United States Patent

[11] **3,610,169**

[72] Inventor **Montague W. Shannon**
P.O. Box 1720, Memphis, Tenn. 38101

[21] Appl. No. **773,470**
[22] Filed **Nov. 5, 1968**
[45] Patented **Oct. 5, 1971**

[54] **ROAD-RAIL TRANSPORT APPARATUS**
10 Claims, 19 Drawing Figs.

[52] **U.S. Cl.** ..... **105/368 B,** 105/159, 105/215 C
[51] **Int. Cl.** **B65j 1/14,** B65j 1/22
[50] **Field of Search** ..... 105/159, 215 C, 368 B; 280/43, 43.23, 482

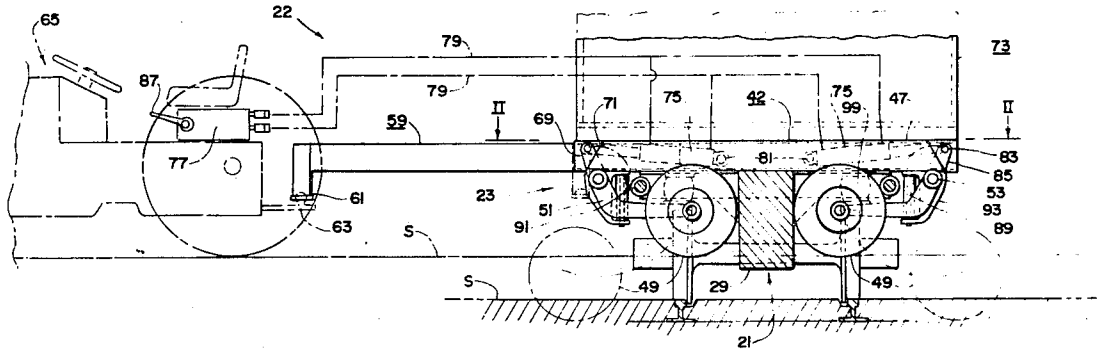
[56] **References Cited**

UNITED STATES PATENTS

2,174,063	9/1939	Richards	280/482
2,986,102	5/1961	Cox	105/215 C
3,011,800	12/1961	Mitsuyasu	280/482
3,168,206	2/1965	Washington	105/368 B X
3,352,438	11/1967	Davidson	105/368 B
3,370,551	2/1968	Shannon	105/368 B
3,410,569	11/1968	Blake	280/43.23
3,429,585	2/1969	Ross	280/43.23

Primary Examiner—Drayton E. Hoffman

ABSTRACT: Compound mode load-transporting apparatus including a railway vehicle having a longitudinally extending frame and a roadway vehicle having front and rear wheels tandem arranged and operative upwardly convergingly and downwardly divergingly wheelbasewise. The roadway vehicle is adapted to be loaded on the railway vehicle by: (a) operating the front and rear wheels downwardly divergingly to a lengthened wheelbase configuration, (b) positioning the roadway vehicle crosswise of the rail vehicle rail track, (c) moving the rail vehicle on the rail track to a disposition positioning the rail vehicle between the front and rear wheels of the roadway vehicle, and (d) retracting the front and rear wheels of the roadway vehicle upwardly convergingly to a contacted wheelbase configuration embracing the frame of the railway vehicle.



PATENTED OCT 5 1971

3,610,169

SHEET 1 OF 5

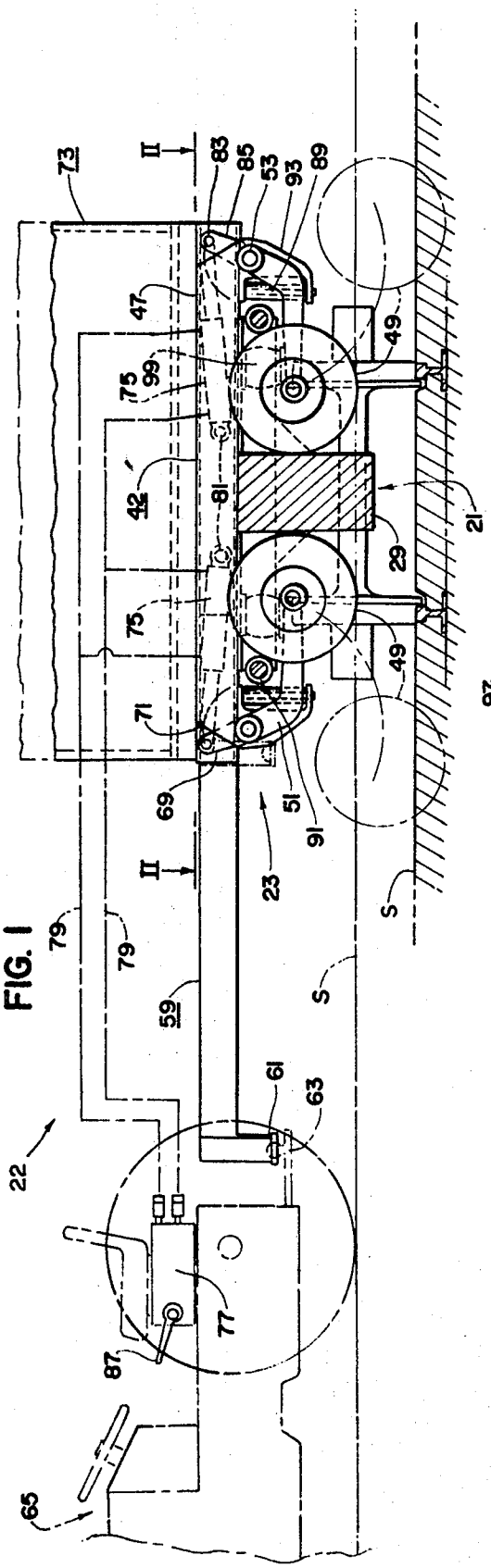


FIG. 1

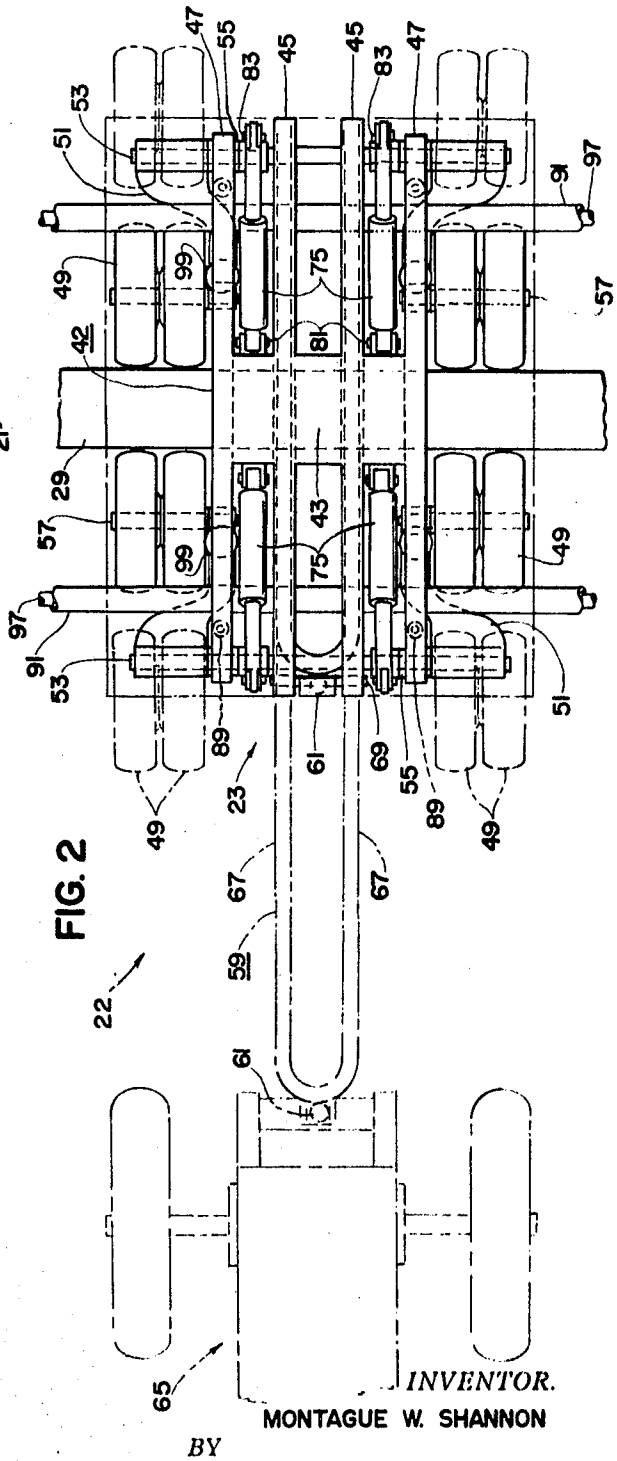


FIG. 2

INVENTOR.
MONTAGUE W. SHANNON

BY

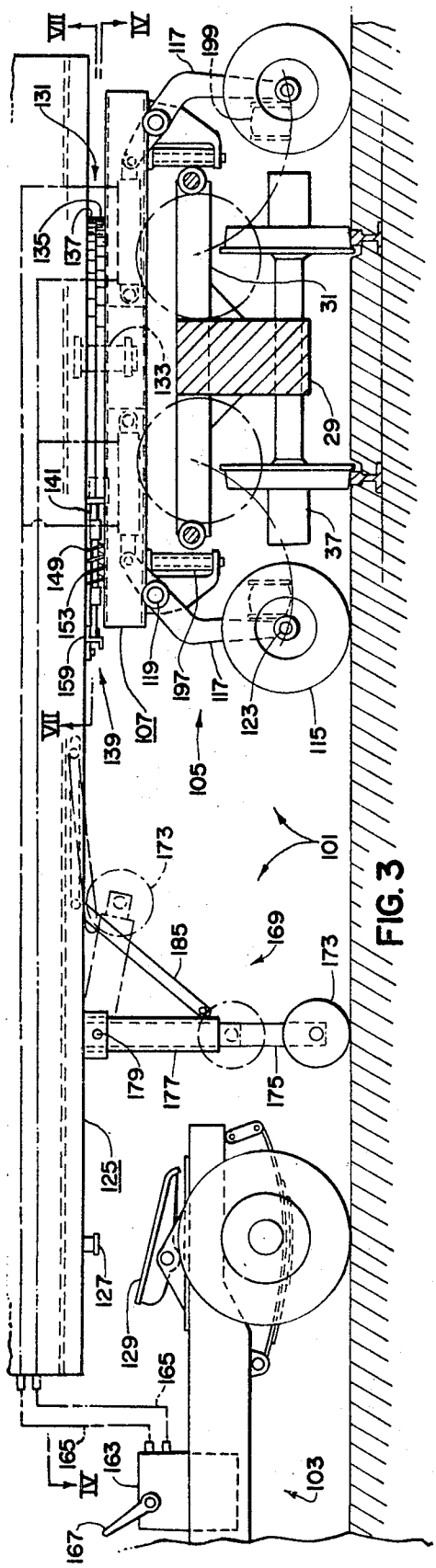


FIG. 3

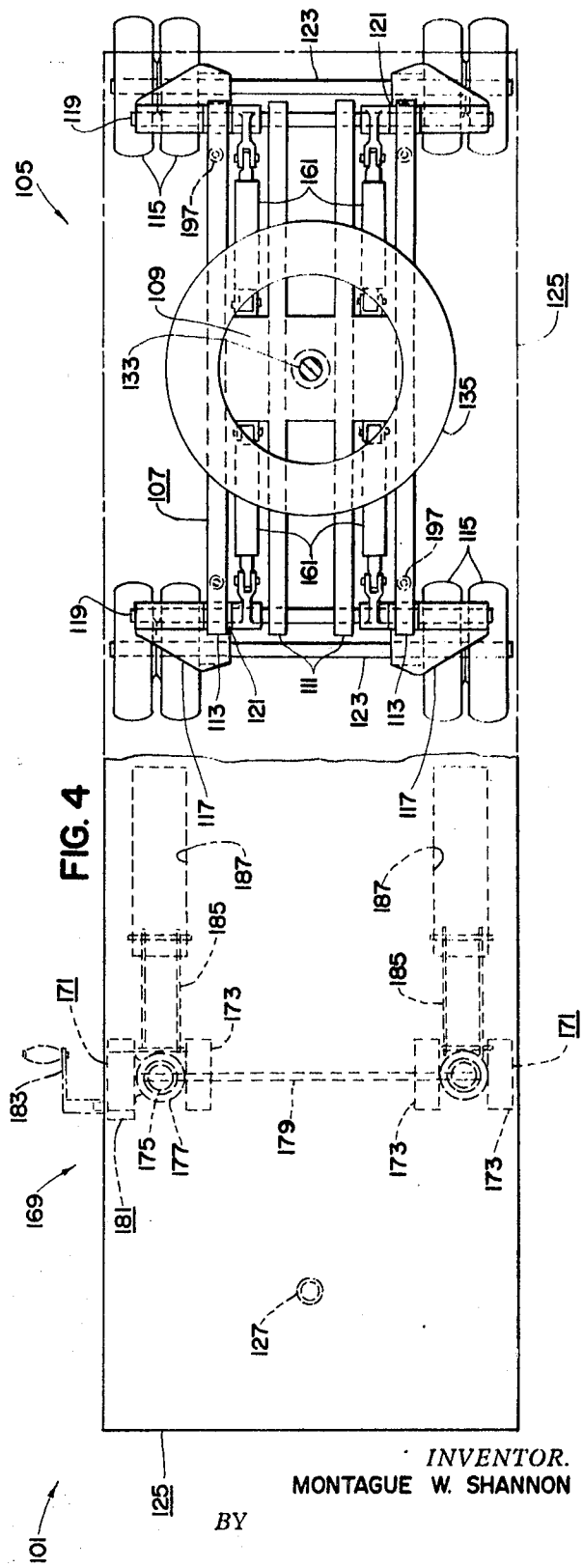


FIG. 4

INVENTOR.
MONTAGUE W. SHANNON

BY

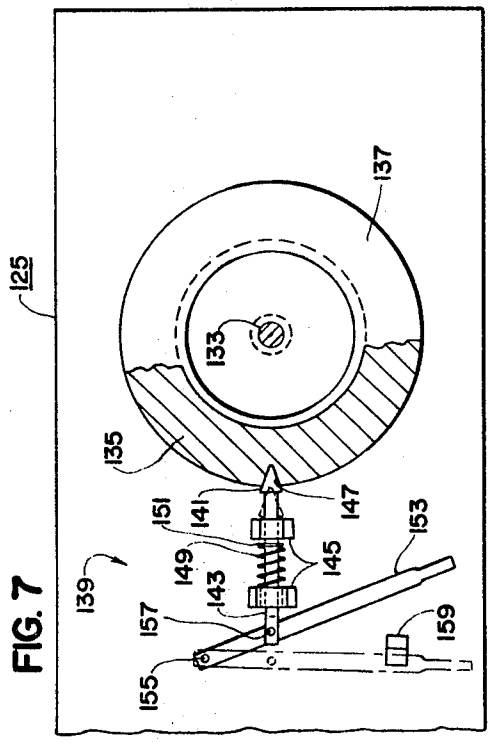


FIG. 7

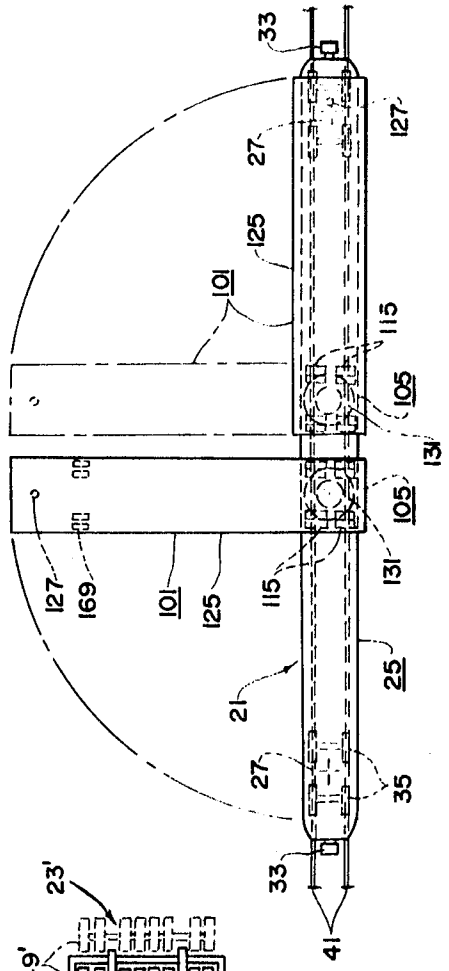


FIG. 10

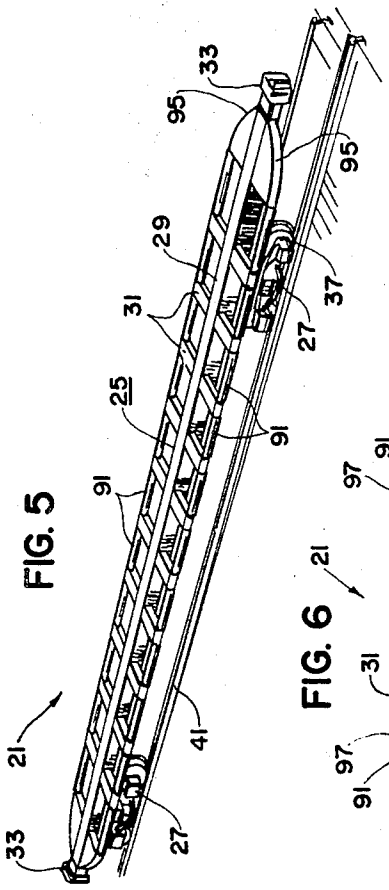


FIG. 5

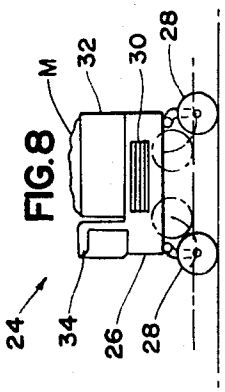


FIG. 8

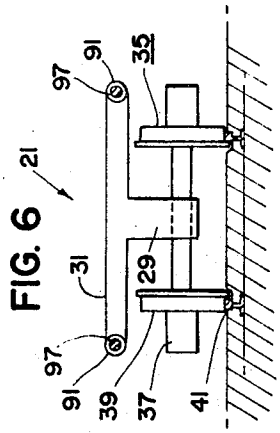


FIG. 6

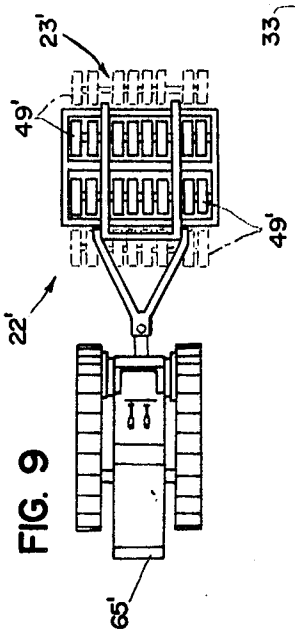


FIG. 9

INVENTOR.
MONTAGUE W. SHANNON

BY

FIG. 11

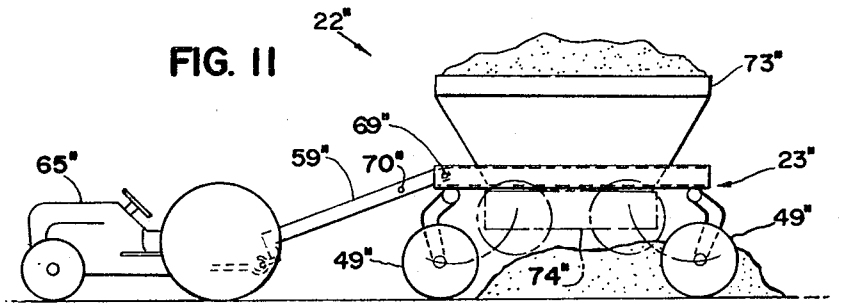


FIG. 12

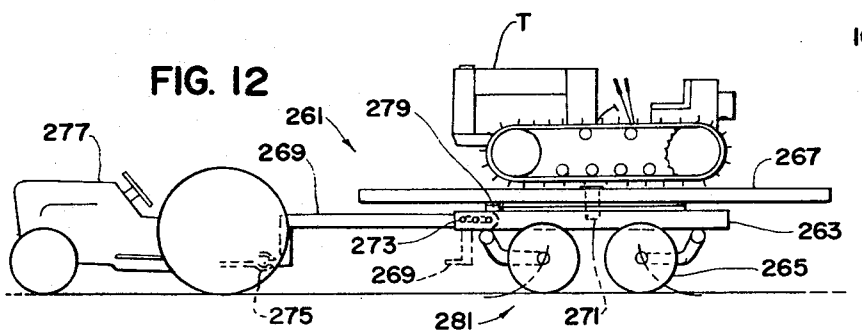


FIG. 13

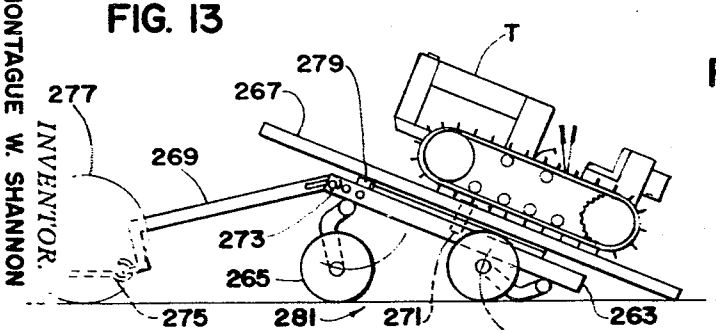


FIG. 15

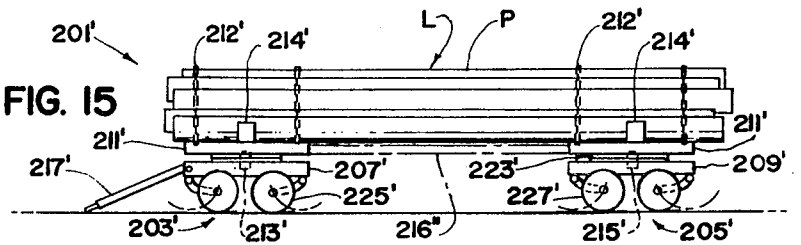


FIG. 14

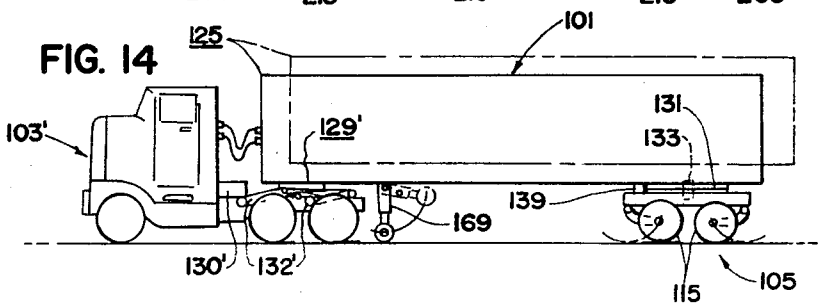


FIG. 16

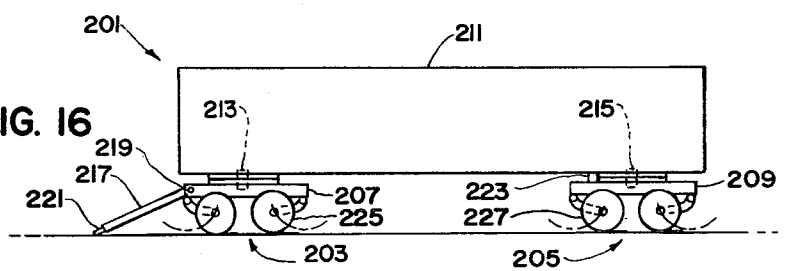
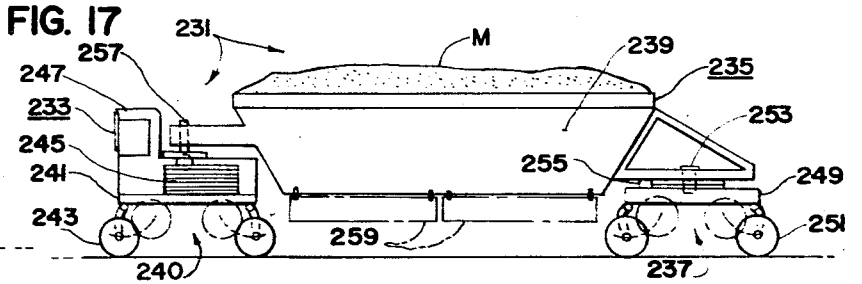


FIG. 17



INVENTOR.
MONTAGUE W. SHANNON

BY

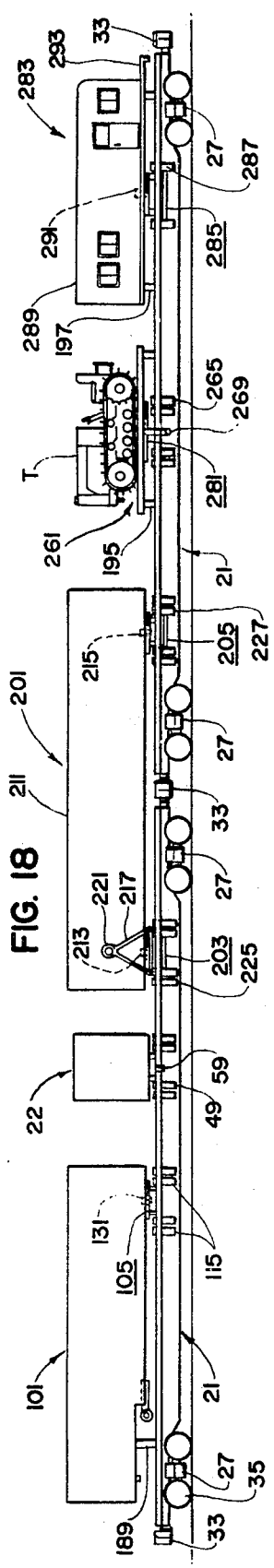


FIG. 18

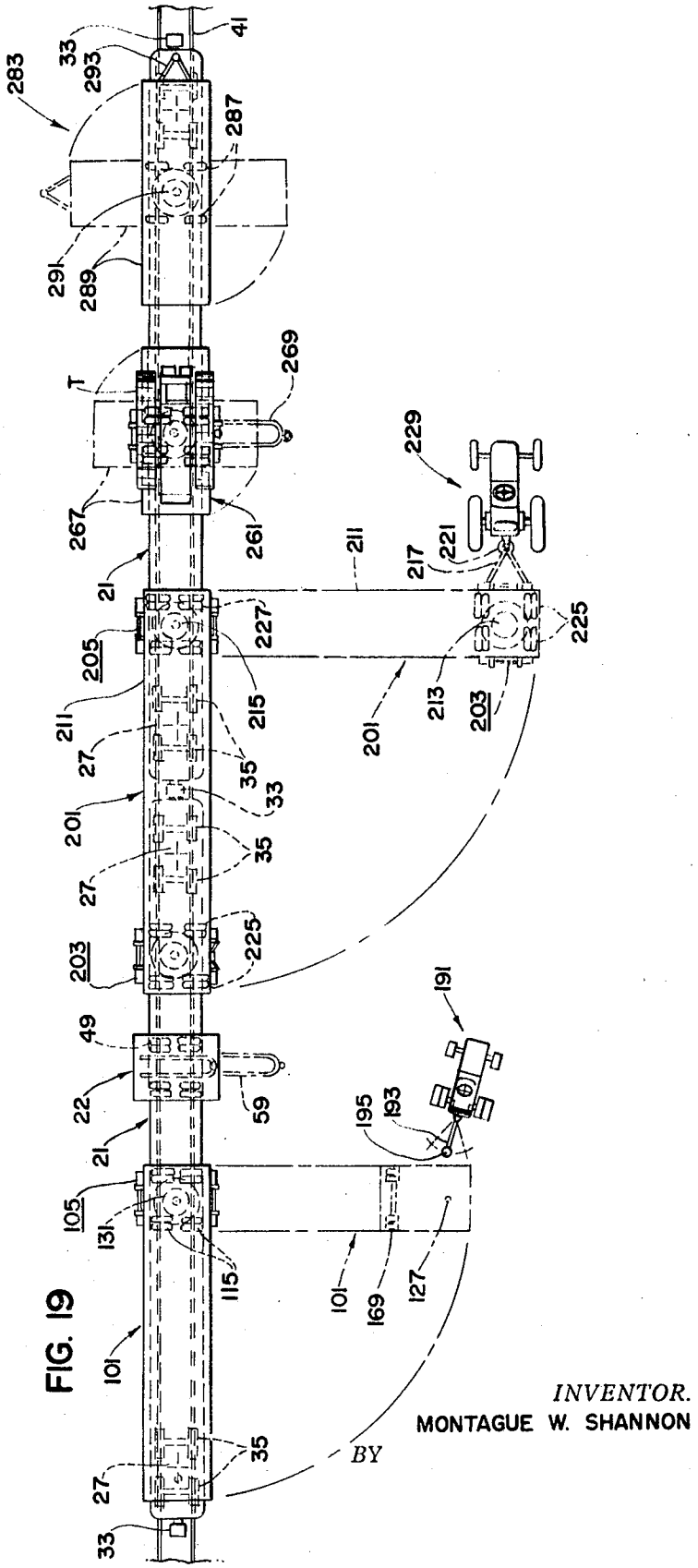


FIG. 19

INVENTOR.
MONTAGUE W. SHANNON
BY

ROAD-RAIL TRANSPORT APPARATUS

BACKGROUND OF THE INVENTION

1. Field of the Invention

Relates to material or load-handling and to railroad-highway transport apparatus adapted for transporting material or load structure over rail or road.

2. Description of the Prior Art

This invention is an improvement on my earlier invention U.S. Pat. No. 3,370,551 the broad concept being to provide a railway vehicle and a road running carrier adapted to be straddle mounted crosswise on the railway vehicle with the direction of travel of the carrier being perpendicular to the direction of travel of the railway vehicle. In certain applications of the road-rail apparatus as disclosed in U.S. Pat. No. 3,370,551 certain undesirable features are noted particularly with regard to the front and rear road wheels of the carrier overhanging oppositely and intersecting existing railroad lateral clearance lines or wayside structure when the carrier was transportably supported astraddle the railway vehicle. Also, the long wheelbase spacing of the road vehicle of U.S. Pat. No. 3,370,551 generally restricted its use to vehicle combinations requiring steerable wheels, and the broad wheelbase spacing and vertical wheel movement was not applicable in tandem wheel arrangements.

SUMMARY OF THE INVENTION

The instant invention obviates the objectional features noted in the road-rail apparatus described in U.S. Pat. No. 3,370,551, substantially by providing road vehicle means of tandem wheel configuration having wheels movable upwardly converging downwardly diverging; the wheel movement may be embodied in vehicle combinations of typical tandem wheelbase configuration and without requiring steerable road wheels. The wheels of the roadway vehicle are arranged upwardly convergingly in a contracted wheelbase configuration: (a) when the road vehicle is being rail transported thereby firmly mounting the roadway vehicle on the railway vehicle and affording railroad wayside clearance, and (b) when the road vehicle is in road-running form, thereby affording typical tandem wheelbase configuration and ready skewing movement of the wheels on a road surface in road travel.

The converging diverging wheel movement of the road vehicle also provides several ancillary advantages when the vehicle is in road-running form: (a) the wheel movement permits selective adjustment of the load-bed height to correspond with the height of a loading dock or platform, (b) a road vehicle for hauling particulate or bulk material may be fitted with drop-bottom gates for dumping a load while the load bed is raised, (c) the folding wheel movement of the road vehicle permits tilting load-bed action without pivotally mounting the load bed, and (d) the roadway vehicle may be fitted to convey and position containers or the like.

The road-rail apparatus is directed toward application in a wide range of transportation activity. It is considered to be useful in general railroad-highway traffic movements, in transporting and positioning containers, in handling water and air freight shipments, in off-highway transporting including earthmoving, agricultural and mining operations, in construction work, transporting heavy equipment, and for use in prefabricated house conveyance and installation.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 illustrates an embodiment of the road-rail apparatus of the invention including a single tandem type road vehicle crosswise supported on a rail vehicle of the invention.

FIG. 2 is a horizontal plane sectional view taken as on the line II–II of FIG. 1, but without showing the rail car truck seen in FIG. 1.

FIG. 3 illustrates another embodiment of the road-rail vehicle means including a single tandem rear tandem semitrailer type road vehicle elevatingly supported with its forward end arranged over a motor transport tractor vehicle and its rearward end arranged crosswise over the rail vehicle.

FIG. 4 is a horizontal broken plane sectional view of the semitrailer type vehicle means taken as on the line IV–IV of FIG. 3, but without showing the motor transport tractor vehicle or the rail vehicle means.

FIG. 5 is a perspective view of a preferred form of railway vehicle means of the road-rail apparatus.

FIG. 6 is a schematic transverse section view of the rail vehicle.

FIG. 7 is a horizontal plane sectional view taken as on the line VII–VII of FIG. 3.

FIG. 8 illustrates automotive truck type road vehicle means of the road-rail apparatus.

FIG. 9 illustrates a heavy duty single tandem trailer type carrier vehicle as being towed by a crawler tractor.

FIG. 10 illustrates the loading of two semitrailer type roadway vehicle means on the railway vehicle means of the invention.

FIG. 11 illustrates a single tandem road vehicle or wheeled carrier similar to the road vehicle of FIGS. 1 and 2.

FIGS. 12 and 13 illustrate a single tandem road vehicle having pivotable and tiltable load-bearing bed structure; FIGS. 12 and 13 illustrate the loading of a crawler tractor load on the bed structure of the vehicle.

FIG. 14 illustrates a motor transport tractor-semitrailer combination of the road-rail apparatus.

FIGS. 15 and 16 illustrate double tandem full trailer road vehicle means of the invention.

FIG. 17 illustrates self-propelling automotive type road vehicle means adapted for heavy hauling service.

FIG. 18 is a side elevational view of the road-rail apparatus illustrating several forms of road vehicle means transportably supported on two connected railway vehicles of the invention.

FIG. 19 is a top view of the apparatus of FIG. 18 illustrating also the loading and unloading of the respective road vehicle means on or off the railway vehicle means.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIGS. 1, 2 and 5 illustrate a somewhat simplified embodiment of the present invention including a railway car 21 and roadway vehicle means 22 including a wheeled carrier assembly 23. Railway car 21 includes a long frame 25, preferably skeleton type in construction, and forward and rearward rail car trucks 27 supporting opposite end portions of frame 25. Frame 25 preferably includes a center sill 29, cross members 31 and forward and rearward railway coupling members 33 arranged on opposite end portions of frame 25. Rail car trucks 27 each include wheel and axle assemblies 35 journaled in truck bearings 37. Flanged wheels 39 runningly engage paired rails 41 of the railroad track.

The base or frame structure 42 of carrier assembly 23 preferably is of openwork construction and includes a transversely arranged medial section 43 and paired inner and outer frame rails 45, 47 rigidly secured to and projecting horizontally from opposite fore and aft sides of medial section 43. Front and rear wheel members 49, preferably dual-arranged wheel members, are pivotally supported on front and rear wheel suspension arms 51 supported on front and rear pivot shafts 53. Bearings 55 subjacently fixed on the opposite end portions respectively of outer frame rails 47 pivotally support front and rear pivot shafts 53 in parallel arrangement and at respectively the forward and rearward areas of the wheeled carrier frame structure. The proximal end of each wheel suspension arm 51 is fixed respectively on opposite end portions of pivot shafts 53. Outwardly extending stub axles 57 are fixedly secured respectively on the distal end portions of wheel support arms 51 and journal respectively front and rear wheel members 49.

Road vehicle means 22 preferably includes reach means in the form of a tongue 59 supported on and extending forwardly horizontally from base structure 42 of carrier assembly 23. Hitch half means 61 secured on the distal end portion of tongue 59 is adapted to coactingly engage hitch half means 63 of a tractor vehicle 65. Tongue 59 is generally hairpin shaped

and is adjustably supported from base structure 42 for translational horizontal adjustable movement relative to the carrier assembly base structure. Inner pair of frame rails 45 preferably are tubular and telescopically receive leg portions 67 of tongue 59. Tubular frame rails 45 define channel means for guidingly supporting tongue 59 between a projected disposition whereupon the tongue projects forwardly cantilever fashion from the forward extremity of the base structure (see FIG. 1) and a retracted disposition whereupon the tongue is substantially fully received in frame rails 45 (see FIG. 2).

A removable horizontal lock pin 69 is fitted in aligned apertures in the forward terminal portions of inner frame rails 45 and provides means for locking tongue 59 in an extended or a retracted disposition. Beveled surfaces 71 on the forward terminal portions respectively of outer frame rails 47 permit horizontal manipulation of lock pin 69 when withdrawing or inserting the pin in paired inner frame rails 45. Lock pin 69 is adapted to be inserted in apertures provided in tongue leg portion 67 when the tongue is in a projected cantilever disposition (see FIG. 1). When tongue 59 is in a retracted disposition, lock pin 69 bridgingly spans frame rails 45 and abuttingly engages the bight portion of the tongue thereby preventing its forward displacement (see FIG. 2). The horizontally rigid tongue structure extending forwardly from carrier assembly base structure 42 provides rigid reach means providing leverage means for turning the carrier left or right during road travel and when it is being trailingly conveyed by a towing vehicle.

The load-bearing means of roadway vehicle means 23 may be of any form suitable for the particular material or load structure handled and may optionally be of flat-bed type for handling solid or vehicular loads; a load containing type having a load container or load shell and binding means removably binding the load shell on the base structure of the wheeled carrier; or a load holding type having load holding van structure permanently secured on the base structure of the carrier assembly: By way of example, roadway vehicle means 22 is illustrated and described as being fitted with a load holding van-type body 73 (the lower portion only of the body being shown in FIG. 1).

The means for actuating wheel suspension arms 51 preferably includes forward and rearward piston-cylinder assemblies or rams 75 and selectively controllable hydraulic power means 77 supported on tractor 65. Conduit means 79 connect hydraulic power means 77 with forward and rearward hydraulic rams 75. Each hydraulic ram 75 is pivotally anchored at its base end by a pin 81 and is pivotally secured at its plunger end by a pin 83 fitted in a lever projection 85 fixed on and projecting upwardly from a respective pivot shaft 53. Actuating control lever 87 on tractor mounted hydraulic power means 77 causes converging or diverging movement of wheel members 49.

For the purpose of clarity in description, FIG. 1 illustrates road vehicle means 22 somewhat ambiguously in both a road running disposition and in a rail transported disposition. That feature of the invention whereby front and rear wheel members 49 are arranged in like configuration both for road travel and rail travel is illustrated in FIG. 1. It will of course be understood that tongue 59 is arranged in a retracted disposition as illustrated in FIG. 2 when vehicle 22 is supported on railway car 21 in rail travel.

The procedure for loading roadway vehicle 22 on railway car frame 25 may include the following actions: Road vehicle 22 is trailingly conveyed on road surface S by tractor 65 transversely across and to a centered position over the railroad track. While keeping hydraulic conduit means 79 connected, vehicle 22 is unhitched from tractor 65 and by manipulation of lock pin 69, tongue 59 is moved to a retracted disposition. Control lever 87 of tractor mounted hydraulic power means 77 is manipulated to cause downward diverging movement of wheel members 49 and raising of carrier assembly base structure 42. Railway car 21 is then moved along track rails 41, underneath the carrier assembly base structure and between front and rear wheel members 49. Hydraulic control lever 87 is again manipulated to cause wheel members 49 to move upwardly convergingly and adjacent opposite sides of rail car center sill 29. The hydraulic conduit means 79 extending between vehicle 22 and tractor 65 may then be disconnected, completing the loading procedure.

Vertical and horizontal positioning rollers 89, 91 preferably are journaled respectively on vehicle 22 and railway car 21. Four vertical positioning rollers 89, arranged in generally rectangular configuration, preferably are journaled on the underside of carrier assembly base structure 42 and respectively dependingly on opposite end portions or paired outer frame rails 47. Confrontingly opening C-shaped brackets 93 (two brackets only shown in FIG. 1) journal vertical positioning rollers 89 in confrontingly arranged pairs of rollers. The vertical positioning rollers are adapted to engage converging side surfaces 95 (see FIG. 5) on the leading end of rail car frame 25 as the rail car is moved beneath the wheel carrier base structure and serve to longitudinally center road vehicle 22 over the rail car as the rail car is moved underneath carrier assembly base structure 42 and between the front and rear wheel members 49.

Horizontal positioning rollers 91 each are arranged in a longitudinally extending row of rollers arranged on opposite sides of rail car frame 25. Rollers 91 are longitudinally arranged and freely journaled on shafts 97 secured respectively on the opposite distal end portions of crossmembers 31. During the vertical movement of carrier assembly base structure 42, during loading and unloading of vehicle 22, horizontal rollers 91 on railway car 21 may engage vertical positioning rollers 89 of vehicle 22 and provide antifriction means for centering the road vehicle over the rail car. Generally cylindrical shock absorber means or air spring members 99 preferably are fitted respectively on the proximal portions of front and rear wheel suspension arms 51 for providing spring means for the road vehicle during road travel. When wheel members 49 are moved upwardly convergingly, spring members 99 are moved upwardly against the underside of outer frame rails 47 and provide cushioning means between wheel members 49 and base structure 42.

Crawler type tractor 65' and a heavy duty trailer type roadway vehicle having front and rear wheel gangs 49' and a vehicle useful for transportably supporting heavy loads on soft terrain. Although not specifically illustrated, the roadway vehicle 22' includes wheeled carrier structure 23' and means for converging diverging movement of front and rear wheel gangs 49'.

FIG. 11 illustrates another embodiment of the invention including a roadway vehicle 22'' having selectively operative means adapted for pivotally or rigidly supporting a tongue 59'' from the base structure of a carrier assembly 23''. Road vehicle 22'' is fitted with load holding structure in the form of an open topped hopper 73'' having selectively operative drop bottom doors 74''. Vehicle 22'' is useful for hauling and spreading particulate or dry bulk material; the vehicle may optionally be fitted with dry bulk spreading mechanism or means for spreading or dispensing chemical fertilizer, seeds, granular or particulate materials.

Tongue 59'' is arrangeable in three positions, namely, a free pivoting position pivotable on a horizontal axis (as illustrated in FIG. 11); a rigid position (not shown) wherein the tongue projects cantilever fashion from the base structure of carrier assembly 23''; or a fully retracted disposition (not shown) wherein the tongue is retracted within the longitudinal extension of the carrier assembly base structure: Lock pin 69'' may be inserted through aperture 70'' for arranging tongue 59'' in a rigid cantilever disposition or the pin may be arranged as illustrated in FIG. 11 for free pivotal movement of the tongue. Wheel members 49'' may be convergingly or divergingly moved during forward travel of vehicle 22'' for dumping a bulk material load or for maneuvering the vehicle in field service. The embodiments of the invention illustrated in FIGS. 1, 2, 9 and 11 depict single tandem full trailer type roadway vehicle means adapted for transporting short length loads or loads

of a length which may be contained within or between the lateral clearance lines or stationary wayside structure along a railroad track.

FIGS. 3, 4, 7, 10 and 14 illustrate a semitrailer type roadway vehicle 101 adapted to be utilized with a motor transport tractor 103. Semitrailer vehicle 101 includes a wheeled carrier assembly 105 including base structure 107 having a transversely extending medial section 109 and oppositely projecting paired inner and outer rails 111, 113. Front and rear wheel members 115 are journaled on distal end portions respectively of wheel suspension arms 117 which are respectively supported on front and rear pivot shafts 119 supported in turn in pivot shaft bearings 121 arranged respectively on opposite end portions of outer frame rails 113. Front and rear axle shafts 123 extend respectively between the distal end portions of front and rear wheel suspension arms 117 and journal respectively front and rear wheel members 115.

The load-bearing means of road vehicle 101 may include removable load shell or container box means or be of any configuration suitable for holding or containing the particular material handled. The load-bearing means exemplified, is in the form of van-type body 125 as illustrated in FIGS. 3, 4, 7, 10 and 14 (only the lower portion of van body 125 being shown in FIG. 3). A king pin hitch half 127 dependingly fixed on the forward underportion of van body 125 is adapted to be coactingly coupled with fifth wheel hitch half 129 of tractor 103. Van body 125, in addition to providing load-bearing means for the material load transported, also provides fore and aft extending reach structure for turning carrier assembly 105 toward the left or right as semitrailer vehicle 101 is trailingly conveyed along a road surface.

Road vehicle means 101 includes vertical thrust pivot means 131 operatively arranged between base structure 107 of carrier assembly 105 and load-bearing van body 125. Thrust pivot means 131 provides means for contradirectional horizontally arced displacement of carrier assembly 105 and van body reach structure 125. A short heavy pivot pin 133 firmly secured respectively in carrier assembly base structure medial section 109 and in the rearward center substructure portion of van body 125 pivotally secures carrier assembly 105 and body 125 against relative radial displacement at the pivot pin. Annular lower and upper thrust plates 135, 137 fixedly secured respectively and on carrier assembly 105 and the rearward substructure portion of van body 125 provide antifriction turntablelike support means for the rearward portion of van body 125 on carrier assembly 105.

Hand lever operative dog means 139 (FIGS. 3 and 7) preferably is mounted on the rearward underside of van body 125 and includes a dog 141 having a shank portion 143 mounted horizontally in bearings 145 fixed dependingly on the substructure of load-bearing body 125. Horizontal movement of dog member 141 into and out of engagement with a notch 147 in lower thrust plate 135 respectively locks or releases carrier assembly 105 and body 125 and constrains or permits relative pivotal displacement of the carrier assembly and van body. A helical compression spring 149 fitted on shank 143 and tensioned between a shoulder 151 on the shank and the forward one of bearings 145 yieldably urges dog member 141 toward lower thrust plate 135 and toward a dogged engagement with notch 147. A horizontal hand lever 153 pivotally fulcrumed at pin 155 to the underside of body 125 and pinned at 157 to dog member shank 143 provides hand operative means for retracting dog 141 from notch 147. A catch 159 dependingly fixed on the underside of body 125 provides means for engaging the distal portion of lever 153 and for holding dog member 141 in a disengaged configuration.

Forwardly and rearwardly arranged pairs of horizontal oppositely projecting ram members 161 fitted on carrier assembly base structure 107 actuate respectively front and rear wheel members 115 through wheel suspension arms 117. Forward and rearward pairs of ram members 161 provide respectively simultaneously operative ram means for lifting and lowering the rearward end portion of semitrailer van body 125. Selectively controllable fluid power means 163 connected to ram members 161 through conduit means 165 preferably provides means for energizing the ram members and for converging diverging movement of wheel members 115. Selectively manipulating control lever 167 of fluid power means 163 controls the converging diverging movement of wheel members 115 and respectively the lifting and lowering of semitrailer vehicle 101.

The means for loading and unloading vehicle 101 on rail car 21 preferably includes landing gear means 169 arranged on the forward underside of van body 125 for raising and supporting the forward end portion of the van body. Landing gear means 169 includes left and right landing gear assemblies 171 having respectively wheels 173. Telescopically fitted standards 175, 177 operatively interconnected by shaft means 170 and driven by power means 181 extend and retract respectively for raising or lowering van body 125. Power means 181 may be hydraulically or pneumatically energized or may include hand crank means 183 for lifting or lowering the van body. Landing gear assemblies 171 are retractable rearwardly by strut members 185 and in retracted dispositions are received respectively in downwardly opening enclosures 187.

The tractor vehicle of the tractor-semitrailer combination preferably includes power operative means for raising and lowering the fifth wheel hitch half of the tractor. FIG. 14 illustrates a tractor-semitrailer combination including a truck-tractor vehicle 103' having a power operative fifth wheel hitch half 129'. Selectively operative power means 130' connected to hitch half 129' through link arms 132' provide means for raising or lowering hitch half 129' respectively for raising or lowering the forward end of semitrailer van body 125.

Considering that a tractor-semitrailer combination includes semitrailer road vehicle means 101 and tractor vehicle 103', the following procedure may be carried out in loading vehicle 101 on railway car 21: Tractor-semitrailer combination 101, 103' is moved transversely across the railroad track and to a position whereat front and rear wheel members 115 are arranged symmetrically laterally of the rail track. The front and rear wheel members 115 of carrier assembly 105 are simultaneously moved divergingly outwardly and downwardly thereby raising carrier assembly base structure 107 and spreading the front and rear wheels as shown in FIGS. 3 and 4. Fifth wheel hitch half 129' of tractor vehicle 103' preferably is simultaneously actuated with the diverging actuation of wheel members 115 for simultaneously raising the forward and rearward portions of van body 125 and for raising the van body in a level disposition; power means 130' of tractor vehicle 103' preferably is simultaneously operative with the diverging movement of the carrier wheels and the van body is raised and held in an elevated disposition (see broken line showing of the van body in FIG. 14). Rail car 21 is then moved along the rail track and underneath the base structure of carrier assembly 105; the railway car is moved between front and rear wheel members 115 of the carrier assembly and to a position whereat carrier assembly 105 is between forward and rearward rail car trucks 27. Front and rear carrier assembly wheel members 115 are convergingly moved inwardly and upwardly relative to base structure 107 thereby causing the somewhat sequential actions, of (a) lowering base structure 107 to rest on rail car frame 25; (b) raising front and rear carrier assembly wheel members 115 from the road surface; and (c) moving front and rear wheel members inwardly convergingly against opposite sides of rail car center sill 29. Vehicle 101 is now elevatingly arranged with its forward end supported on tractor vehicle fifth wheel hitch half 129' and its rearward end supported on rail car 21 with wheel members 115 arranged astraddle rail car frame 25. Van body reach structure 125 may then be moved in a horizontal arc about pivot pin 133 to a corresponding longitudinally aligned disposition over rail car frame 25 (see FIGS. 10, 18 and 19). Fifth wheel hitch half 129' of truck-tractor 103' may be lowered thereby lowering the forward end of van body 125. Bolster structure 189 (see

FIG. 18) may be arranged between rail car frame 25 and the forward end of van body 125 for supporting the forward end of vehicle 101 during rail travel.

A forklift truck type yard vehicle 191 (see FIG. 19) having horizontal fork structure 193 may be utilized in horizontally moving the forward end portion of semitrailer vehicle 101 in an arc in loading and unloading the vehicle on the railway car. A seat 195 fitted on the distal end of horizontally pivoted and vertically liftable fork structure 193 is adapted to liftably engage the forward underside of van body structure 125 of vehicle 101 and swing the forward end of the body structure in a 90° arc about thrust pivot pin 133. Yard vehicle 191 is operative for loading or unloading semitrailer vehicle 101 without the assistance of truck-tractor vehicle means 103 or 103'.

Each railway car 21 preferably is long enough to transportably accommodate two semitrailer vehicles 101 (see FIG. 10). A plurality of vehicles 101 may be spotted in intermittently spaced pairs of vehicles along a railroad track by use of respective truck-tractor vehicles 103, 103'. A plurality of pairs of vehicles 101 may be spotted with each pair of vehicles being arranged for loading on a respective railroad car; each vehicle 101 is stationarily supported on its landing gear means 169 and wheeled carrier assembly 105, and with its van body supported in an elevated disposition. After moving a train of railway cars 21 underneath assemblies 105 of the plurality of pairs of vehicle 101 and centering each car 21 in relation to a respective pair of vehicles 101, yard vehicle 191 may be utilized in horizontally swinging van body structure 125 of each vehicle 101 onto frame means 25 of railway car means 21; a single yard vehicle 191 may be utilized for loading or unloading a plurality of pairs of spotted vehicles 101 on or off a train of railway cars 21.

Two opposingly arranged pairs of vertical positioning rollers 197 arranged each pair on a forward and rearward substructure portion of each carrier assembly base structure 107 are adapted to runningly engage horizontal positioning rollers 91 on rail car 21 as the rail car is moved underneath each carrier assembly base structure 107; opposingly operative pairs of rollers 197 provides means for longitudinally centering carrier assemblies 105 over railway car frame 25 in response to movement of rail car 21 along the railroad track thereby longitudinally shifting semitrailer vehicles 101 each to correct positions perpendicular to a respective rail car. (See FIG. 10). Carrier assembly 105 of each vehicle 101 preferably includes spring members 199 mounted respectively on the distal end portions of wheel suspension arms 117 for cushioning the weight of vehicle 101 in road travel.

FIGS. 16, 18 and 19 illustrate a double tandem full trailer type carrier vehicle 201 including forward and rearward carrier assemblies 203, 205 having respectively base structures 207, 209; load-bearing means in the form of van body 211; and forward and rearward thrust pivot means 213, 215 arranged respectively between van body 211 and forward and rearward carrier assembly base structures 207, 209. A tongue 217 is supported at its proximal end on a horizontal pivot pin 219 supported on forward assembly base structure 207 (see FIG. 16). Hitch half means 221 supported on the distal end of tongue 217 is adapted to be coupled with coacting hitch half means on a towing vehicle for trailingly conveying vehicle 201 in road travel. Dog means 223 operatively arranged between rearward carrier assembly base structure 209 and the rearward portion of body structure 211 is adapted to be selectively manipulated for releasably locking the contradirectional rotational movement of carrier assembly 205 and body 211. Dog means 223 is adapted to be arranged in a locked disposition when vehicle 201 is operative in road travel and is adapted to be arranged in a released disposition when the vehicle is being loaded or unloaded on a railway car or is being transportably supported on the railway car.

Double tandem trailer vehicle 201 may be transportably supported on a single rail car 21 or may be supported on two rail cars 21 as shown in FIGS. 18 and 19. When supported on two rail cars 21, thrust pivot axis means 213, 215 provide pivotal support means for body 211 particularly operative when the two rail cars are in angular relationship and traveling along a curved railroad track. A rail yard tractor vehicle 229 (FIG. 19) may be utilized in loading double tandem vehicle 201 on railway cars 21 and in pivotally manipulating vehicle 201 from a perpendicular relationship with the railroad track (broken line showing in FIG. 19) to a loaded disposition on the railway cars (full line showing in FIG. 19).

In contrast to the loading procedure of single tandem semitrailer vehicle 101, double tandem vehicle 201 is horizontally manipulated 90° by tractor vehicle 229 to a corresponding longitudinally aligned arrangement over the railroad track before railway car means 21 is moved under the base structures respectively of carrier assemblies 203, 205. After railway car means 21 is moved between front and rear wheel members 225, 227 and positioned under the base structures of the forward and rearward carrier assemblies, wheel members 225, 227 are convergingly contracted thereby lowering van body 211 and contracting wheel members 225, 227 from the road surface. Tongue 217 may be pivotally moved upwardly against the side of van body 211 to a stored arrangement and carrier vehicle 201 be disposed in rail travel configuration.

FIG. 15 illustrates a double tandem trailer type arrangement 201' including forward and rearward wheeled carrier assembles 203', 205' having respectively base structures 207', 209'; forward and rearward load-bearing structures 211', 211'; and forward and rearward thrust pivot axis means 213', 215' pivotally interconnecting respectively forward and rearward base structures 207', 209' and load-bearing structures 211', 211'. Wheel members 225', 227' of forward and rearward carrier assemblies 203', 205' are guidingly constrained for converging diverging movement and each carrier assembly includes actuating mechanism and power means for convergingly divergingly moving respective wheel members 225', 227'. Vehicle 201' includes a tongue 217' pivotally supported on a horizontal axis from forward carrier assembly base structure 207' and includes dog means 223' selectively operable for releasably locking the pivotal movement of rearward wheel carrier assembly 205' relative to rearward load-bearing structure 211'.

FIG. 15 illustrates double tandem vehicle means 201' in an arrangement supporting a load of long pipe sections P. Paired chains 212', 212' and chock members 214', 214' included respectively in load-bearing structure 211', 211' rigidly bind together pipe sections P in a stressed load L constituting substantially the reach structure for turning movement of rearward carrier assembly 205' on the road surface. Double tandem trailer arrangement 201' may optionally include a coupling or reach pole 216'' (shown in broken lines) bridgingly extending between forward and rearward carrier assemblies 203', 205' and interconnecting respectively forward and rearward load-bearing structures 211', 211'.

FIG. 8 illustrates an automotive truck type road vehicle 24 including self-propelling power means and manually operative control means for automotive movement of the vehicle on a roadway. Vehicle 24 includes a wheeled carrier assembly including base structure 26, front and rear wheels 28, and means mounting wheels 28 on base structure 26 in converging diverging movement. Vehicle 24 includes also engine means 30 for driving wheels 28 and for converging diverging movement of the wheels, load-bearing structure 32 adapted to contain load structure or material M, and cab means 34 for housing the operator and control means of the vehicle. Steering clutches or the like preferably are included in the drive train means for wheels 28 for steering the vehicle in road travel.

FIG. 17 illustrates roadway vehicle means 231 including a traction truck 233 and trailer means 235 including a carrier assembly 237 and combined reach and load-bearing structure 239 bridgingly interconnecting truck 233 and carrier assembly 237. Traction truck 233 is similar to truck type vehicle 24 of FIG. 8 and includes a wheeled carrier assembly 240 including base structure 241, and front and rear wheels 243. Traction truck 233 includes also engine means 245, cab means 247 and

preferably includes power means transmitted to front and rear wheels 243 through steering clutches for left and right directional control of truck 233 when front and rear wheels 243 are in a contracted wheelbase disposition. Carrier 237 includes base structure 249 and front and rear wheels 251. Thrust pivot 253 connects load-bearing structure 239 with carrier assembly 237. Releasable dog means 255 permit turning load-bearing reach structure 239 90° relative to carrier assembly 237 in loading and unloading roadway vehicle means 231 on railway vehicle means 21. Vertical thrust pivot means 257 pivotally connects the forward portion of load-bearing structure 239 with the body structure of traction truck 233. Load-bearing structure 239 illustrated in FIG. 17 is adapted for hauling dry or particulate material and includes deep bottom doors 259. Wheels 243, 251 respectively of traction truck 233 and carrier assembly 237 may be simultaneously actuated to diverged dispositions when material M is being dumped through doors 259. Roadway vehicle means 231 is loaded on rail vehicle means 21 in much the same manner as the loading of the double tandem trailer vehicle 201 on the railway vehicle means. However, road vehicle means 231, being a self-powered vehicular combination, may be loaded or unloaded on the railway car means without the assistance of other road vehicle means.

FIGS. 12, 13, 18 and 19 illustrate a full trailer single tandem road vehicle 261 adapted for hauling intermediate length loads (approximately 10 feet 6 inches to 20 feet in length). The vehicle 262 includes a carrier assembly including base structure 263, front and rear wheels 265, and means mounting wheel members 265 in converging diverging movement; and load-bearing bed structure 267, a tongue 269 adjustably supported on base structure 263 and thrust pivot means including a pin 271 pivotally supporting bed structure 267 on carrier assembly base structure 263.

Vehicle 261, as illustrated in FIGS. 12 and 13, is particularly useful for transporting heavy vehicular equipment such as crawler tractor T. By manipulating pin 273, tongue 269 may be arranged in a selected one of three configurations: (a) the tongue may be arranged freely pivotable about pin 273 when it is in a full forwardly extended disposition (see FIG. 13); (b) the tongue may be adjusted to project forwardly rigidly cantilever fashion from the base structure by moving the tongue inwardly rearwardly within the base structure a short distance (see FIG. 12); (c) Tongue 269 may be translationally moved rearwardly and to a fully retracted disposition within base structure 263 (see broken line showing of tongue in FIG. 12). Military type hitch means 275, permitting vertical and horizontal movement of tongue 269, preferably hitches vehicle 261 to a tractor 277. Selectively operative dog means 279 releasably locks the load bed 267 and carrier assembly 281.

The front and rear wheel members 265 are individually operative for tilting bed structure 267 along its fore and aft axis (see FIG. 13). The tilting bed feature of vehicle 261 permits ready loading and unloading of heavy vehicular loads such as the crawler tractor T illustrated.

A housetrailer vehicle 283 is illustrated in FIGS. 18 and 19 and includes a carrier assembly 285 including wheel members 287; house structure 289; thrust pivot axis means 291; and hitch means 293 adapted for hitching vehicle 283 to a towing vehicle (not shown). Housetrailer vehicle 283 is adapted to be loaded and unloaded on railway car 21 in substantially the same manner as the above described manner of loading and unloading vehicle 261 on the railway car. Bolsters 195, 197 or other such structure may be used for supporting or stabilizing respectively carrier vehicles 261, 283 on the railway car in rail travel.

I claim:

1. Transporting apparatus comprising a railway vehicle supported for movement on a rail track, having a frame extending longitudinally of the vehicle; a roadway vehicle having front wheels and rear wheels arranged in tandem, movable upwardly convergingly and downwardly divergingly wheelbasewise; and means for lifting said roadway vehicle from a road surface supported disposition with the front and rear wheels arranged downwardly divergingly and respectively on opposite sides of the rail track centerline to a disposition supported on said railway vehicle, including means for moving said railway vehicle on the rail track to a disposition positioning said frame between the front wheels and rear wheels of said roadway vehicle and means for moving the front and rear wheels of said roadway vehicle upwardly convergingly to a contracted wheelbase configuration embracing the frame of the railway vehicle.

2. Transporting apparatus as defined in claim 1 wherein said roadway vehicle includes self-propelling means and selectively operative means for automotive movement of the roadway vehicle in road travel.

3. Transporting apparatus as defined in claim 1 wherein said roadway vehicle includes reach means extending longitudinally of the wheels of the roadway vehicle and means for detachably connecting said reach means with a traction vehicle in road travel.

4. Transporting apparatus comprising a railway vehicle supported for movement on a rail track, having a frame extending longitudinally of the vehicle; roadway vehicle means including a truck-tractor, a semitrailer and means separably hitching the truck-tractor and semitrailer together, said semitrailer including a carrier having front wheels and rear wheels operative upwardly convergingly and downwardly divergingly wheelbasewise, and load-bearing means turnably supported on said carrier turnable in a horizontal arc relative thereto; and means for lifting said semitrailer from a road surface supported disposition with said front wheels and rear wheels arranged downwardly divergingly and respectively on opposite sides of the rail track, to a disposition supported on said railway vehicle, including means for moving said railway vehicle on the rail track to a disposition positioning said frame between the front wheels and rear wheels of the carrier, including means for moving the front and rear wheels of the carrier upwardly convergingly, embracing the frame of the railway vehicle, and means for horizontally turnably adjusting the load-bearing means of said semitrailer to a disposition corresponding with the longitudinal extension of said railway vehicle.

5. Transporting apparatus comprising railway vehicle means supported for movement on a rail track; a double tandem roadway vehicle including a forward and a rearward carrier each having front and rear road wheels, load-bearing means supported on and extending between the forward carrier and rearward carrier; and means for lifting said roadway vehicle from a road surface supported disposition to a disposition surmounting said railway vehicle means, including forward and rearward pivot means operative between said load-bearing means and the forward carrier and rearward carrier, means for horizontally turnably adjusting the load-bearing means relative to the forward carrier and rearward carrier for arranging the roadway vehicle with the load-bearing means correspondingly aligned with the rail track and with the forward carrier and rearward carrier each being arranged crosswise of the said rail track, including means for moving said railway vehicle means on the rail track to a disposition between the front and rear wheels of the forward carrier and rearward carrier, and means for retracting the front and rear wheels of the forward carrier and rearward carrier upward and toward the major axis of the railway vehicle means.

6. Transporting apparatus as defined in claim 5 wherein said roadway vehicle is adapted for trailing attachment to a towing vehicle in road travel and includes reach means extending forwardly of the wheels of said forward carrier and between said rearward carrier and forward carrier, and hitch half means supported on the reach means of said forward carrier adapted for connecting with a coating hitch half on the towing vehicle.

7. Transporting apparatus as defined in claim 5 wherein at least one carrier of said roadway vehicle is of traction truck form and includes self-propelling means and selectively operative control means for automotive movement of the roadway vehicle in road travel.

8. Transporting apparatus comprising railway vehicle means supported for movement on a rail track; roadway vehicle means including a carrier having front and rear road wheels, and load-bearing means supported on said carrier; and means for lifting said roadway vehicle means from a road surface supported disposition with said carrier arranged crosswise of the rail track to a disposition supported on said railway vehicle means with said carrier crosswise surmounting said railway vehicle means, including means for moving said railway vehicle means on the rail track to a disposition between the front and rear wheels of the carrier, means for retracting the front and rear wheels of the carrier upward and toward the major axis of the railway vehicle means, and means for horizontally turnably adjusting the load-bearing means of said roadway vehicle means to a disposition corresponding with the longitudinal extension of said railway vehicle means including vertical thrust pivot means operative between said carrier and load-bearing means of said roadway vehicle means.

9. Transporting apparatus as defined in claim 8 wherein the roadway vehicle means is adapted for trailing attachment to a towing vehicle in road travel and includes reach means extending forwardly of said carrier for trailingly guiding said carrier in road travel, including a tongue, means adjustably supporting said tongue on the carrier, and hitch half means arranged on the outboard end of said tongue adapted for connecting with a coacting hitch half on the towing vehicle.

10. Transporting apparatus as defined in claim 8 wherein said roadway vehicle means is of semitrailer form, adapted for trailing attachment to a towing vehicle in road travel, including reach means extending forwardly of said carrier for guiding said carrier in road travel, hitch half means arranged on the forward extension of said reach means for connecting with a coating hitch half on the towing vehicle, and means substantially integrally connecting said reach means and load-bearing means.

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,610,169 Dated October 5, 1971

Inventor(s) Montague W. Shannon

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

On the cover sheet in the heading, item [72], "P.O. Box 1720 Memphis, Tenn. 38101" should read -- P.O. Box 80732, Chamblee, Georgia 30341 -- .

Signed and sealed this 24th day of October 1972.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents

ORM PO-1050 (10-69)

USCOMM-DC 60376-P69
* U.S. GOVERNMENT PRINTING OFFICE : 1969 O—366-334.