 1, or a truss having the same functions, as shown in Fig. 10. None of the trusses shown will exert oblique outward thrusts on the top chords, S, of side trusses, B, from impacts or loads acting in a parallel plane to said side trusses. The whole overhead roof portion of car-body, consisting of the exterior inclined longitudinal trusses along the rafters q^4, and the interior longitudinal truss along the bottom chords, q', in connection with the vertical transverse roof-trusses q, form in themselves a complete external and internal statically-constructed auxiliary prism, wherein each member assists in resisting all impacts from load or other strains. The top chords, q^4, form a support for the usual ventilator, E, if used.

As already stated, my car-frame externally constitutes a statically-constructed hollow prism. To give additional strength to this prism, the following interior constructions are used.

First. One or more lines of interior vertical longitudinal trussing, F, constructed similarly to the side truss, B, extends inside the car from the ends toward the center any desired distance or continuously through the car, dividing it longitudinally into compartments, which are subdivided by the transverse bracing shown in Fig. 12, and serving to increase the strength, rigidity, and carrying capacity, besides affording increased resistance against external forces, particularly against telescoping. The interior longitudinal truss or trusses may, depending upon the nature and purpose of the car, be provided at intervals with openings for access to the compartments, said openings being braced above and below, similarly to the construction shown in Fig. 6, to transmit strain arising in the longitudinal trusses. The bottom chords may form substitutes for the floor members r. The top chords may form substitutes for q^6 and q^7, or both.

Second. Interior transverse bracing is provided at proper points, the fundamental principle of which is illustrated in Fig. 7, and comprises, in connection with opposite vertical web-posts, S^2 of the side trusses, B, a transverse floor-strut, r', and a bottom chord, q', of the transverse roof-truss q, diagonal braces o, secured at their extremities to diagonally-opposite chords, S and S', or to any of the members stated, or to a combination of any or all of them with the chords.

As represented in Figs. 1, 8, 9, and 10, the diagonal braces O are supplanted by knee or corner braces O' when the posts S^2 of the side trusses, B, and the lower floor-struts, r', are in the form of girders; and instead of the bottom chord, q', the whole truss q has to serve as a girder, and is rigidly connected from the upper and lower girders to the vertical girders S^2. In case the vertical posts S^2 of side trusses, B, are omitted, web diagonals S^3 have to fulfill the same functions, and must be constructed and connected accordingly.

Another modification of the interior transverse trussing is seen in Fig. 12 in connection with the interior vertical longitudinal trusses F. The space above and below the passage-way is to be suitably trussed to transmit web strains.

At the ends of the car-body frame a similar construction of transverse bracing is employed, as shown in Fig. 6, in which the door-opening and window-opening n and n' are properly braced to take up and transmit strains above and below these openings.

The ends of the car-body frame are further strengthened by means of vertical columns or girders m, built into them, (see Figs. 2, 3, 4, 6, and 11,) extending from the roof to or below the floor, and serving, when extended below, an additional purpose, hereinafter described in connection with the platform.

The transverse bracing, besides strengthening the car-frame against external force, also strengthens it against the pressure of the load by transmitting and distributing the strains therefrom, and thereby augments the carrying capacity.

The platforms G are extensions of the girder or girders r or extensions of the interior vertical longitudinal truss-work F at opposite ends of the car, thereby providing continuous connection of the platforms between their extreme ends. Additional short girders x, Fig. 3, are used in connection with diagonal braces l in the platforms and l' in the horizontal exterior floor-truss C to the extent required to equalize and distribute strains; also the vertical side trusses, B, and interior longitudinal trusses, F, have web members l^2, Figs. 2 and 11, added at the ends, and which may extend toward the center as far as desired to additionally increase the power of resistance in the platforms and transmit and equalize the strains exerted against both decks.

The upper deck of each platform is a continuation of the upper longitudinal trusses, D, as shown in Fig. 4, and is constructed like the lower platform trussing already described.

The overhead constructions, in connection with the additional web members of the vertical longitudinal trusses at the ends, all as hereinbefore specified, are calculated to resist impacts and strains nearly equal to the floor-framing; hence cars may be coupled at the top or upper deck in addition to the usual platform coupling and divide the duty and assist in holding them steady in their normal relative positions, and also afford greater security from uncoupling in case of accident, as well as to offer increased resistance to telescoping in case of collision.

At the extremity of each platform G are vertical columns or girders k, rigidly connected to the upper extension-deck, and to the platform, suitable lattice or girder web-framing, i, being provided between the columns; also trussing above and below the various openings, as shown in Figs. 2, 11, and 13, to increase the rigidity of the columns and of the platforms.

The columns or girders k may be extended above the upper deck and below the platforms, either straight, as shown by the dotted lines, or curved, as shown by the full lines in Fig. 2. In the latter case suitable connection between the columns k can be made with the columns m, provided in the end walls, and which may be also extended above the upper deck and below the platforms and connected with the longitudinal stringers q^6 and q^7 of the upper exterior deck, and with the girders r of the lower deck, or both decks with the interior vertical longitudinal trusses F, or all combined. This construction of the platform ends of the car affords a guard against telescoping in case of collisions, since it must necessarily be demolished before the car-body can be injured, further injury in case of such destruction being next resisted by the columns m in the end walls, and subsequently by the longitudinal and transverse internal bracing and general truss-work of the car-frame.

By bending the columns K toward the car-body at their upper and lower ends they form framing for a hood protection at the top, and at the bottom guard against the lifting of one car by another in case of collision or derailment, and prevent one platform from cutting into the end of an adjoining car; also the downwardly-extending guard may penetrate the ground and retard the progress of the car in case of derailment.

This improved car-frame body, consisting externally of a hollow statically-constructed skeleton prism or body, in connection with the various kinds of interior longitudinal as well as transverse trussing and the improved overhead vertical roof trusses, prevents the car-body from getting dislocated, as any part or member under strain or impact will be assisted by all the other members to keep proper equilibrium in the structure, and still more so on account of the improved platform portions, all this being very essential for regular loadings, especially in the event of accidents.

No strength is added to my car-frame by the external or internal coverings suitably connected, which may be made of asbestus or paper-boards or other materials especially prepared for the purpose, thereby dimishing the weight of the car and rendering it fire-proof.

Another reason for making the open spaces in my metallic car-frame as large as permissible is to admit of windows of the largest size and of such shape and construction as may be deemed advisable.

I am aware that it is old to construct a railway-car frame having external vertical side trusses, and I therefore make no claim to such a construction.

I am also aware that it is old to construct car-bodies entirely of wrought metal having a trussed frame beneath the body of the car to support the same, and that is is old to construct a car-body entirely of metal, in which the base of the car is composed of solid tubular girders, the side of vertical walls having T-braces between the walls in such a manner as to make the car-body a tubular truss; also that it is old to construct an iron car-frame having the external vertical trussing extending throughout the length of the car, but only to a portion of the height of the sides. Such constructions, however, do not come within the scope of my invention, and are not designed to receive and transmit exterior strains equally in all directions at any points where such strains may be brought to bear, as is the case with my improved car-frame.

What I do claim, and desire to secure by Letters Patent of the United States, is—

1. A railway-car frame in which each exterior longitudinal face is constructed of a statically-formed truss with skeleton members and one chord for each pair of adjacent trusses in common, the whole forming a complete skeleton tube, substantially as described.

2. A railway-car frame consisting of a hollow statically-constructed skeleton prism or body having a number of panel-points in each of the faces of the longitudinal sides of the

frame, which panel-points intersect or coincide at the junction of the sides of the frame with the longitudinal chords thereof, substantially as described.

3. A railway-car frame consisting of an exterior longitudinal frame-work having interior transverse-vibration trusses, substantially as described.

4. A railway-car frame consisting externally of a skeleton prism or body, with one or more interior longitudinal trusses connected with the exterior frame-work, substantially as described.

5. A railway-car frame having a body in the form of a skeleton prism or body, with one or more interior longitudinal trusses connected with the external frame-work, and one or more interior transverse-vibration trusses connected also to the frame-work, substantially as described.

6. A railway-car frame having externally a skeleton prism or body, with one or more vertical transverse statically-constructed overhead roof-trusses, having web members throughout its entire length, substantially as described.

7. A railway-car frame having externally a body in the form of a skeleton prism, with one or more interior transverse-vibration trusses and one or more vertical transverse statically-constructed overhead roof-trusses, having web members throughout its entire length, all connected together substantially as described.

8. A railway-car frame having externally a body in the form of a skeleton prism, with one or more interior longitudinal trusses and one or more transverse statically-constructed overhead roof-trusses, having web members throughout its entire length and suitable connections for rigidly connecting the same together, substantially as described.

9. A railway-car frame externally in the form of a skeleton prism or body, with one or more interior longitudinal trusses and one or more vertical transverse statically-constructed overhead trusses, having web members throughout its entire length and one or more interior transverse-vibration trusses, all connected together substantially as described.

10. A railway-car frame having an upper and lower deck frame projecting beyond the ends of the body of the main frame, connected by columns or girders at their extreme ends, substantially as described.

11. A railway-car frame having an upper and lower deck frame projecting beyond the ends of the body of said frame, connected by columns and girders at their extreme ends extending above said upper and below said lower decks, substantially as described.

12. A railway-car frame having a truss-body with an upper and lower deck frame projecting beyond the ends of the body, connected by columns or girders at the ends thereof, and having columns or girders *m* built into the end wall of the body, with projecting ends of members *k*, substantially as described.

13. A railway-car frame in the form of a prism or body having trussed side, top, and bottom faces, in combination with one or more longitudinal interior trusses, substantially as described.

14. A railway-car frame having trussed side, top, and bottom faces, in combination with one or more lateral interior trusses connecting the sides, top, and bottom, substantially as described.

15. A railway-car frame having trussed side, top, and bottom faces, in combination with one or more longitudinal interior trusses and one or more lateral interior trusses, all connected together substantially as described.

16. A railway-car frame consisting of a trussed body, in combination with projecting trussed platforms, substantially as described.

17. A railway-car frame consisting of a trussed body, in combination with trussed platforms and trussed projecting roof portions, connected, respectively, to the body of said frame, substantially as described.

18. A railway-car frame consisting of trussed longitudinal side, top, and bottom faces, in combination with a trussed roof-supporting frame, substantially as described.

19. A railway-car frame having four or more longitudinal external members, with diagonal and vertical members connecting the sides of said frame to said longitudinal members and diagonal and horizontal members connecting the top and bottom of such frame to said longitudinal members, substantially as described.

20. A railway-car frame having vertical and diagonal braces in its side faces, in combination with diagonal and horizontal braces in its top and bottom faces and knee-braces between the sides and top and bottom faces, substantially as described.

MAX A. ZÜRCHER.

In presence of—
J. W. DYRENFORTH,
CHAS. E. GORTON.