March 27, 1934. H. H. LINN 1,953,053

TRAILER CONSTRUCTION

Filed Feb. 14, 1931 2 Sheets-Sheet 1

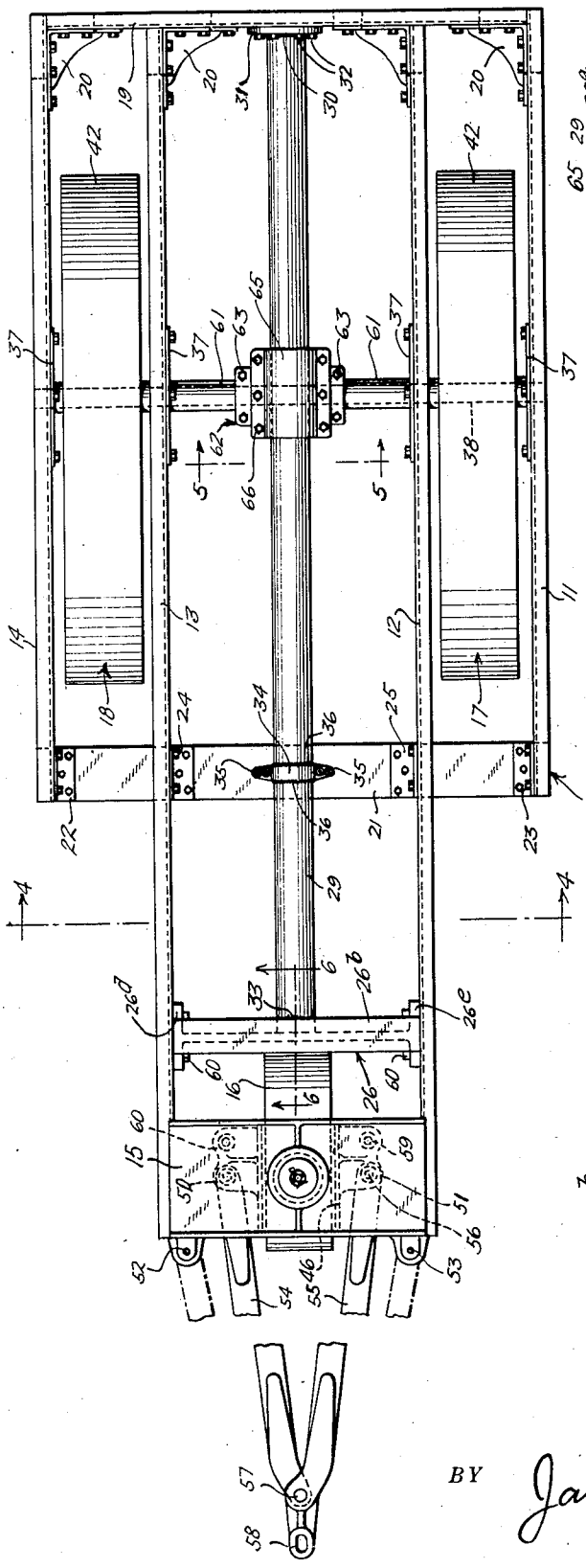


Fig. 1.

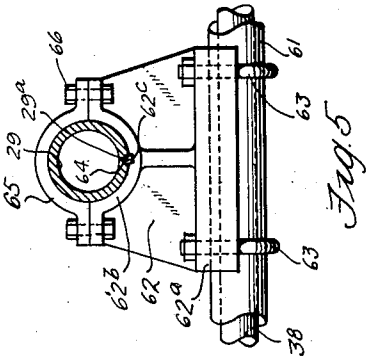


Fig. 5.

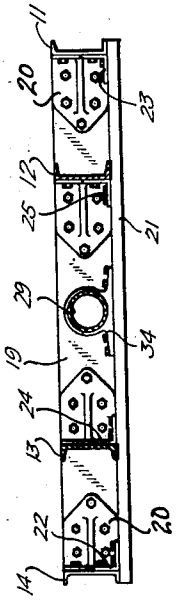


Fig. 4.

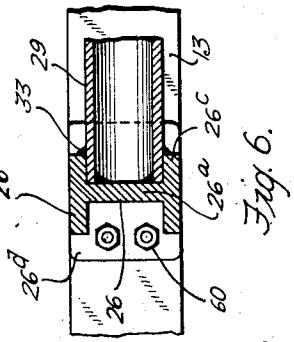


Fig. 6.

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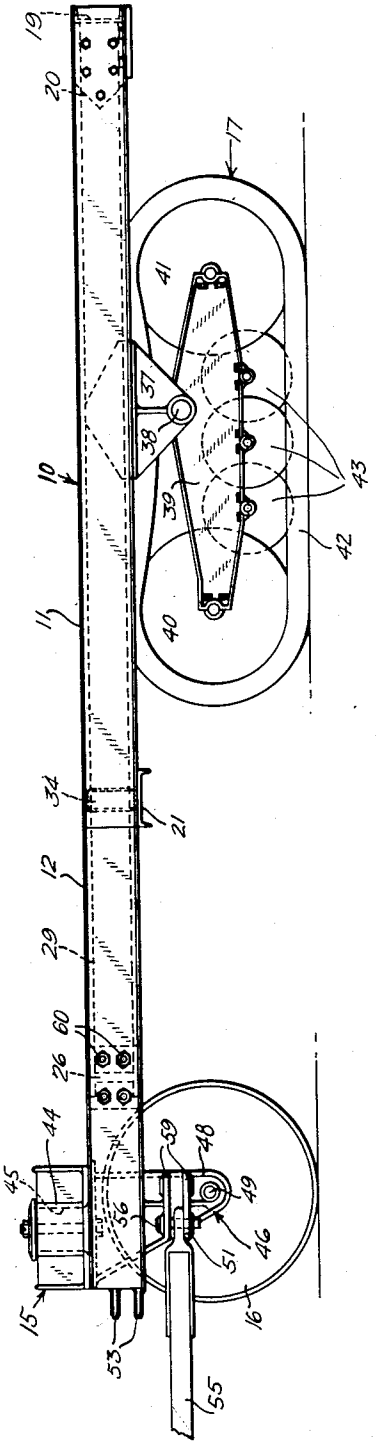


Fig. 2.

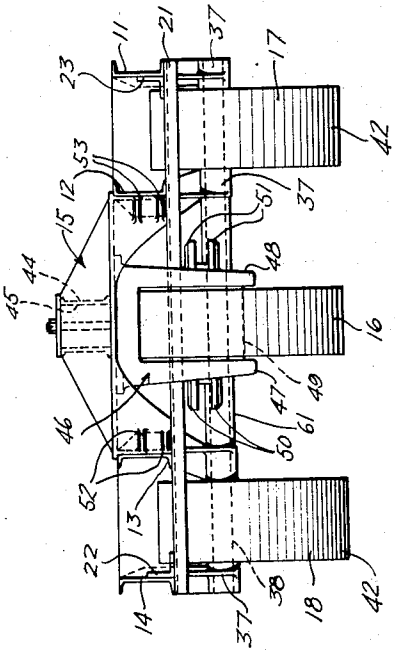


Fig. 3

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TRAILER CONSTRUCTION

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Application February 14, 1931, Serial No. 515,697

20 Claims. (Cl. 280—33.4)

This invention relates to trailer construction.

One of the objects of this invention is to provide a practical and strong trailer construction that will be of inexpensive construction of light weight, and well adapted to carry heavy loads. Another object is to provide a construction of the above-mentioned character in which torsional strains upon the vehicle body or frame, due to the character of the stresses imposed thereon by either the load, uneven road conditions, or variations in the direction of the force hauling or pushing the vehicle may be dependably resisted. Another object is to provide a vehicle body or frame construction well adapted to meet the varying conditions of hard practical use. Other objects will be in part obvious or in part pointed out hereinafter.

The invention accordingly consists in the features of construction, combinations of elements, and arrangements of parts as will be exemplified in the structure to be hereinafter described and the scope of the application of which will be indicated in the following claims.

In the accompanying drawings, in which is shown one of the various possible embodiments of this invention,

Figure 1 is a plan view of an assembled trailer;

Figure 2 is a side elevation thereof;

Figure 3 is a front elevation, as seen from the left in either Figures 1 or 2;

Figure 4 is a vertical cross-sectional view on an enlarged scale, as seen along the line 4—4 of Figure 1;

Figure 5 is a sectional view on an enlarged scale, as seen along the line 5—5 of Figure 1; and

Figure 6 is a sectional view on an enlarged scale, as seen along the line 6—6 of Figure 1.

Similar reference characters refer to similar parts throughout the several views.

Referring now more particularly to Figures 1 and 2, there is generally indicated at 10 a vehicle frame made up of preferably four parallel and longitudinally extending frame members 11, 12, 13 and 14, preferably of channel cross-section as appears more clearly in Figure 4. Main frame members 12—13 are extended to the left, as viewed in Figures 1 and 2, where they are joined to a transversely extending and upwardly arched header 15 (see also Figure 3), in a central portion of which is mounted, in a manner to be more clearly described hereinafter, a front wheel 16.

Main frame members 12—13 may be given any desired lateral spacing from each other but the spacing of auxiliary or side frame members 11 and 14 from main frame members 12 and 13, respectively, is preferably such that the spaces between members 11 and 12 and between members 13 and 14 accommodate track units 17 and 18, respectively, the construction and action of which will be more clearly described hereinafter.

The channel frame members 11, 12, 13 and 14, faced with respect to each other as is better shown in Figure 4, are connected at their rear or right-hand ends, as viewed in Figures 1 and 2, by means of a cross-beam 19, preferably also of channel cross-section, as is better shown in Figure 2. The connection between these frame members and the cross-beam 19 may be achieved in any suitable manner and I may employ welding for this purpose. Preferably, however, I employ suitably ribbed and flanged bracing angles 20 (see right-hand portion of Figure 1) for not only securing the longitudinally extending frame members to the cross-beam 19 but also to prevent distortion of the resultant frame.

As appears clearly from Figures 2 and 3, channel frame members 11, 12, 13 and 14 are preferably of the same dimensions in cross-section and thus their upper and lower faces lie in the same parallel planes; extending underneath these four alined frame members is a cross-beam 21 (Figures 1, 4 and 2) preferably of channel cross-section and with its plane-faced side facing upwardly. Cross-beam 21 is secured to the auxiliary frame members 11 and 14 adjacent the forward or left-hand ends thereof, as by securing and bracing angles 22 and 23, respectively, similar angles 24 and 25 being employed to connect cross-beam 21 securely to the main frame members 12 and 13 (see Figures 1 and 4).

Extending crosswise of and fitted between the main frame members 12 and 13 is a cross-beam 26 (Figures 1 and 2) that is preferably in the form of a steel casting; it is relatively heavy and very rigid, being preferably of I cross-section, as is better shown in Figure 6. It therefore has a vertical web 26^a and upper and lower ribs or flanges 26^b and 26^c. At its ends it has integrally formed therewith transversely extending plates 26^d and 26^e (Figure 1), and in Figure 6 one of the end plates, namely plate 26^e is clearly shown. These end plates are of a vertical height substantially equivalent to the height of the main frame members 12 and 13 against which they abut, being suitably and securely secured thereto as by rivets, bolts, welding, or the like. In the drawings I have shown bolts 60 (Figures 1, 2 and 6) as rigidly securing the main frame members 12 and 13 to the cross-beam 26. The latter is positioned close to the header 15 but preferably sufficiently to the

rear thereof (to the right as viewed in Figures 1 and 2) so that wheel 16, which is pivoted about a vertical axis, adequately clears the member 16.

Extending lengthwise and intermediate of main frame members 12 and 13 and with its ends abutting cross-beams 26 and 19, is a torque tube 29 preferably of steel and preferably of substantial diameter. As appears clearly from the drawings, the diameter of tube 29 approximates the depth of the longitudinal channel members of the frame 10. The ends of the torque tube are rigidly secured to the cross-beams 26 and 19. Preferably the rear end of torque tube 29 is secured, as by welding, indicated at 30 (Figure 1), to a relatively heavy circular plate 31 which is bolted or riveted, as at 32, to the vertical web of the cross-beam 19. The circular plate 31 may be made relatively heavy and thus greatly facilitates the welding thereto of the end of tube 29 and, in having preferably a relatively large area, also reinforces and strengthens the cross-beam 19 and particularly the connection thereto of the torque tube 29.

The front end of torque tube 29 (see Figure 6) preferably fits in between the horizontal flanges 26^b and 26^c of the cross-beam 26 and abuts against the vertical web 26^a thereof; to these parts the torque tube 29 is rigidly secured preferably by welding, as is indicated at 33. The cross-beam 26, being preferably heavy and cast, thus also facilitates the achievement of a dependable weld between itself and the end of torque tube 29.

Torque tube 29 thus substantially overlies intermediate cross-beam 21 (Figures 1 and 4) and at this point tube member 29 preferably passes through a heavy bracket 34 (Figures 1 and 4) which is secured to cross-beam 21 as by bolts 35. Tube member 29 and the bracket 34 are welded together as at 36, the weld extending throughout the entire periphery of the torque tube 29.

Intermediate of cross-beams 21 and 19, frame members 11, 12, 13 and 14 have secured thereto downwardly extending brackets 37 (see also Figure 3) which are suitably shaped to provide alined bearings for a shaft 38 upon which track units 17 and 18 are mounted. The detailed construction which the track units 17—18 may assume is not per se part of this invention but is preferably of the construction disclosed and claimed in my co-pending application Serial No. 485,778, filed October 1, 1930, to which reference may be had for detailed description thereof. Insofar as my present invention is concerned, it is sufficient to point out that each track unit comprises a pair of laterally spaced rigidly connected frame-like members 39 pivotally supported by shaft 38 and supporting in turn relatively large end wheels or pulleys 40 and 41 (Figure 2) about which extends an endless track member 42 of any suitable flexible or articulated or linked construction. The spaced frame members 39 of each of track units 17 and 18 preferably also support intermediate smaller and preferably inter-leaved wheels 43 to coact with end wheels 40 and 41 in achieving a uniform and wide distribution of the load to the road-contacting portion of the endless track member 42. The pivoted connection of the track units, by way of shaft or rod 38, permits the two track units independently of each other to adapt themselves to varying contours of the roadbed, while the spaces between the frame members 11 and 12 and between frame members 13 and 14 (Figure 1) insure adequate range of this pivoting movement of the track units 17 and 18, respectively, without necessitating undue height of the resultant vehicle construction.

Extending about the shaft 38 (see Figure 6) and between the plates 37 that depend from frame members 12 and 13, is a steel tubular member 61 which may be welded or otherwise secured at its ends to the brackets 37 which are thus held in predetermined spaced relation by the steel tube 61. The latter is connected to the torque tube 29 by a construction that is better shown in Figure 5. This connection includes a casting 62 having an elongated portion 62^a suitably curved or concaved to embrace about half of the spacing tube 61 and of a length to extend a substantial distance along the tube 38. Suitable U-bolts 63 rigidly secure the cast bracket 62 to the tube 61.

The upper portion of the casting 62 has a part 62^b suitably shaped to embrace half of the torque tube 29, the axis of the portion 62^b extending at right angles to the axis of the portion 62^a. Torque tube 29 has a keyway 29^a cut therein and complementary to the keyway 29^a is a keyway 62^c in the part 62^b, these complementary keyways receiving a key 64. A suitably curved or half-cylindrical casting 65 overlies the torque tube 29 and the latter is tightly clamped between the parts 65 and 62^b, as by bolts or cap screws 66. The parts 62^b and 65 preferably extend a substantial distance along the torque tube 29 which they tightly embrace or clamp and thus also hold the key 64 in place. By this construction any tendencies to throw the axle or shaft 38 out of its intended alinement with respect to the main frame are resisted and overcome by the action of the torque tube 29 and, moreover, many of these tendencies or forces or stresses are converted, by this construction, into forces tending to twist the torque tube 29. But such twisting is dependably resisted by the construction of the torque member 29 itself.

The header 15 (Figures 1, 2 and 3) is provided with a vertically extending bore 44 forming a bearing for the portion 45 of a fork generally indicated at 46 and in the arms 47 and 48 of which the wheel 16 is supported by a suitable shaft 49. The header 15, preferably in the form of a suitable steel casting appropriately braced and ribbed, is shaped to fit in between the forward or left-hand ends of the main frame members 12 and 13 (see Figures 2 and 3) and is secured thereto in any suitable manner, as by riveting, bolting or welding. The header 15 thus functions not only as a support for the swiveled wheel 16 but also as a strong cross-piece at the forward end of the vehicle frame.

The arms 47 and 48 of the fork 46 are suitably shaped, for example, as is shown in Figure 2, so that the horizontal axis of the shaft 49 about which the wheel 16 rotates is displaced horizontally from the substantially vertical axis about which the fork 46 pivots and thus the wheel 16 may, under certain conditions, function as a caster wheel.

The arms 47 and 48 of the fork 46 are provided with vertically spaced eyes or lugs 50 and 51 (see Figures 2 and 3) and similar vertically spaced eyes 52 and 53 are provided on the front face of the header 15 (see Figures 1, 2 and 3). A tongue conveniently in the form of two intersecting and interconnected compression and tension members 54 and 55 (see Figure 1) may be connected either to the ears 50 and 51 on the wheel fork or to the ears 52 and 53 on the header 15, as by pins 56 (Figure 2). Members 54—55 are pivotally connected as at 57 (Figure 1), the connection being provided with a suitable link 58 to permit it to be secured to the towing or haul-

ing vehicle. The above-mentioned ears are preferably cast integrally with the parts with which they are respectively associated, ears 50 and 51 being duplicated as at 59 and 60 (Figures 1 and 2) so that the towing tongue 54—55 may be connected to the wheel fork with the latter and the wheel swung through 180° from the position shown in Figures 1 and 2.

If the tongue 54—55 is connected to the fork 46, the vehicle is in effect steered by the front wheel 16 whose movement about the vertical axis of the fork 46 is controlled by the towing vehicle. The wheel 16 has a wide tread so as to insure a good frictional contact with the roadbed under the influence of that portion of the load carried by the wheel 16 but under some circumstances, particularly where the load is heavy and the train of vehicles is proceeding down-hill, this frictional contact may be insufficient to prevent the trailing vehicle from "jack-knifing" or, in effect doubling up about the vertical axis of the fork 46. Under such circumstances as these, the towing tongue 54—55 is connected to the ears 52—53 on the header 15, whence the connection of the vehicle frame to the hauling vehicle becomes a rigid one and wheel 16 becomes a caster wheel, simply swinging about the vertical axis of the fork in response to whatever changes in direction of movement of the trailer that are imposed upon it by the towing vehicle.

The trailer will thus be seen to meet a wide variety of practical conditions but in so doing the trailer frame is subjected to peculiar strains and stresses which might become severe were it not for the peculiar and unique coaction of the torque tube 29 with various other above-described features of construction.

The torque tube 29, otherwise relatively light in weight, is, nevertheless, of great rigidity, offering great resistance to bending and particularly offering very great resistance to twisting about its own axis. As illustrative of certain of the above-mentioned coactions, it might be pointed out that, where the hauling of the trailer is achieved by applying the hauling force to the ears 50—51 on the fork (see Figure 2), that force is applied at a point below the frame members 12—13 and whether that force is in a direction to pull the trailer (toward the left as viewed in Figure 2) or to push the trailer (toward the right), the frame is subjected to bending stresses; the bending of the frame, however, is definitely precluded by the great rigidity of the tube member 29 which, as appears clearly from Figure 1, is secured to the frame not only at its ends but also intermediate of its ends.

More particularly, however, the frame, particularly the forwardly extended portions of frame members 12 and 13, are subjected to severe bending strains when the vehicle, as viewed in Figure 1, is swung to the left or right of its longitudinal axis; such swinging takes place under the control of the towing vehicle when moving around a corner or curve or bend in the roadway, and the severity of such bending strains is increased by reason of the resistance offered by the track units 17 and 18 to change in the direction of travel of the trailer. This resistance is important, particularly in preventing the above-described "jack-knifing" action. The frame members 12 and 13, particularly at the forwardly extended portions thereof, are most severely subjected to these bending strains but are relieved from being too severely strained by the action of the tube 29.

If the force, applied to the fork 46, either in a pulling or pushing direction, is at an angle to the longitudinal axis of the trailer, the reaction on the frame is a twisting action which may better be appreciated when it is considered, referring to Figure 3, that this force tends to tilt the axis of the fork 46 out of its normal vertical position. Such twisting of the frame, however, is prevented by the torsion-resisting torque tube 29 which effectively prevents the front portion of the frame from being thrown out of line, about the longitudinal axis of the trailer.

Twisting strains on the vehicle frame, due to uneven distribution of load or due to irregularities in the roadbed are by this torque tube 29 also effectively resisted.

Thus, I am enabled greatly to simplify the construction and to avoid expensive and laborious reinforcing braces, trusses, or the like. At the same time I am enabled greatly to minimize the labor cost inasmuch as the torque tube 29 is quickly and simply installed, in fact much more readily and inexpensively than is the installation of reinforcing cross-braces or trusses.

Thus, it will be seen that there has been provided in this invention a construction in which the several objects hereinbefore noted, together with many thoroughly practical advantages, are successfully achieved. The construction will be seen to be of a thoroughly practical nature and is capable of withstanding the severest road and load conditions.

As many possible embodiments may be made of the above invention and as many changes might be made in the embodiment above set forth, it is to be understood that all matter hereinbefore set forth, or shown in the accompanying drawings, is to be interpreted as illustrative and not in a limiting sense.

I claim:

1. In vehicle construction, in combination, a frame having longitudinally extending structural steel frame members having a cross-section adapted better to withstand bending about a horizontal axis than to withstand bending about a vertical axis, wheel means supported in said frame at three points, and a torsion-resisting member extending lengthwise of said frame and rigidly secured thereto for resisting torsional stresses acting on said frame.

2. In vehicle construction, in combination, a frame having wheel means at one end thereof and two laterally spaced track units adjacent the other end thereof, said frame having a cross-beam adjacent each end thereof, and a torsion-resisting tubular member extending lengthwise of said frame and rigidly connected to said end cross-beams.

3. In vehicle construction, in combination, a frame comprising a pair of laterally spaced members extending from end to end thereof, a cross-beam connecting said members adjacent one end thereof, a cross-beam connecting said members adjacent the other end thereof, a cross-beam connecting said frame members intermediate the ends thereof but displaced vertically from said other cross-beams, and a torsion-resisting member extending between said frame members and abutting said first and second cross-beams but by-passing said intermediate cross-beam and secured to each of said cross-beams.

4. In vehicle construction, in combination, a frame comprising a pair of laterally spaced members extending from end to end thereof, a cross-beam connecting said members adjacent one end

thereof, a cross-beam connecting said members adjacent the other end thereof, and a torque tube of relatively large diameter extending between said frame members and secured to said two cross-beams, said cross-beams being of vertical dimensions commensurate with the diameter of said tube and said tube being accommodated substantially between the plane passed through the upper edges of said cross-beams and the plane passed through the lower edges of said cross-beams.

5. In vehicle construction, in combination, a frame comprising a pair of laterally spaced members extending from end to end thereof, a cross-beam having a vertical web connecting said members adjacent one end thereof, a cross-beam having a vertical web connecting said members adjacent the other end thereof, a cross-beam connecting said frame members intermediate the ends thereof, a torque tube of relatively large diameter extending between said frame members and abutting said vertical webs, the latter having a vertical dimension sufficient to receive thereagainst the ends of said large-diametered tube, and means rigidly securing said tube to each of said cross-beams.

6. In vehicle construction, in combination, a frame comprising a pair of laterally spaced outer members extending in substantially parallel relation from the rear of the frame to a point intermediate the ends thereof, a pair of spaced inner members between said first members and extending in substantially parallel relation from the rear of said frame to the forward end thereof, a cross-beam connecting the ends of said frame members at the rear of said frame, a cross-beam connecting said inner members adjacent the forward end thereof, a pair of endless track units mounted respectively at the sides of the frame between the substantially parallel portions of said inner and outer members, wheel means for supporting the forward ends of said inner members, and a torque-resisting tubular member of relatively large diameter connecting said cross-beams.

7. In vehicle construction, in combination, a frame comprising a pair of laterally spaced outer members extending in substantially parallel relation from the rear of the frame to a point intermediate the ends thereof, a pair of spaced inner members between said first members and extending in substantially parallel relation from the rear of said frame to the forward end thereof, a cross-beam connecting the ends of said frame members at the rear of said frame, a cross-beam connecting said inner members adjacent the forward end thereof, a pair of endless track units mounted respectively at the sides of the frame between the substantially parallel portions of said inner and outer members, wheels means pivotally connected to the forward ends of said inner members and to swing about a vertical axis, and structural steel torsion-resisting means rigidly connecting said cross-beams.

8. In vehicle construction, in combination, a frame comprising a pair of laterally spaced outer members extending in substantially parallel relation from the rear of the frame to a point intermediate the ends thereof, a pair of spaced inner members between said first members and extending in substantially parallel relation from the rear of said frame to the forward end thereof, a cross-beam connecting the ends of said frame members at the rear of said frame, a cross-beam connecting said inner members adjacent the forward end thereof, a pair of endless track units mounted respectively at the sides of the frame between the substantially parallel portions of said inner and outer members, wheel means pivotally connected to the forward ends of said inner members and to swing about a vertical axis, said wheel means being adapted to caster, and a torsion-resisting tubular member connecting said cross-beams.

9. In vehicle construction, in combination, a frame comprising a pair of laterally spaced outer members extending in substantially parallel relation from the rear of the frame to a point intermediate the ends thereof, a pair of spaced inner members between said first members and extending in substantially parallel relation from the rear of said frame to the forward end thereof, a cross-beam connecting the ends of said frame members at the rear of said frame, a cross-beam connecting said inner members adjacent the forward end thereof, a pair of endless track units mounted respectively at the sides of the frame between the substantially parallel portions of said inner and outer members, wheel means pivotally connected to the forward ends of said inner members and to swing about a vertical axis, means for connecting the forward end of said frame to a hauling vehicle, means associated with the forward end of said frame and with said wheel means adapted alternatively to have said connecting means attached thereto whereby said connecting means operates either directly on said frame or directly on said wheel means in response to changes in direction of travel of the hauling vehicle, said track units, because of their longitudinally extending areas of contact with the roadbed, resisting in either case the action of said connecting means when the latter causes change in direction of travel and thereby tending to strain and twist said frame about a vertical axis, and a torsion-resisting structural steel member extending substantially centrally of said frame and connected to said cross-beams for preventing twisting of said frame when changes in direction of travel effected by said connecting means are resisted by said track units.

10. In vehicle construction, in combination, a frame comprising a pair of laterally spaced outer members extending in substantially parallel relation from the rear of the frame to a point intermediate the ends thereof, a pair of spaced inner members between said first members and extending in substantially parallel relation from the rear of said frame to the forward end thereof, a cross-beam connecting the ends of said frame members at the rear of said frame, a cross-beam connecting said inner members adjacent the forward end thereof, wheel means mounted at the sides of said frame between the substantially parallel portions of said inner and outer members, a cross-beam connecting the forward ends of said outer members to intermediate portions of said inner members, wheel means supporting the forward ends of said inner members, and a tubular member of sufficient diameter to resist torsion connecting said three cross-beams.

11. In vehicle construction in combination, a frame, wheel means including axle means supporting said frame, a torsion-resisting member extending longitudinally of said frame to prevent twisting thereof and vertically displaced from said axle means, and means having a portion extending lengthwise of said member and a portion extending lengthwise of said axle

means for rigidly connecting said member and said axle means.

12. In vehicle construction, in combination, a frame having a plurality of cross members, one of which is tubular, caster wheel means adjacent one end of said frame and positioned substantially along the longitudinal axis thereof and adjacent an end cross member, torsion-resisting means extending substantially along the longitudinal axis of said frame and connected rigidly to said cross members for preventing a twisting or warping of the frame, an axle supported by said tubular member, and wheel means supported by said axle.

13. In vehicle construction, in combination, a frame, wheel means positioned on opposite sides of said frame adjacent one end thereof, caster wheel means adjacent the other end of said frame and positioned substantially along the longitudinal axis thereof, cross-means securing said wheel means to said frame, means securing said caster wheel means to said frame, and a torque tube of relatively large diameter along the length of the axis interconnecting said cross-means and said securing means.

14. In vehicle construction, in combination, a structural steel frame with a cross member, a pair of axle-supported wheel means positioned on opposite sides of said frame, caster wheel means, means securing the latter to one end of said frame at a substantially intermediate point thereof, and a torque tube extending along the length of said frame and interconnecting the said frame cross member and said securing means.

15. In vehicle construction, in combination, a longitudinally extending structural steel frame, wheel means supporting one end of said frame, means extending transversely of said frame for connecting said wheel means thereto, caster wheel means, means securing said caster wheel means to the front end of said frame at a point substantially along the longitudinal axis thereof, and a torque tube extending along the axis of said frame rigidly connecting said transversely extending means and said securing means to prevent twisting of said frame.

16. In vehicle construction, in combination, a frame having a tubular torsion-resisting member embodied therein and extending lengthwise thereof, axle means extending crosswise of said frame and crosswise of said member but vertically displaced from the latter, and rigid means connecting said tubular member and said axle means, said rigid means having a rigid connection with said tubular member whereby relative rotation between said tubular member and said rigid means is prevented.

17. In vehicle construction, in combination, a frame having cross members, a tubular torque member extending lengthwise of said frame and rigidly interconnecting said cross members, axle means extending crosswise of said frame and displaced vertically from said torque member, and frame having cross members, a tubular torque member and having an extension for rigidly engaging said axle means.

18. In vehicle construction, in combination, a frame having cross members, a tubular torque member extending lengthwise of said frame and rigidly interconnecting said cross members, axle means extending crosswise of said frame and displaced vertically from said torque member, and a member having two sleeve-like portions, one of which encompasses said torque member and the other of which encompasses said axle means.

19. In vehicle construction, in combination, a frame having cross members, a tubular torque member extending lengthwise of said frame and rigidly interconnecting said cross members, axle means extending crosswise of said frame and displaced vertically from said torque member, and a member having two sleeve-like portions, one of which encompasses said torque member and the other of which encompasses said axle means and one of said sleeve-like portions being in sections whereby it may be made to encompass the member to which it is secured.

20. In vehicle construction, in combination, a frame having cross members, a tubular torque member extending lengthwise of said frame and rigidly interconnecting said cross members, axle means extending crosswise of said frame and displaced vertically from said torque member, a member having two sleeve-like portions, one of which encompasses said torque member and the other of which encompasses said axle means, and a keyed connection between said torque member and its associated sleeve-like portion for preventing relative rotary movement therebetween.

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