



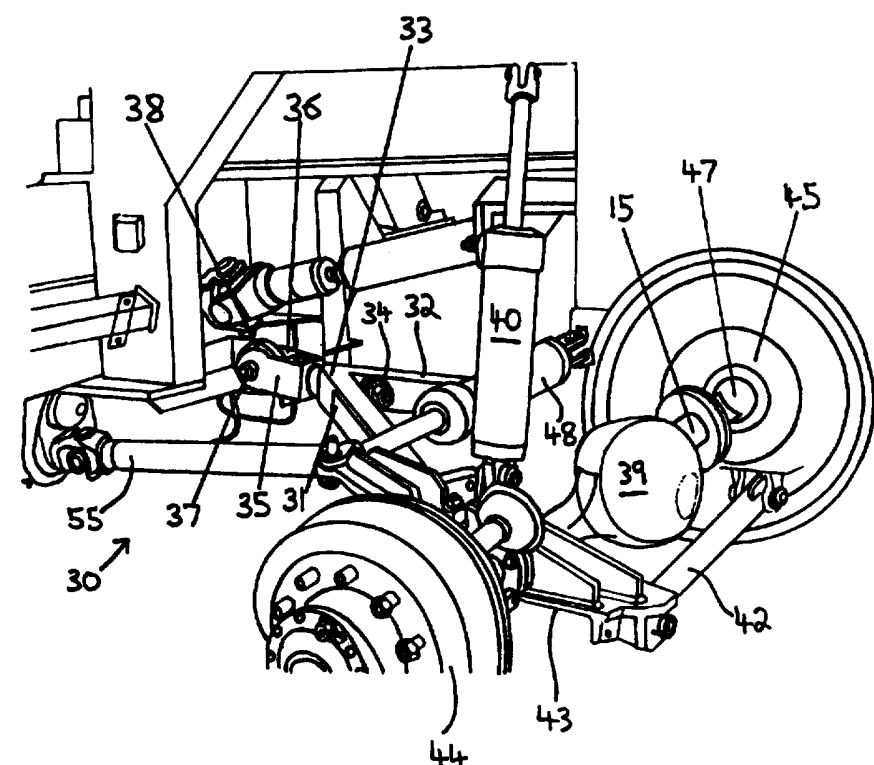
INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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<p>(21) International Application Number: PCT/AU96/00053 (22) International Filing Date: 2 February 1996 (02.02.96) (30) Priority Data: PN 0940 7 February 1995 (07.02.95) AU (71)(72) Applicants and Inventors: KRIEDEMANN, Barry, Walter [AU/AU]; Mail Service 1372, Jacobs Well Road, Norwell, QLD 4208 (AU). KRIEDEMANN, Graeme, John [AU/AU]; Mail Service 1372, Jacobs Well Road, Norwell, QLD 4208 (AU). (74) Agent: CULLEN & CO.; Level 12, 240 Queen Street, Brisbane, QLD 4000 (AU).</p>	<p>(81) Designated States: AL, AM, AT, AU, AZ, BB, BG, BR, BY, CA, CH, CN, CZ, DE, DK, EE, ES, FI, GB, GE, HU, IS, JP, KE, KG, KP, KR, KZ, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, TJ, TM, TR, TT, UA, UG, US, UZ, VN, ARIPO patent (KE, LS, MW, SD, SZ, UG), Eurasian patent (AZ, BY, KG, KZ, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).</p> <p>Published <i>With international search report.</i></p>	

(54) Title: TIPPING VEHICLE FRONT WHEELS SUSPENSION

(57) Abstract

Self propelled tipping vehicle front wheel suspension having a front wheel axle (15) and wheels (44, 45). The axle (15) is supported by two support arms (30, 32) connected at one end to the axle (15) at spaced apart locations and joined together at the other end at (33) to pivot about longitudinal pin (34) and about transverse pivot pin (37) relative to the vehicle's chassis. An arm (42) prevents the axle's (15) lateral movement and rams (40) allow axles' (15) vertical movement. Wheels (44 and 45) are steered by hydraulic cylinder (48).



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TITLE

TIPPING VEHICLE FRONT WHEELS SUSPENSION

FIELD OF THE INVENTION

This invention relates to a tipping vehicle and particularly to a self propelled tipping vehicle suitable for transporting and tipping sugar cane billets. The invention shall be described with reference to the sugar cane industry, but it should be appreciated that the tipping vehicle can be used in other applications.

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BACKGROUND ART

In the sugar cane industry sugar cane is cut by a sugar cane harvester which cuts the sugar cane stalks slightly above ground level, removes the top of the sugar cane plant, strips off the leaves and cuts the stem into short lengths called billets. The billets are thrown from the rear of the sugar cane harvester into a bin which is towed by a tractor. When the bin is full, it is towed to a railway siding where the bin is tipped into railway trucks for transportation to a sugar cane crushing mill. The bin is tipped hydraulically by a pair of hydraulic rams and can be tipped sideways or rearwardly.

15

Self propelled tipping vehicles are known. These tipping vehicles have a bin on the rear of the vehicle, a front driver's cabin, an engine, and pneumatic wheels to allow the vehicle to move next to the sugar cane harvester. However, these known vehicles suffer from many disadvantages including lack of forward suspension arrangement, an operator cabin which is mounted too far forward of the wheels, an underpowered motor, an undesirable bouncing sensation as the vehicle moves around and the like.

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There is a general requirement for tipping vehicles, or towed tipping bins to have a relatively narrow track width to allow them to be used in a sugar cane field. Thus, while normal road vehicles with a wider track width can have traditional or standard types of suspension arrangements, this is not necessarily so with tipping vehicles for use in the sugar cane industry, where the

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track width should be approximately 5 feet.

DISCLOSURE OF THE INVENTION

It is an object of the invention to provide a self propelled tipping vehicle useful for receiving and transporting sugar cane bolts and which may overcome at least some of the abovementioned disadvantages.

In one form, the invention resides in a self propelled tipping vehicle, the vehicle having a forward engine, a driver's cabin, a rear tipping bin, a pair of front wheels interconnected by an axle, at least one pair of rear wheels, and a front suspension arrangement characterised in that the front suspension arrangement has a pair of support arms, each arm having one end coupled to the vehicle chassis for pivotal movement about a substantially horizontal axis, and having the other end fastened to the front axle at spaced apart locations, and damping means extending between the axle and the chassis or another part of the vehicle to dampen the pivotal movement of the arm members.

It is found that this particular type of suspension arrangement allows the self propelled vehicle to have a relatively narrow track width thereby making it more suitable for use in the sugar cane industry, and where the suspension arrangement provides a smooth ride to a driver in the cabin.

The damping means may comprise at least one hydraulic or pneumatic cylinder and these may be of an adjustable type to allow the degree of damping to be varied. Preferably, the damping means comprises hydraulic cylinders and may be of the nitrogen over hydraulic type.

The pair of support arms may be convergent relative to each other and may be attached to, or relative to each other adjacent the one end which is coupled to the chassis. Suitably, the support arms, as well as being able to pivot about a horizontal axis, can also swivel about an horizontal axis substantially at right angles to the pivot axis.

The front axle may comprise a pair of opposed

hubs to which wheels such as pneumatic wheels can be fitted in the usual manner. Braking means may also be provided typically these will be located within the hubs.

The hubs may be steerable such that the self
5 propelled tipping vehicle has front wheel steering. This can be achieved by having the front wheels attached to the axle using a ball and socket type arrangement, with steering means being provided to steer the wheels. The steering means may include a fluid steering means such as
10 an hydraulic or pneumatic cylinder which may be operatively coupled to one of the wheels.

Suitably, the front wheels are driven, and this can be achieved by a conventional type of differential and shaft assembly.

15 To assist in supporting the front suspension assembly, there may be provided a support rod. The support rod may extend from the chassis point to the front axle and may be mounted for pivotal movement about a horizontal axis, the horizontal axis being substantially at right
20 angles to the pivot axis of the pair of support arms.

The driver's cabin is preferably located substantially above the suspension assembly to provide the driver with a smooth ride. It is preferred that the driver's cabin is accessible from both sides of the vehicle
25 as opposed to one side only which is a feature of other types of tipping vehicles.

BRIEF DESCRIPTION OF THE FIGURES

An embodiment of the invention will be described and illustrated with reference to the accompanying drawings
30 in which

Figure 1 is a side view of a self propelled tipping vehicle according to an embodiment of the invention;

Figure 2 is a front view of the vehicle of Figure
35 1 showing the tipping bin in a tipping position;

Figure 3 is a close up view of the suspension assembly of the tipping vehicle.

BEST MODE

Referring to the drawings there is shown a self propelled tipping vehicle 10. The vehicle 10 has a forward engine 11, a rear tipping bin 12, a pair of front wheels 13, 14 which are interconnected by an axle 15 (see Figure 3), and two pairs of opposed rear wheels 16, 17 (only one of each pair illustrated in Figure 1).

The tipping vehicle has a suspension arrangement illustrated in Figure 3 which provides a smooth ride to a driver, and also allows the track width to be narrower than usual, the track width between the centres of front wheels 13 and 14 being 5 foot.

In the embodiment, front wheels 13 and 14 are driven wheels as are the rear pair of wheels 16 and the rear pair of wheels 17. Therefore, the tipping vehicle of the embodiment can be seen as being a six wheel drive. The front wheels 13, 14 are also steered, some of the steering componentry being illustrated in Figure 3 and which shall be described in greater detail below.

Tipping bin 12 is of a standard type and tips sidewardly as shown in Figure 2. The bin itself and its tipping arrangement is known and forms no part of the present invention apart from it being present on the vehicle. Tipping bin 12 is typically formed from sheet steel and is typically rectangular when viewed in plan. The base 18 of tipping bin 12 is closed, while the side walls are formed from mesh material 19 which is supported by a steel frame 20.

Bin 12 is tipped between a substantially horizontal position and a tipped emptying position by hydraulic cylinders 20,21 which are positioned on the front and rear end of the bin. The bin is pivotally attached for tipping movement about two pivot pins 22,23 (23 not shown), at the upper corner edge of the front and rear ends of bin 12. These pins are supported by a vertically extending substantially A-frame assembly (not shown). Movement of hydraulic cylinders 20,21 will cause bin 12 to tip about pivot pins 22,23, and this arrangement is already known.

Engine 11 can be of any suitable type, and

typically comprises a diesel or petrol internal combustion engine having suitable horse power to power the vehicle and the hydraulics. Typically, a 250 horsepower engine will be suitable.

5 The engine is coupled to a transmission shown generally as 24 which is positioned behind the driver's cabin 25 on chassis 26 and between front wheels 14 and the first pair of rear wheels 16. A drive shaft 27 couples engine 11 to transmission 24.

10 As mentioned above, each of rear pairs of wheels 16 and 17 are driven wheels and separate drive shafts (not shown) extend from transmission 24 to each of rear wheels 16 and 17 through differentials (not shown), which can be of a known type.

15 Driver's cabin 25 is positioned centrally on the vehicle such that it can be accessed from either side of the vehicle. Furthermore, driver's cabin 25 is positioned substantially above the suspension arrangement which suspends it from the remainder of the vehicle and which shall be described in more detail below.

20 Referring to Figure 3 there is illustrated the suspension arrangement which is positioned between front wheels 13 and 14 and which provides a high degree of comfort and also allows the front wheels to have a relatively narrow track width. Suspension arrangement 30 comprises a pair of support arms 31,32 which are formed from steel box section. Arms 31 and 32 are welded together adjacent one end shown as 33, and can swivel or pivot about a horizontal axis through pivot pin 34 which extends through a hollow collar (not shown) through joined portion 33. Thus, arms 31 and 32 can swivel from side to side.

30 Pivot pin 34 extends through the support arms and is attached to a pair of thick steel spaced apart plates 35,36 which themselves pivot about a pivot pin 37 which is dampened to some degree by spaced rubber disks 38. Thus, arm members 31 and 32 can move up and down relative to the ground surface by moving about pivot pin 37, and can also swivel from side to side about pivot pin 34.

The other end of arm members 31 and 32 are rigidly attached to axle 15 on each side of differential housing 39, and therefore function to allow axle 15 to move up and down and rock from side to side. The up and down movement of axle 15 is dampened by a pair of hydraulic rams 40,41 one end of which is attached to the axle and the other end of which is attached to a portion of the chassis. Rams 40 and 41 comprise the damping means of the suspension arrangement and are nitrogen over hydraulic rams. The damping effect can be varied by adjusting the amount of fluid and/or gas in the cylinder of the ram and therefore the softness of the ride can be varied.

Axle 15 is also held in place by a solid steel connecting rod 42 which extends forward of axle 15. Connecting rod 42 has one end pivotally mounted to a portion of the chassis for up and down movement about a substantially horizontal axis, the axis extending in line with the direction of travel of the vehicle. The other end of connecting rod 42 is pivotally attached to a bracket arrangement 43 for movement about a substantially horizontal axis which is also in line of the direction of travel of the vehicle. Bracket arrangement 43 comprises strong steel plates which attach connecting rod 42 to axle 15.

At the ends of axle 15 are provided hubs 44,45 to which a pneumatic wheel can be fitted in the usual manner. Inside hubs 44,45 are brake shoes to allow the front wheels to be braked, and this arrangement can also be conventional. Behind each hub 44,45 is located a ball and socket arrangement 46,47 to allow front wheels 13,14 to be steered.

The front wheels are steered by virtue of a hydraulic steering cylinder 48 one end of which is attached to a chassis point and the other end of which is attached to a lever arm 49, the other end of lever arm 49 being rigidly attached to the socket housing in which the ball locates. Thus, operation of steering cylinder 48 will cause socket housing and therefore hub 44 to move in a

desired steering direction.

Front wheels 13,14 are driven by a drive shaft 55 which extends from transmission 24 into differential housing 39 and to front wheels 13,14 in a known way.

5 It can be seen that the self propelled tipping vehicle and the suspension arrangement allows the vehicle to have a narrow track width and provides a smooth ride to the operator. The centrally positioned cabin with access from each side of the cabin provides advantages to the
10 driver, and by having the cabin positioned above the floating front suspension, a smooth ride is obtained. The vehicle in the embodiment has six wheel drive which means that the rear wheels will not drag and also provides efficient propulsion over soft or loose surfaces. The
15 suspension can allow the vehicle to be driven on road surfaces at high speeds of up to 100 km/hr although this may require a change to be made to the hydrostatic steering.

20 It should be appreciated that various other changes and modifications may be made to the embodiment described without departing from the spirit and scope of the invention.

CLAIMS:

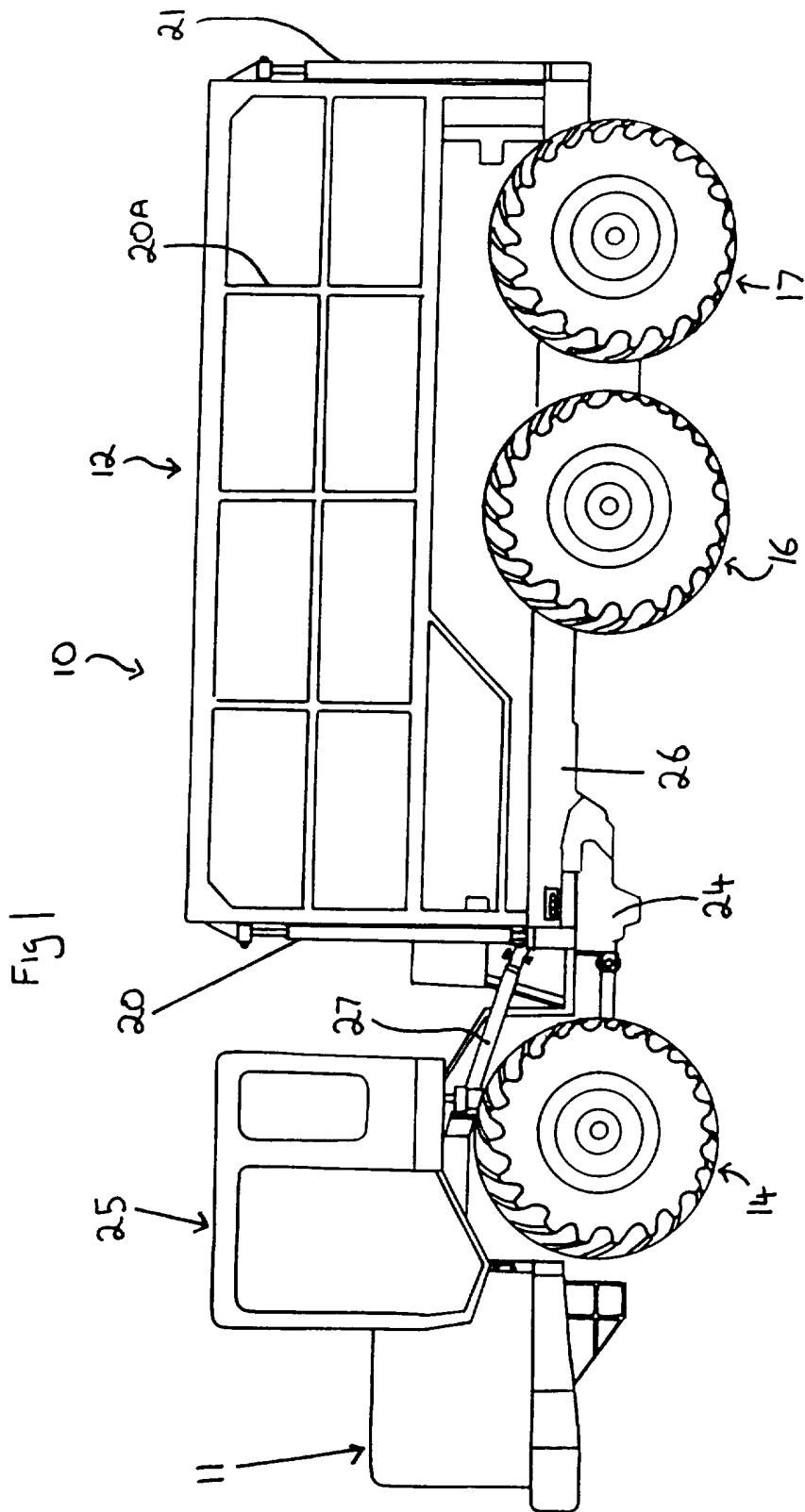
1. A self propelled tipping vehicle, the vehicle having a forward engine, a driver's cabin, a rear tipping bin, a pair of front wheels interconnected by an axle, at least one pair of rear wheels, and a front suspension arrangement characterised in that the front suspension arrangement has a pair of support arms, each arm having one end coupled to the vehicle chassis for pivotal movement about a substantially horizontal axis, and having the other end fastened to the front axle at spaced apart locations, and damping means extending between the axle and the chassis or another part of the vehicle to dampen the pivotal movement of the arm members.
2. The vehicle of claim 1, wherein the support arms are coupled to the vehicle chassis through a swivel arrangement for swivelling movement about a horizontal axis which is substantially at right angles to the horizontal axis defined in claim 1.
3. The vehicle of claim 2, wherein the pair of support arms converge towards each other from their spaced apart attachment to the front axle, with the proximal ends of the support arms being coupled to a single said swivel arrangement, the swivel arrangement also being pivotally moveable about a horizontal axis which is substantially at right angles to the swivel axis.
4. The vehicle of claim 3, wherein the damping means comprises at least one fluid cylinder adapted to dampen up and down movement of the axle.
5. The vehicle of claim 4, wherein the front suspension arrangement includes a support rod to support the suspension arrangement, the support rod having one end pivotally attached to the chassis for movement about a horizontal axis, and a second end attached relative to the axle.
6. The vehicle of claim 5, wherein the front wheels are steerable.
7. The vehicle of claim 6, wherein the front wheels comprise hubs, the hubs having a socket, the axle having

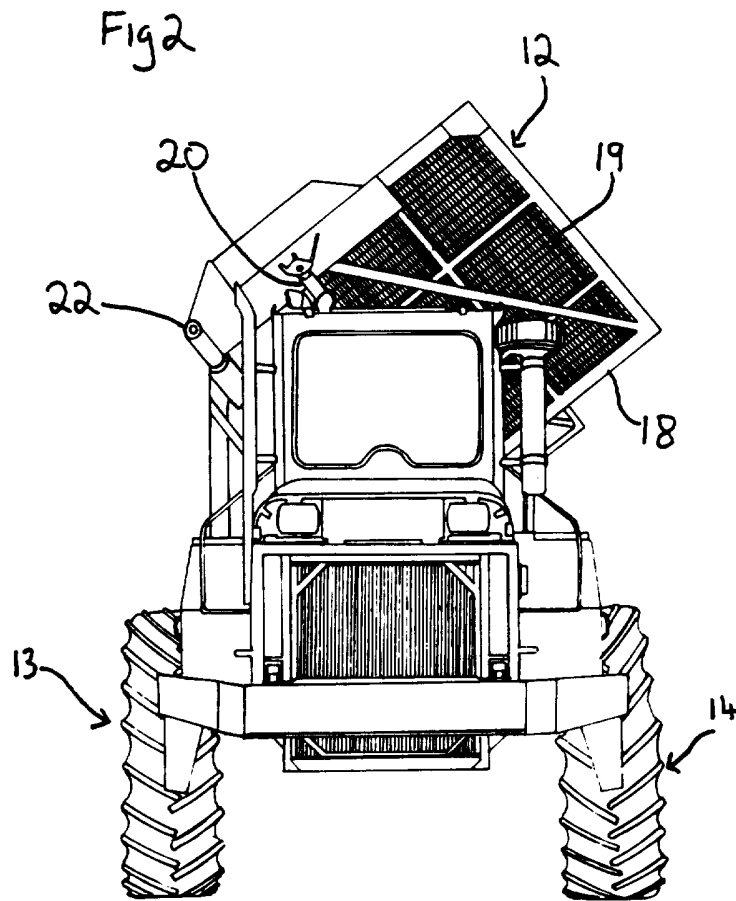
terminal balls which fit in the sockets.

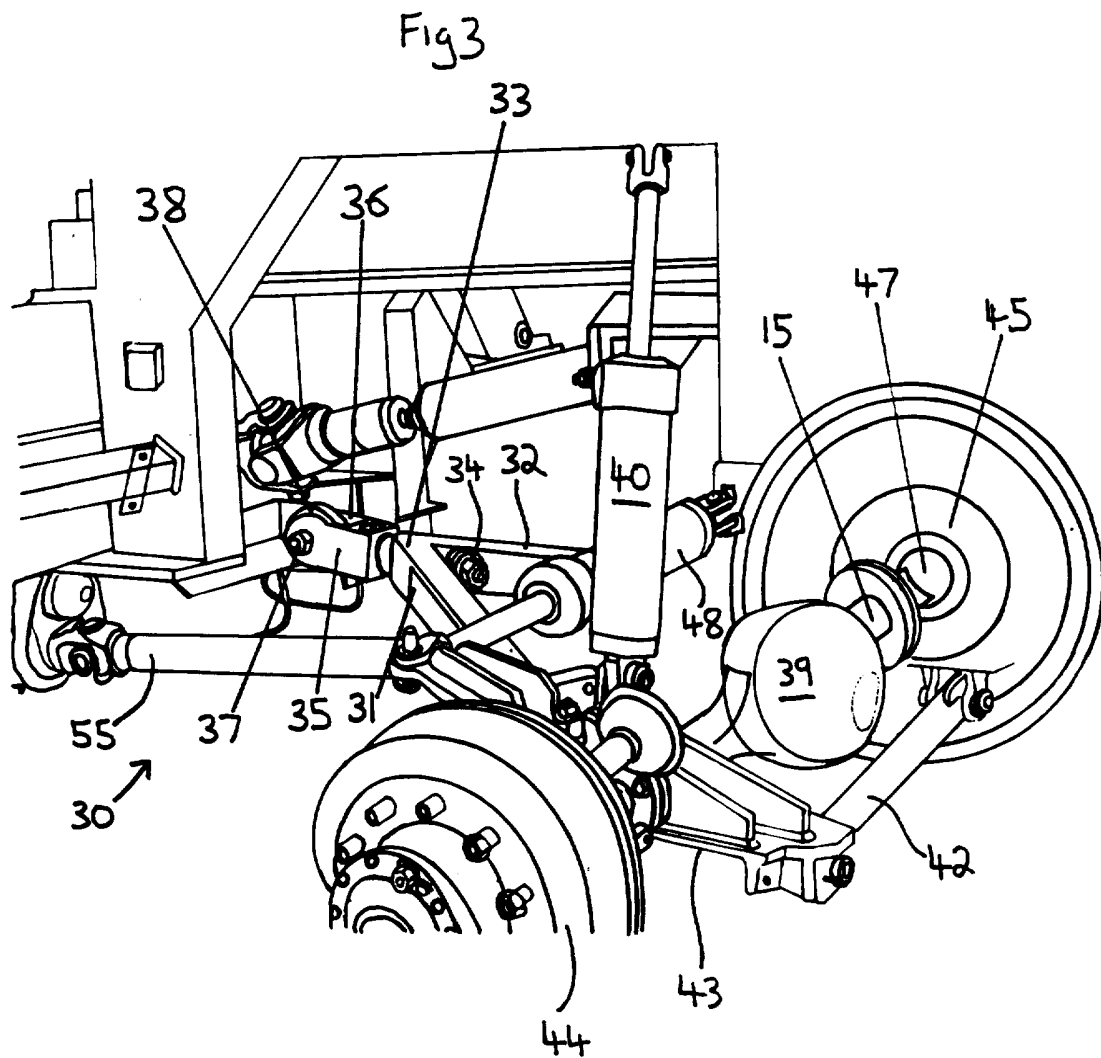
8. The vehicle of claim 7, wherein the front wheels are steered by a fluid cylinder attached at one end to the chassis and at the other end to a lever, the lever being
5 attached to the hub of one said wheel.

9. The vehicle of claim 8, wherein the drivers cabin is positioned above the suspension arrangement.

10. The vehicle of claim 9, wherein the track width between the front wheels is about 5 feet.







INTERNATIONAL SEARCH REPORT

International Application No.
PCT/AU 96/00053

A. CLASSIFICATION OF SUBJECT MATTER

Int Cl⁶: B60G 9/02, 7/00, 7/02 // A01D 90/10, B60P 1/04, 1/16

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC B60G 9/02, 7/00, 7/02

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
AU: IPC as above, B60P 1/04, 1/16

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
DERWENT

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X,Y	DE 827594 a (DAIMLER-BENZ A.G.) 10 January 1952 the whole document	1-9
X,Y	GB 785958 A (DAIMLER-BENZ A.G.) 6 November 1957 the whole document	1-9
X,Y	DE 2137122 A (BAYERISCHE MOTOREN WERKE A.G.) 8 February 1973 claims 1-6 and drawings	1-9

Further documents are listed in the continuation of Box C

See patent family annex

* Special categories of cited documents:	
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Date of the actual completion of the international search
13 May 1996

Date of mailing of the international search report
15TH May 1996.

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INTERNATIONAL SEARCH REPORT

International Application No.

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C (Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X,Y	GB 746169 A (DAIMLER-BENZ A.G.) 7 March 1956 the whole document	1-9
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X,Y	AT 340782 A (STEYR-DAIMLER-PUCH A.G.) 10 January 1978 claims 1-3 and drawings	1-9
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