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(54) Road-rail vehicle with articulated chassis frame

(57) A vehicle has rail wheels (12, 14) for operating on rail track (22) and retractable road wheels (16, 18) for operating on land. The vehicle has a first frame (23) which is connected to a second frame (24) by a longitudinal pivot (26). On each frame is mounted one rail wheel axle (28, 30), a pair of road wheels (16, 18), and means (60, 64) for raising and lowering the road wheels between inoperative and operative positions. The frames (23, 24) are capable of relative rotation to maintain equal wheel loadings on both pairs of rail wheels or road wheels, whichever is supporting the vehicle.

FIG. 2

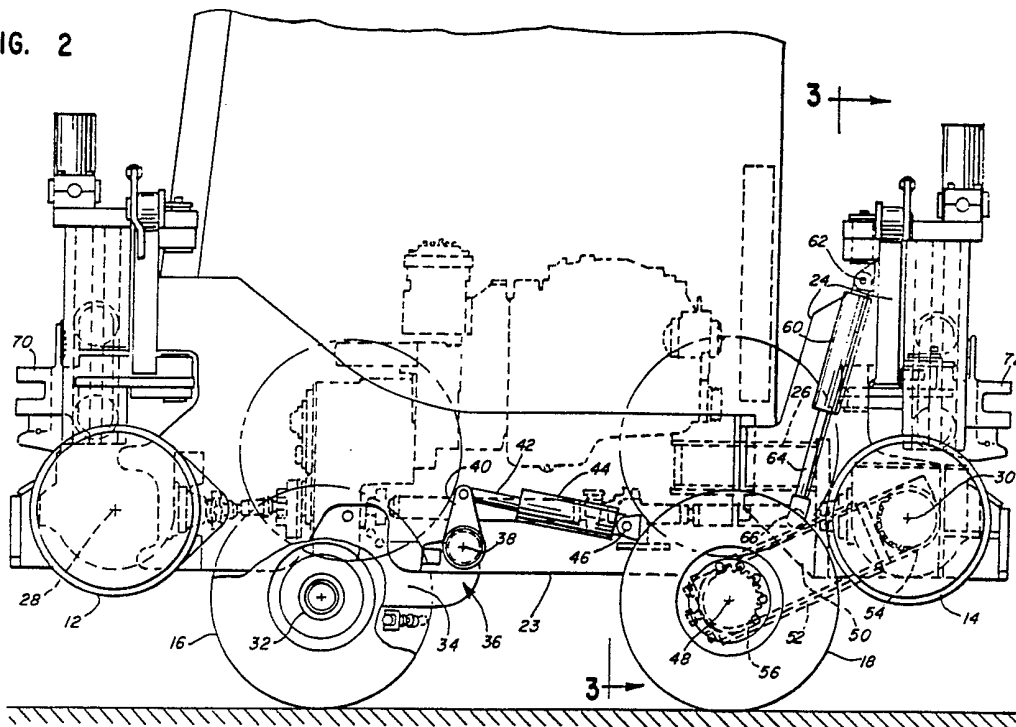
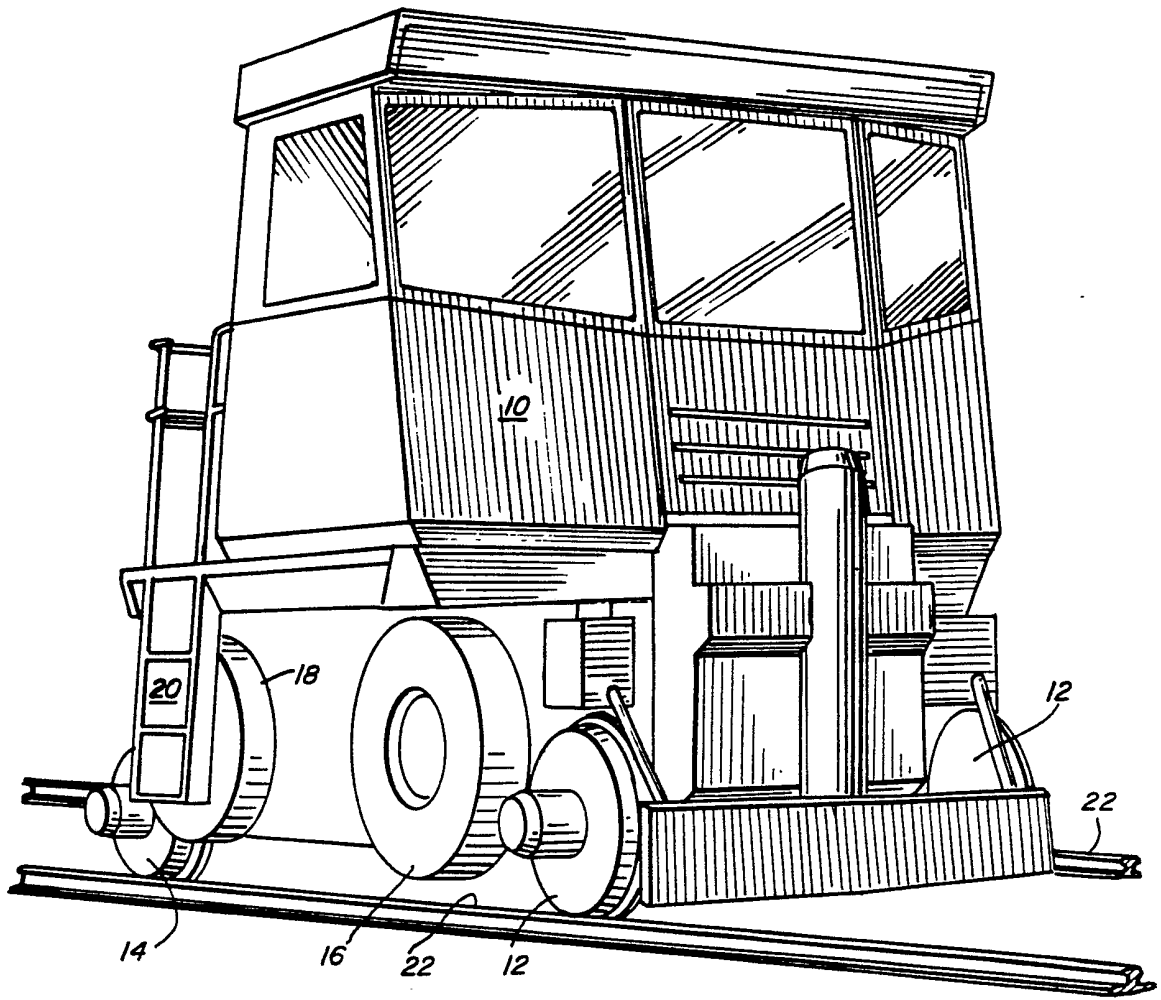


FIG. 1



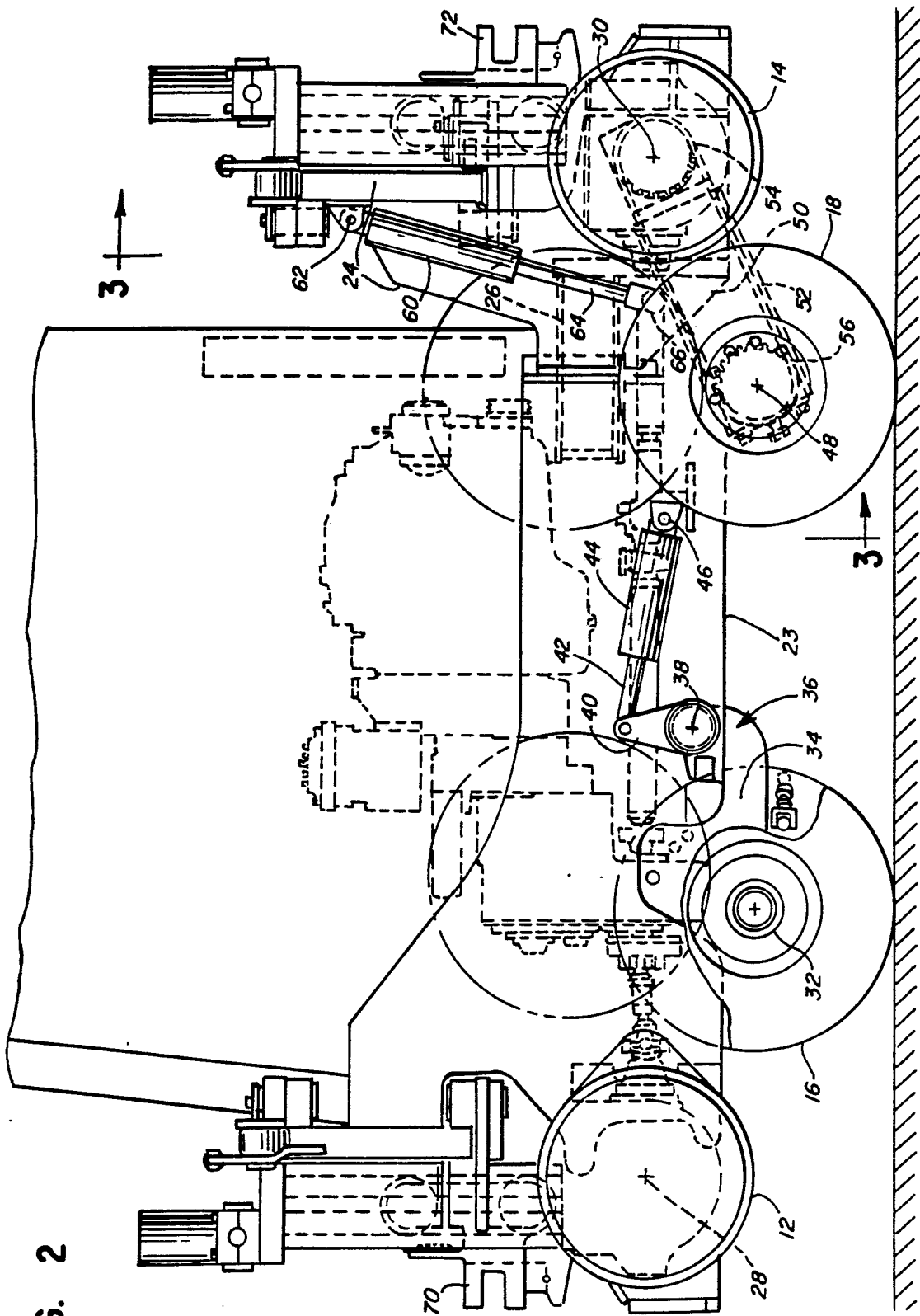


FIG. 2

FIG. 3

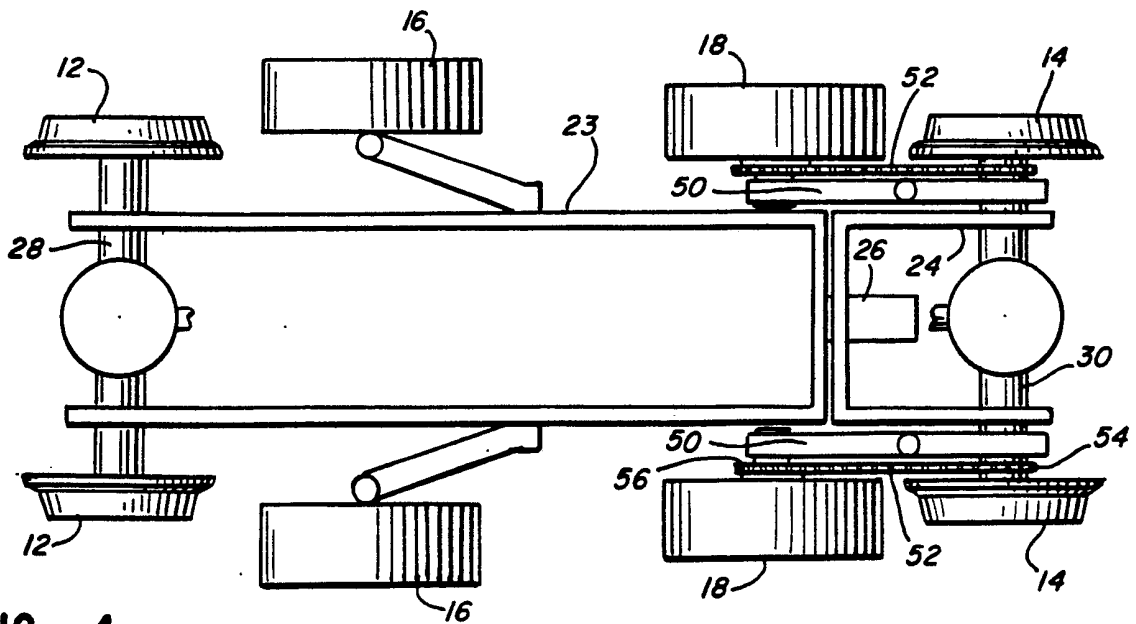
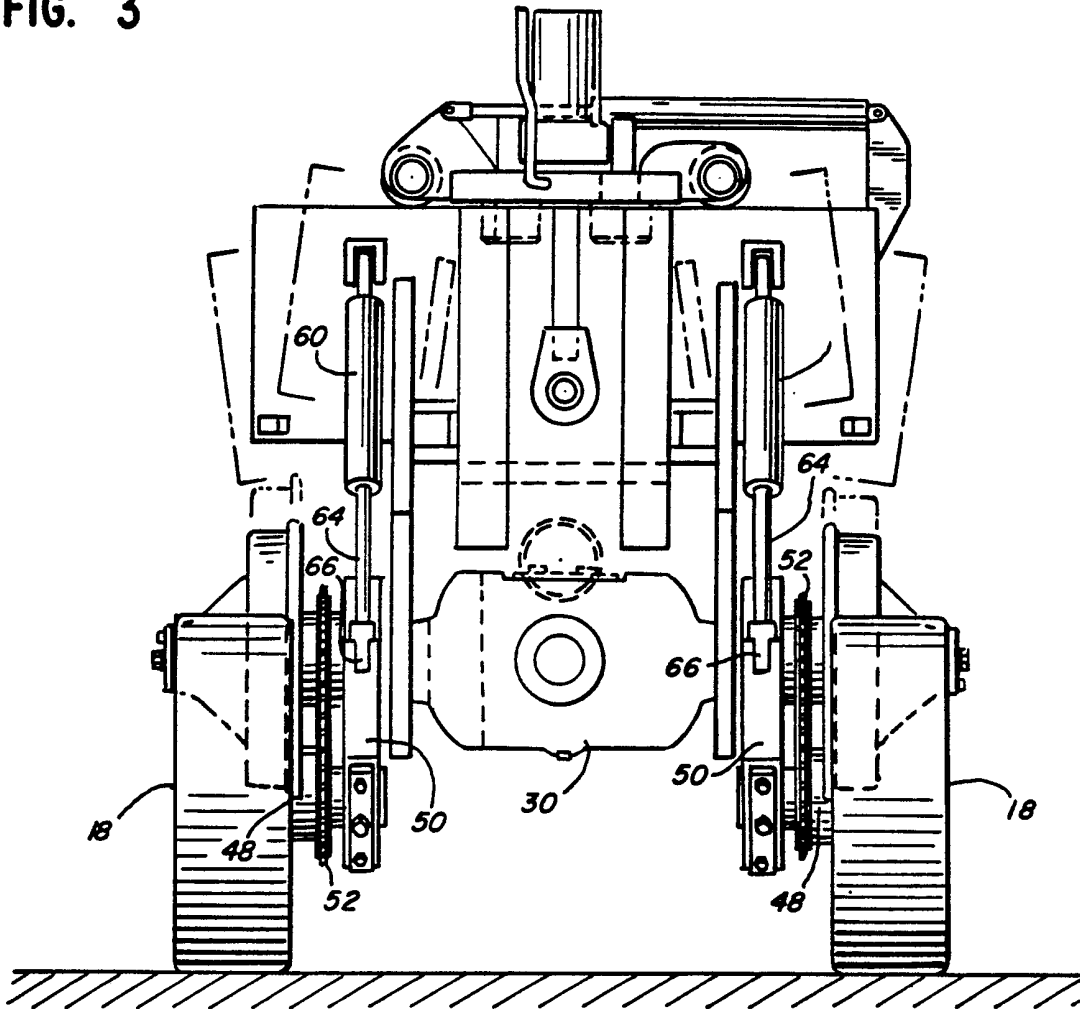


FIG. 4

VEHICLE FOR USE ON ROAD OR RAIL

The present invention relates to a vehicle which is operable on rails to push or pull one or more railcars and is also operable on land when a plurality of road wheels are moved downwardly into operative positions.

It is known in the art to provide a railcar moving vehicle having a main frame member and a second frame which is connected to the main frame for relative pivotal movement about a longitudinal axis. Such a railcar moving vehicle is disclosed in U.S. Patent 4,355,584. This vehicle offers the advantage that one rail wheel axle is mounted on a pivotable frame member to permit pivotal movement between that rail wheel axle and the other rail wheel axle which is mounted on the main frame member. However, in that known design all four road wheels are carried on the main frame so that when operating on roadway there is no benefit from the pivotal frame assembly.

According to the present invention a vehicle for selective use on rail tracks or land comprises first and second frames pivotally mounted relative to each other about a generally longitudinal axis of the vehicle; first and second rail wheel axles, each carrying two rail wheels and mounted respectively on the first and second frames; a first pair of road wheels mounted on the first frame, with first actuating means mounted on the first frame for raising and lowering the first pair of road wheels; and a second pair of road wheels mounted on the second frame, with second actuating means mounted on the second frame for raising and lowering the second pair of road wheels, the actuating means being operable to move the road wheels between raised positions for use of the vehicle on rails, and lowered positions for use of the vehicle on land. In preferred embodiments, a cab is mounted on the first frame with depending structure on each side, and the second pair of road wheels are adapted to be received behind respective structure in their

raised positions. Conveniently, access steps are formed on one or both pieces of depending structure.

Normally, the rail wheel axles are disposed at opposite ends of the vehicle, with the pairs of rail
5 wheels disposed between the rail wheel axles. The first pair of road wheels may be steerable, and normally only the second pair of road wheels are driven wheels. Driven road wheels may be driven directly from a pair of road wheels, and mounted on the respective frame for pivotal
10 movement about the rail wheel axle.

The first frame in vehicles of the invention is normally a forward frame, and is typically the main frame of the vehicle. Thus, a cab may be carried on a forward end of the main frame and a pair of driven road wheels
15 are carried at the rear of the vehicle on a separate pivotable second frame. As noted above, the driven road wheels when raised to inoperative positions may be located behind access steps depending from the cab thus guarding against injury from the driven road wheels which
20 continue to rotate with the rail wheels when in their raised inoperative positions.

The mounting of road wheels and rail wheels on respective frames in accordance with the invention enables both the rail wheel and the road wheel axes to
25 move or oscillate relative to one another and thereby manoeuvre over uneven track or land to maintain substantially equal wheels loadings on both the rail wheels or road wheels, whichever is supporting the vehicle.

30 An embodiment of the invention will now be described by way of example and with reference to the accompanying drawings wherein:

Figure 1 is a schematic, perspective view of a
35 vehicle constructed in accordance with the present invention and illustrating the road wheels in their raised inoperative positions with the rear, driven road wheels located behind access steps depending from the

rear of the cab;

Figure 2 is a side elevational view of a vehicle constructed in accordance with the present invention and showing the road wheels in their lowered, operative
5 positions as when operating on land;

Figure 3 is a vertical sectional view taken substantially along the line 3-3 of Figure 2; and

Figure 4 is a schematic top plan view of the main frame and the rear pivotable frame illustrating in
10 accordance with the present invention that the rear rail wheels and the rear driven road wheels are mounted on the pivotable frame with the driven road wheels being pivotally carried on the rail wheel axle.

Figure 1 illustrates a cab 10 mounted on a vehicle
15 having a pair of front rail wheels 12 and a pair of rear rail wheels 14, a pair of front steerable road wheels 16, , and a pair of rear driven road wheels 18. Each side of the cab is provided with depending access steps 20 which
20 enable an operator to climb up to the cab.

As shown in Figure 1, the vehicle is operating on rails 22 with the road wheels 16 and 18 elevated to inoperative positions. However, even when retracted the driven road wheels 18 are normally rotating with the rail
25 wheels 14 and can therefore pose a safety hazard. Thus, in accordance with one feature of the invention, the driven road wheels 18 are retracted behind the access steps 20 to a relatively safe position.

Figures 2 and 4 show a front main frame member 23
30 and a rear pivotable frame member 24. The relatively short rear frame member 24 is connected to the main frame 23 by a longitudinal pivot pin 26 to permit relative pivotal movement between the two frame members. In the preferred embodiment described herein, the total pivotal
35 or oscillating angle between the two frame members is 16 degrees.

The front rail wheels 12 are carried on a front rail wheel axle 28 which is mounted on the main frame member

23. The rear rail wheels 14 are carried on a rear rail axle 30 which is mounted on the pivotable frame member 24. Accordingly, oscillating or pivotal motion is permitted between the front and rear rail wheels to improve manoeuvrability over uneven track and effect balanced loading on the several rail wheels thereby improving draw bar pull.

The front road wheels 16 are not driven wheels but are steerable to afford front wheel steering for the railcar moving vehicle of the present invention. Those front road wheels 16 are each carried on a corresponding front road wheel axle 32 (see Figure 2) which is mounted on one end 34 of a bellcrank lever 36 which is pivotally connected to the main frame 23 at 38. The other end 40 of the bellcrank lever 36 is pinned to a piston rod 42 of a hydraulic cylinder 44, the other end of the cylinder being pinned to the main frame 23 at 46.

When cylinder 44 is retracted to pivot bellcrank 36 clockwise, the front road wheel 16 is raised to its inoperative position as shown in Figure 1. Similarly, when the hydraulic cylinder 44 is extended, bellcrank lever 36 is pivoted in a counterclockwise direction to lower the corresponding front road wheel 16 to an operative position as shown in Figure 2 where the rail wheels 12 are elevated above the ground. It should be understood that a second cylinder 44 and bellcrank 36 as shown in Figure 2 are provided on the opposite side of the vehicle for actuating the other front road wheel 16.

The rear road wheels 18 are each journalled on a respective axle 48 which is mounted on one end of a road arm 50, the other end of the arm 50 being pivotally carried on the rear rail wheel axle 30 as shown in Figures 2 and 4. A drive chain 52 is mounted on a rail wheel axle sprocket 54 and a road wheel sprocket 56 associated with the road wheel axle 48 to drive the road wheels 18 from the rail wheels 14. Each of the four rail wheels is driven by conventional engine means and front and rear differential drive axles. As shown in Figures 3

and 4, a pair of drive chains 52 are provided, one on each side of the frame, for driving the respective road wheels 18.

As best shown in Figure 2, a hydraulic cylinder 60 has its upper end connected to the pivotable frame 24 at 62 and the lower end of the piston rod 64 is connected to the road arm 50 at 66. When the cylinder 60 is shortened, the road arm 50 is pivoted clockwise about the rail axle 30 to raise the road wheel 18 from its lower operative position shown in solid lines to its raised inoperative position shown in dash lines.

Similarly, when the cylinder 60 is extended to the position shown in Figure 2, the road wheels 18 are moved down to their lower operative positions which causes the rail wheels 14 to be elevated. It will be seen from Figure 3 that two cylinders 60 are provided, one on each side of the vehicle, for actuating a corresponding one of the road wheels 18. In accordance with conventional practice, the front road wheels 16 and rear road wheels 18 are raised and lowered conjointly through simultaneous actuation of the cylinders 44 and 60.

The operation of the railcar moving vehicle of the present invention will now be described. When the vehicle is to be operated on rail to push or pull one or more railcars, there are provided couplers 70 and 72 at the opposite ends of the vehicle (see Figure 2) as is known in the art. In the rail mode, the cylinders 44 and 60 are retracted to raise the road wheels 16 and 18 to their inoperative positions so the rail wheels 12 and 14 are operative as shown in Figure 1.

When the vehicle is in the rail mode as shown in Figure 1, the forward rail wheels 12 which are mounted on the main frame 23 can oscillate or pivot about the longitudinal axis of the pin 26 relative to the rear wheels 14 which are mounted on the pivotable frame 24. Accordingly, there is provided an equalizing pivoting action because the front frame assembly 23 and the rear frame assembly 24 can oscillate with respect to each

other around the centerline of the longitudinal pin 26 when load reactions are induced to any of the rail wheels. Such an arrangement allows all four rail wheels to maintain equal wheel loadings in spite of uneven conditions in the rail with a total oscillating angle between the two frames of up to 16 degrees.

Similarly, when the vehicle is in the road mode as shown in Figure 2, the forward steerable road wheels 16 which are mounted on the main frame 23 can oscillate or pivot about the longitudinal axis of the pin 26 relative to the rear driven road wheels 18 which are pivotally suspended from the rear rail wheel axle 30 which is carried on the pivotable frame 24 along with the cylinders 60 which raise and lower the wheels 18. As a result, even when in the road mode, the front and rear wheels can oscillate relative to one another under uneven road conditions to maintain equal wheel loadings.

Thus, in accordance with the present invention, there is provided equalizing pivoting action for the four rail wheels and also for the four road wheels. The important advantage of the foregoing feature is that both the rail wheels and the road wheels can manoeuvre over uneven track or uneven terrain while maintaining equal wheel loadings at all times. Among the other advantages of the present invention are better vehicle stability, front wheel steering, better manoeuvrability over rough terrain, and better draw bar pull due to the even wheel loadings.

CLAIMS

1. A vehicle comprising first and second frames pivotally mounted relative to each other about a
5 generally longitudinal axis of the vehicle; first and second rail wheel axles, each carrying two rail wheels and mounted respectively on the first and second frames; a first pair of road wheels mounted on the first frame, with first actuating means mounted on the first frame for
10 raising and lowering the first pair of road wheels; and a second pair of road wheels mounted on the second frame, with second actuating means mounted on the second frame for raising and lowering the second pair of road wheels, the actuating means being operable to move the road
15 wheels between raised positions for use of the vehicle on rails, and lowered positions for use of the vehicle on land.

2. A vehicle according to Claim 1 wherein the rail wheel axles are disposed at opposite ends of the
20 vehicle, with the pairs of road wheels disposed between the rail wheel axles.

3. A vehicle according to Claim 1 or Claim 2 wherein the rail wheel axles are differential drive axles and wherein the second pair of road wheels are driven
25 from the second rail wheel axle.

4. A vehicle according to Claim 3 wherein the first pair of road wheels are steerable road wheels.

5. A vehicle according to any preceding Claim including a cab mounted on the first frame, with
30 depending access steps on each side thereof, the second pair of road wheels being positioned to be received behind respective access steps when in their raised positions.

6. A vehicle according to any preceding Claim
35 wherein the second pair of road wheels are driven from the second rail wheel axle and are mounted for pivotal movement about the second rail wheel axle between their raised and lowered positions.

7. A vehicle according to Claim 6 wherein the second pair of road wheels are mounted on respective road arm means affording pivotal movement thereof about the second rail wheel axle between their raised and lowered positions.

8. A vehicle according to any preceding Claim wherein the first frame is disposed at the forward end of the vehicle and the second frame is disposed at the rearward end of the vehicle.

9. A vehicle according to any preceding Claim wherein the axes of the first and second rail wheel axles are fixed on the respective frames.

10. A vehicle according to any preceding Claim wherein the actuating means comprises hydraulic piston-cylinder mechanisms.

11. A vehicle substantially as described herein with reference to the accompanying drawings.