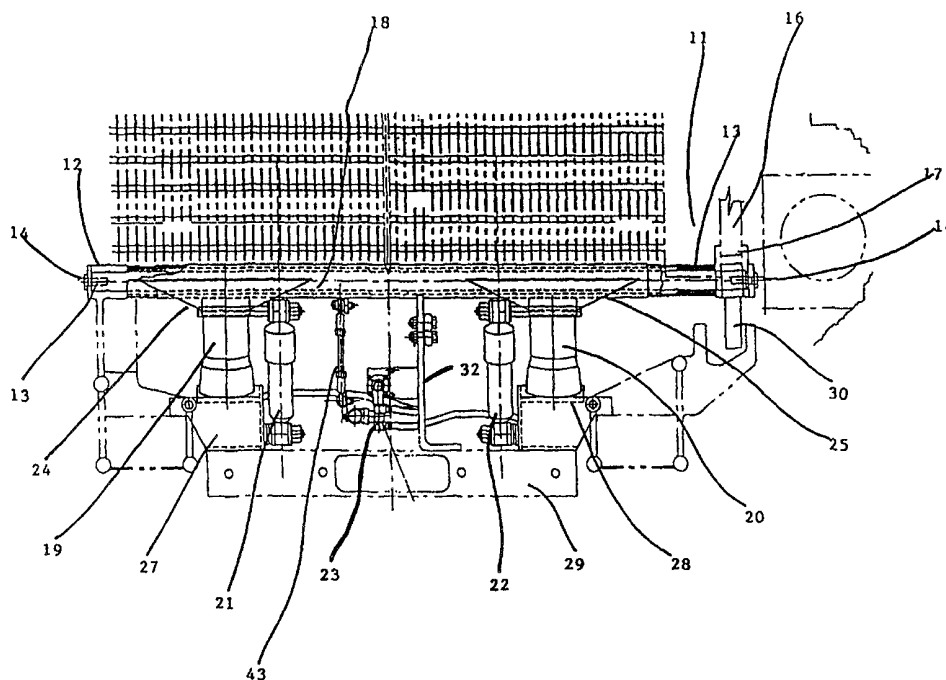




## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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<p>(21) International Application Number: PCT/AU00/00244</p> <p>(22) International Filing Date: 24 March 2000 (24.03.00)</p> <p>(30) Priority Data: PP 9396 24 March 1999 (24.03.99) AU</p> <p>(71) Applicant (for all designated States except US): P &amp; A MORGAN PTY. LTD. AND T &amp; K WEBB AUTOMOTIVE PTY. LTD. AS TRUSTEES FOR M W AIR RIDE TRUST [AU/AU]; P.O. Box 1017, Springgood, QLD 4017 (AU).</p> <p>(72) Inventors; and (75) Inventors/Applicants (for US only): MORGAN, Peter [AU/AU]; 4 Dean Street, Rochedale, QLD 4123 (AU). WEBB, Troy [AU/AU]; 49 McGregor Way, Ferny Grove, QLD 405 (AU).</p> <p>(74) Agent: GRIFFITH HACK; G.P.O. Box 3125, Brisbane, QLD 4001 (AU).</p>	<p>(81) Designated States: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).</p> <p><b>Published</b> With international search report.</p>	

(54) Title: A SUSPENSION SYSTEM FOR A TILTABLE CAB



## (57) Abstract

A suspension system (11) for a vehicle having a tilting cab, the suspension system having a first support (12) connectable to a shock absorber means (21) and a second support (13) connectable to the cab frame, wherein the first support (12) is pivotable with respect to the second support (13).

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## A SUSPENSION SYSTEM FOR A TILTABLE CAB

Background of the Invention

The present invention relates to vehicles having a tilting cab.

5 Field of the Invention

In particular the invention relates to trucks and semi-trailers and earth moving equipment.

A typical truck with a tilting cab generally has a suspension system which is inferior to that for standard  
10 trucks.

The problem with a tilting cab truck is that the suspension system must be arranged to allow the cab frame to tilt down approximately through a 90° angle.

As a result of this problem if a suspension system is  
15 provided at all it must be located behind the front of the cab, (that part including the grill and any bullbar) so that the suspension system is out of the way when the cab is tilted.

As a result of this limitation on the location of the  
20 suspension system shock absorbers are normally located at an acute angle extending downwardly and rearwardly from a front part of the underside of the cab. The shock absorbers operate through a lever system to change the direction of travel from vertical to near horizontal thus making the  
25 operation very inefficient by not controlling dampening in the same direction as the travel of the cab.

Because the shock absorbers are located at this acute angle (closely approaching horizontal) the majority of any vertical shocks imparted to the cab during movement of the  
30 truck, result in very little shock being dampened by the shock absorbers. Instead the shock absorbers provide most damping when forces are applied in a horizontal plane.

Unfortunately it is not possible to place the shock absorbers in a vertical plane because of the limited space available and furthermore because truck manufacturers have not come up with a means of connecting them to the cab  
5 without the lever system they are currently using and by using a coil-over type of shock absorber the ride would be too harsh with not enough travel.

Because of the problems associated with tilting cab trucks as explained above, the present invention provides an  
10 alternative method of suspension system which has the objective of reducing the problems associated with the suspension systems of existing trucks with tilting cabs.

#### Summary of the Invention

According to the present invention there is provided a  
15 suspension system for a vehicle having a tilting cab, the suspension system having a first support connectable to a shock absorber means and a second support connectable to the cab frame, wherein the first support is pivotable with respect to the second frame.

20 It is preferred that the first support comprises an elongate member.

Preferably the second support comprises an elongate member.

The second support may be located at least partly  
25 within the first support.

The second support preferably extends through the centre of the first support.

The first support is preferably a hollow rod.

The first support may be cylindrical in shape.

30 The second support is preferably in the form of a bar.

The second support may be a cylindrical shaped bar.

The second support preferably extends beyond both ends of the first support.

The ends of the first and second support may be connected together through a pivoting means.

The pivoting means may include pivot pins which are locatable through centrally located holes in the ends of each of the first and second supports.

It is preferred that the ends of the second support are connected to parts of the cab frame.

It is preferred that the ends of the second support are provided with annular grooves or spaces which are adapted to receive forked portions or sleeve portions of a supporting structure of the cab frame.

According to an alternative embodiment of the present invention the first support is located inside the second support.

Preferably the shock absorbing means includes an air bag and shock absorber.

According to the alternative embodiment the shock absorbing means includes a bar which is connected to ends of the first support.

According to another embodiment of the present invention the first and second supports are arranged side by side in parallel and are connected at their ends through end pieces which permit the supports to pivot with respect to each other.

According to another embodiment of the present invention the first support is connected through a hinge member to the second support.

According to another embodiment of the present invention each support comprises at least two bars aligned in parallel with the second support located at least partly within the first support.

Each support may comprise a plurality of end to end bars connected together through an intermediate connection means.

#### Brief Description of the Drawings

5 Preferred embodiments of the present invention will now be described by way of example only with reference to the accompanying drawings in which:

Figure 1 shows a schematic diagram of a front view of a suspension system according to the preferred embodiment of  
10 the present invention;

Figure 2 shows a side view of an air bag suspension arrangement shown in Figure 1;

Figure 3 shows a front view of a cabin suspension system in accordance with a second embodiment of the present  
15 invention;

Figure 4 shows a side view of the suspension system shown in Figure 3;

Figure 5 shows a plan view of the suspension system shown in Figure 3; and

20 Figure 6 shows an opposite side view of the suspension system shown in Figure 3.

#### Detailed Description of the Drawings

As shown in the drawing the suspension system 11 consists of a horizontally extending cylindrical bar 12 with  
25 another cylindrical bar, inner support bar 13 of small diameter extending through its centre and extending beyond each end.

Each end of the bars 12 and 13 are provided with open ends, with a centrally located bolt hole to which a thick  
30 washer 14 is bolted covering both the cylindrical bar 13 and the lower end of a cab mount bar 16, which prevents any sideways movement of any of the components.

- 5 -

Each end of the inner bar 13 is adapted to receive the lower end of the cab mount bar 16, this cab mount bar 16 is provided with axially aligned planar sleeve elements 17 which fit over the inner bar 13.

5 The cab mount bars 16 are freely rotatable on the ends of the inner bar 13 so that they pivot with or independently of the inner bar 13 to allow the cab to tilt.

The outer cylindrical bar 12 is connected directly to the suspension arrangement 18 of the vehicle cab. This  
10 suspension arrangement 18 consists of left and right side air bags 19, 20.

Each of the shock absorbers 21, 21 are connected to triangular shaped claspings brackets. The air bags 19, 20 are connected to a pneumatic valve system 23 consisting of  
15 two hoses 40, 41, which are connected to a height control valve 42. A ball joint system 43 with a threaded rod is connected between the outer bar 12 and valve 23.

Each of the air bags 19, 20 are connected, directly to the outside of the outer cylindrical bar 12, through  
20 triangular shaped claspings brackets 24, 25 in one embodiment. At their other lower ends the air bags 19, 20 are supported on brackets 27, 28 which rest on the top of a chassis bracket 29 of the vehicle.

As shown most clearly in Figure 2 pivoting of the  
25 chassis frame is controlled by a torque rod device 32 consisting of a shark fin bracket 33 and torque rod 34.

The bottom of the shark fin bracket is connected to the chassis bracket 29, while the fin part of the shark fin bracket 33 is connected to one end of the torque rod 32  
30 which at its other end is connected to the outer cylindrical bar 12.

With the torque rod device locating the outer bar 12 in the above manner the cabin is allowed to tilt with the outer

bar 12, but the torque rod device 32 prevents the air bags 20 from turning the outer bar 12 whilst under air pressure.

The shark fin bracket 33 and torque rod 34 are located at a position to the right hand side of the mid point of  
5 outer bar 12.

According to another embodiment to limit the extent by which the chassis frame can pivot with the inner bar 13 with respect to the outer bar 12 and associated suspension arrangement 18, each end of the inner bar 13 is provided  
10 with a downwardly extending lever 30 from the old suspension system of the cab. This lever 30 is adapted to strike forked tongue attached to the ends of bar 12 and extending horizontally so as to straddle either side of the lever 30, thus keeping the suspension in line at all times no matter  
15 what position the cab is in.

In order to tilt the cab of a truck which has the above described suspension system, the cab frame is tilted forward and the support beam 16 located on each end of the inner cylindrical bar 13, rotates with the inner cylindrical bar  
20 with respect to the outer cylindrical bar 12.

Because the suspension arrangement 18 is connected directly to the outer cylindrical bar 12 pivoting of the cab has no effect on the overall suspension system. Accordingly components of the suspension system do not need to be  
25 removed. Furthermore, when the truck incorporating the above suspension system is being driven the driver in the truck cab, enjoys the full benefit of the suspension system which is arranged to provide maximum shock absorption because the shock absorber and air bag components are  
30 oriented in a vertical plane.

The height control valve system 23 enables the height of the suspension to be adjusted.

Figures 3 and 4 show a suspension system in accordance with the second embodiment of the present invention. In this embodiment a cabin 40 of a vehicle is able to be tilted sideways rather than forwardly as in the first embodiment.

5 As shown in Figure 4 on one side, a suspension arrangement 41 consists of a frame support having an elevated horizontal central section 43 and lower horizontal end sections 44 separated from the central section 43 by downwardly angled sections 45 having an approximate taper of  
10 45°.

The central section 43 is supported by an air bag and shock absorber arrangement 46 mounted on the chassis of the vehicle.

The cabin 40 is supported on the one side through cabin  
15 locks 47 seated on each end section 44.

The suspension arrangement 41 shown in Figure 4 supports one side of the cabin whereas a different suspension arrangement supports the other side of the cabin.

As shown in Figure 3 the other side of the cabin is  
20 supported by suspension arrangement 48 and a bolt-in cross member holds 48 in position and extends across to the other side.

Suspension arrangement 48 includes a pivot bar 49 which runs from the front to the back of the cabin along the whole  
25 of the other side of the cabin.

The pivot bar 49 operates in similar fashion to cylindrical bars 12 and 13 of the first embodiment.

Accordingly an outer bar 60 is provided and an inner bar 61 extends through the outer bar beyond both ends  
30 thereof.

The other side of the cabin is supported on each end of the inner cylindrical bar 61 which protrudes beyond each end of the outer cylinder 60.

The suspension arrangement 48 including air bags 50 and shock absorbers 51 at their upper ends which are welded to outer bar 60. Torque rods are connected to the outer bar 60 through a welding bar. Each torque rod 52 is pivotally  
5 connected to a support bracket 54 extending upwardly from the cross member 49 through a rubber bush and located approximately one third of the distance along the cross member 49 from the suspension arrangement 48.

As with the first embodiment of the invention the cabin  
10 is connected to inner bars 61 and the inner bars allow the cabin 40 pivot with respect to the outer bar 60.

Accordingly the cabin is able to lift off the suspension arrangement 41, but is supported on the inner cylindrical bar of the pivot bar 49 through the suspension  
15 arrangement 48.

As shown in Figure 6 the cabin 40 is connected through anchor mount bracket 64 through a locking pin 66 to cab anchor mounts 65 welded to the chassis.

On the side of the vehicle shown in Figure 4 the bar 43  
20 is anchored to the chassis permanently through anchor mount brackets 67 which are each pinned through a pin 68 to an anchor mount 69 welded to the chassis.

The pins 66 shown in Figure 6 enable the cab 40 to be locked on both sides of the vehicle when the vehicle is in  
25 use. In order to allow the cab 40 to be tilted the pins 66 are removed and the cab 40 can then pivot on the inner bar 61.

The above embodiments exemplify how the pivot bar arrangement may be used for a forward tilt cabin or a side  
30 tilt cabin.

The present invention encompasses a pivot bar arrangement in which the outer bar is connected directly to part of a vehicle and the inner bar is connected to another

part of the vehicle. Optionally a suspension arrangement may be connected directly to the outer bar or alternatively the suspension may be connected through appropriate frame supports to the inner bar so that the suspension pivots with  
5 the inner bar and whatever else it is connected to.

In addition it is possible for part of the suspension to be connected indirectly or directly to the inner bar and the rest of the suspension to be connected indirectly or directly to the outer bar.

10 In other embodiments the pivot bar arrangement may be replaced by equivalent assemblies including more than one pivot bar.

CLAIMS:

1. A suspension system for a vehicle having a tilting cab, the suspension system having a first support connectable to a shock absorber means and a second support  
5 connectable to the cab frame, wherein the first support is pivotable with respect to the second support.

2. The suspension system as claimed in claim 1 wherein the first support comprises an elongate member.

3. The suspension system as claimed in claim 1 or 2  
10 wherein the second support comprises an elongate member.

4. The suspension system as claimed in claim 3 wherein the second support is located at least partly within the first support.

5. The suspension system as claimed in claim 4  
15 wherein the second support extends through the centre of the first support.

6. The suspension system as claimed in claim 5 wherein the first and second supports have opposing ends which are connected together through a pivoting means.

7. The suspension system as claimed in claim 6  
20 wherein the pivoting means includes pivot pins which are locatable through centrally located holes in the ends of each of the first and second supports.

8. The suspension system as claimed in claim 7  
25 wherein the ends of the second support are connected to parts of the cab frame.

9. The suspension system as claimed in claim 8 wherein the shock absorber means comprises twin air bags which have their upper ends including mounting means through  
30 which the air bags are connected to the first support.

10. The suspension system as claimed in claim 9 wherein the mounting means comprises clasping brackets.

11. The suspension system as claimed in claim 10, wherein the shock absorber means includes two shock absorbers which are respectively associated with respective ones of the air bags.

5 12. The suspension system as claimed in claim 11, including a torque rod device which is adapted to control tilting of one support with respect to the other.

10 13. The suspension system as claimed in claim 12, wherein the torque rod device comprises a torque rod which is connected between the first support and a support bracket of the vehicle chassis.

15 14. The suspension system as claimed in claim 13 wherein the torque rod device includes a shark fin bracket which at its lower end is connected to the vehicle chassis and at its upper end is connected to one end of the torque rod.

20 15. The suspension system as claimed in claim 10 wherein the ends of the second support are provided with annular grooves or spaces which are adapted to receive forked portions or sleeved portions of a supporting structure of the cab frame.

25 16. The suspension system as claimed in claim 3 wherein each support comprises at least two bars aligned in parallel, with the second support located at least partly within the first support.

17. The suspension system as claimed in claim 15 or 16 wherein the shock absorber means includes a pneumatic valve system for controlling operation of shock absorbers and torque rod device.

30 18. The suspension as claimed in claim 15 wherein the torque rod device is located at a central region of the shock absorber means.

19. The suspension system as claimed in claim 18 wherein the torque rod is connected to the first support at a location approximately to one side of the mid point of the length of the first support.

5        20. A suspension system substantially as hereinbefore described with reference to the accompanying drawings.

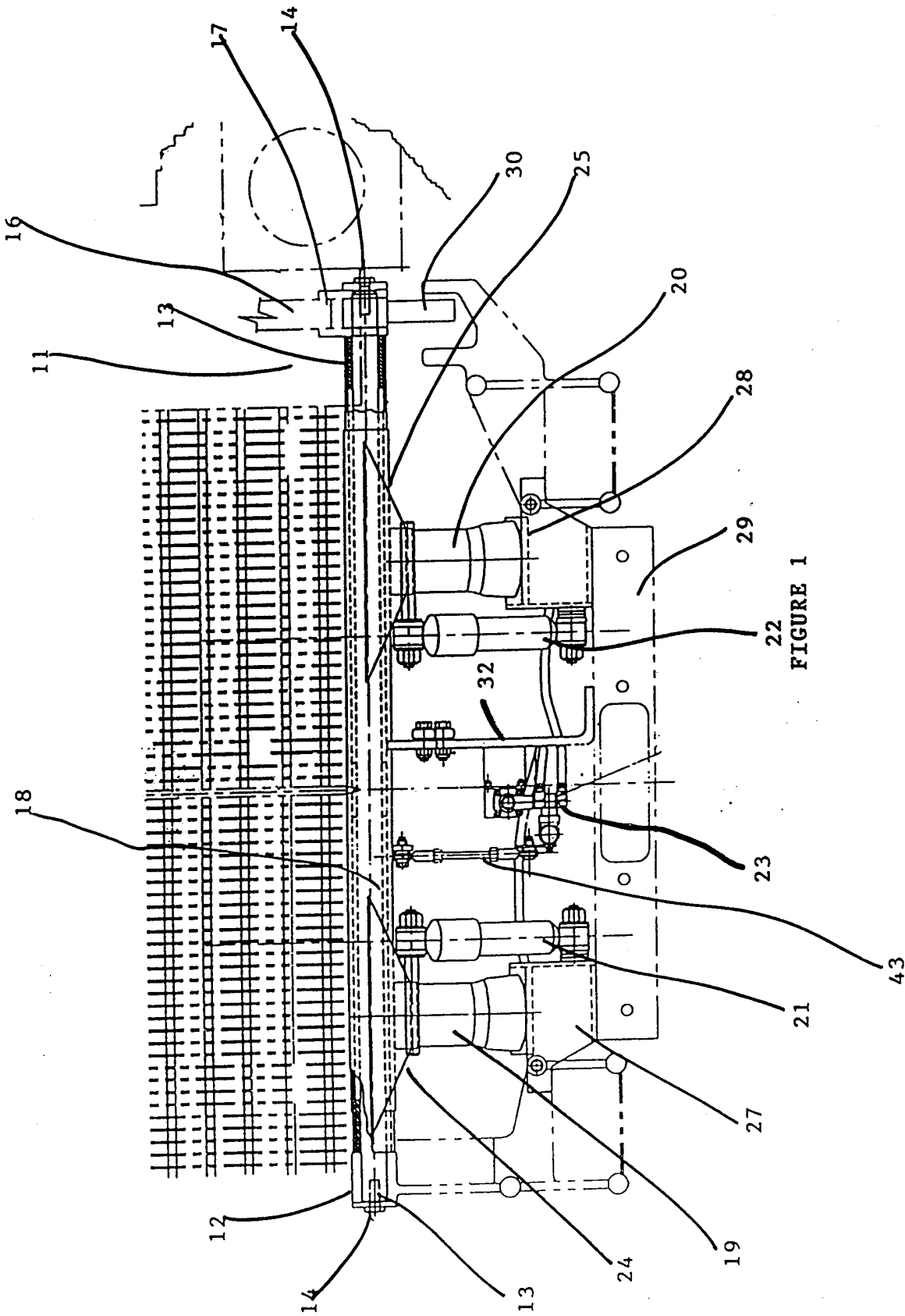


FIGURE 1

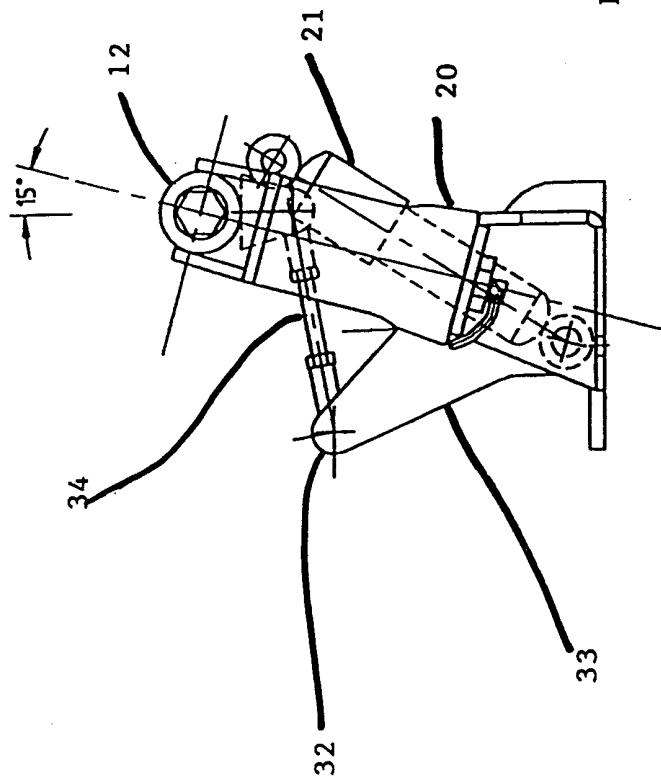


FIGURE 2

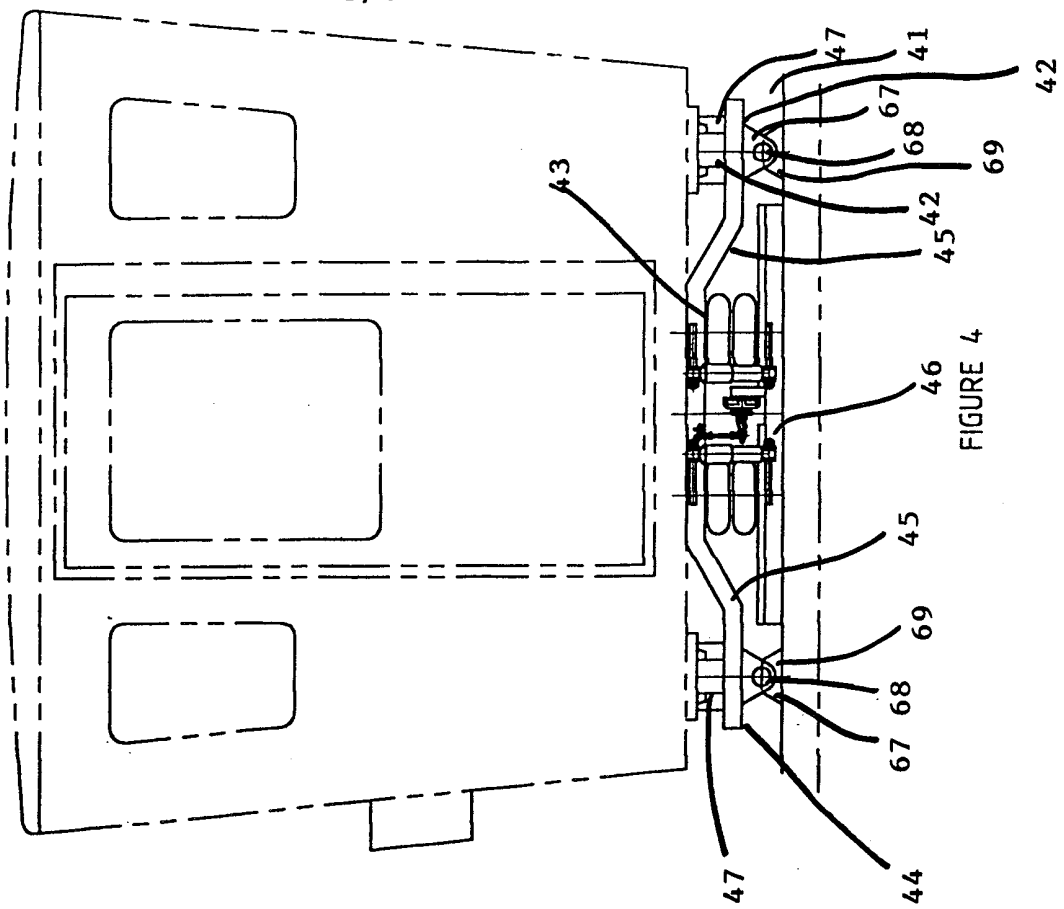


FIGURE 4

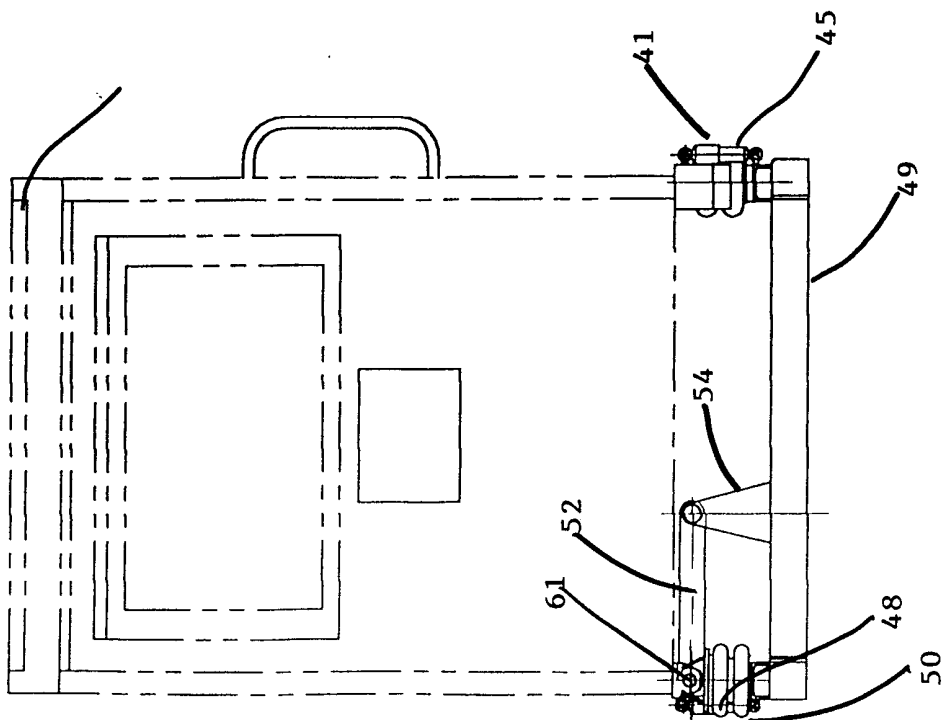


FIGURE 3

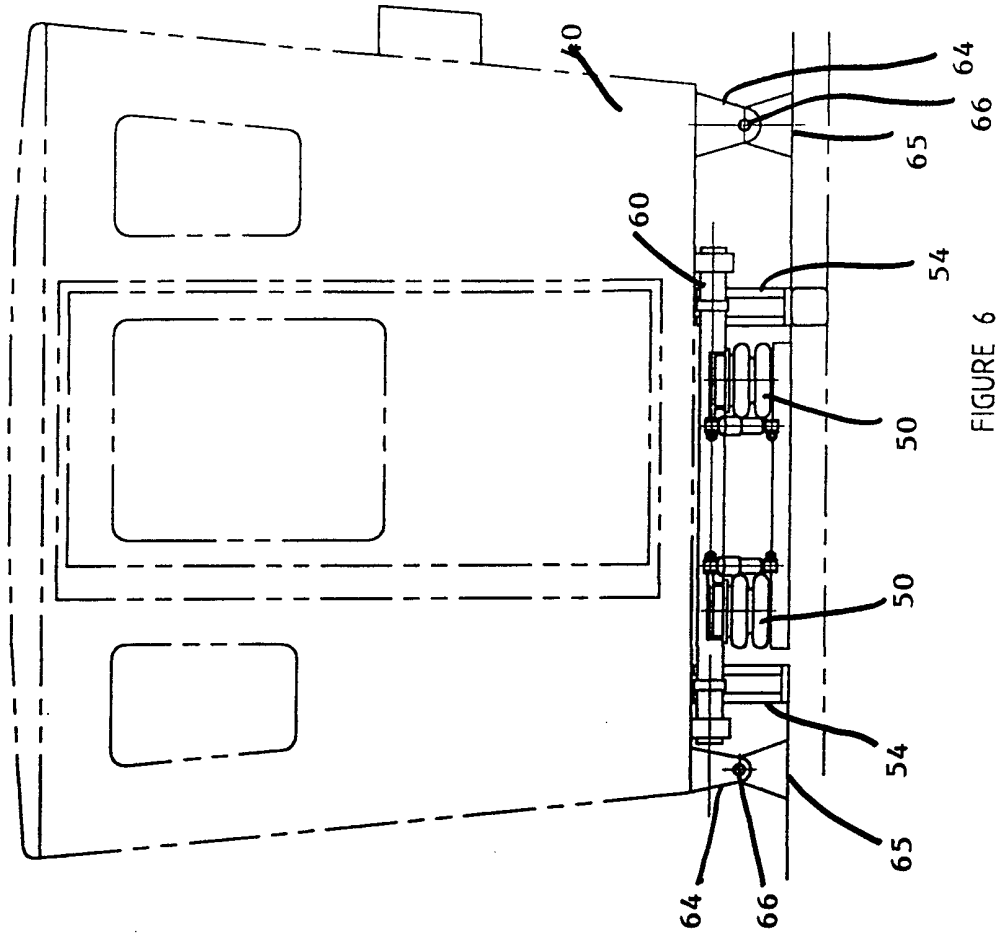


FIGURE 6

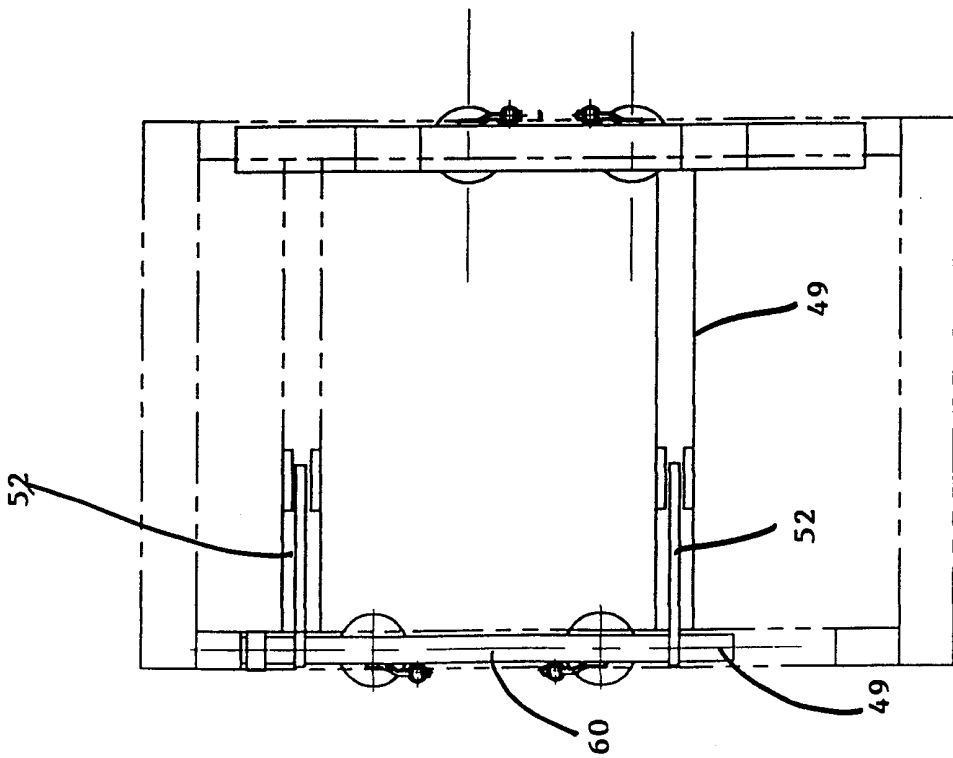


FIGURE 5

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/AU00/00244

A. CLASSIFICATION OF SUBJECT MATTER		
Int. Cl. <sup>7</sup> : B62D 33/067, 33/10		
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: B62D 33/067, 33/10		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched AU : IPC B62D 33/-		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) Derwent World Patent Index		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 3948341 A ( FOSTER) 6 April 1976 See figure 2 and column 2 line 42 - column 4 line 21	1-19
X	EP 798198 A (MAN NUTZFAHRZEUGE AKTIENGESELLSCHAFT) 1 October 1997 Column 2 line 54 - column 3 line 13	1-10, 12
A	EP 047628 A ( FORD MOTOR COMPANY LIMITED et al) 17 March 1982 Whole document	1-19
<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C <input checked="" type="checkbox"/> See patent family annex		
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Date of the actual completion of the international search 11 April 2000		Date of mailing of the international search report 14 APR 2000
Name and mailing address of the ISA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA E-mail address: pct@ipaaustralia.gov.au Facsimile No. (02) 6285 3929		Authorized officer  <b>D.R. LUM</b> Telephone No : (02) 6283 2544

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/AU00/00244

<b>C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT</b>		
<b>Category*</b>	<b>Citation of document, with indication, where appropriate, of the relevant passages</b>	<b>Relevant to claim No.</b>
A	WO 9219484 A (NILSSON et al) 12 November 1992 Whole document	1-19

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/AU00/00244

**Box I Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)**

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1.  Claims Nos :  
because they relate to subject matter not required to be searched by this Authority, namely:
  
2.  Claims Nos : **20**  
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:  
Claim 20 does not comply with PCT rule 6.2 (a) as it relies on references to the description and drawings.
  
3.  Claims Nos :  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a)

**Box II Observations where unity of invention is lacking (Continuation of item 3 of first sheet)**

This International Searching Authority found multiple inventions in this international application, as follows:

1.  As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims
2.  As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3.  As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
  
4.  No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

**Remark on Protest**

- The additional search fees were accompanied by the applicant's protest.
- No protest accompanied the payment of additional search fees.

**INTERNATIONAL SEARCH REPORT**  
 Information on patent family members

International application No.  
**PCT/AU00/00244**

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Member					
US	3948341	DE	2548749	GB	1483967	GB	1485350
		US	3944017				
EP	798198	DE	19612502				
EP	47628	DE	3169262	GB	2082985		
WO	9219484	DE	69211848	EP	583323	JP	6506890
		SE	9101327	US	5398774		
END OF ANNEX							