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A request for addition of claims 8 to 12 and part of 13 has been filed pursuant to Rule 88 EPC. A decision on the request will be taken during the proceedings before the Examining Division (Guidelines for Examination in the EPO, A-V, 3.).

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(54) Loader vehicle.

(57) A loader vehicle comprising a body having a front end and a rear end and provided with ground engageable propulsion means, an operator's compartment and a boom assembly, comprising a lift arm assembly and a pivot member which projects transversely from the inner end of the lift arm assembly on one side thereof and extends transversely across the body from said one side of the lift arm assembly and which is pivotally mounted on the body, adjacent the rear end thereof, for movement of the lift arm assembly between a raised position and a lowered position in which the lift arm assembly extends forwardly alongside the operator's compartment and means for carrying a material handling implement at an outer end of the boom assembly so as to be disposed forward of the front end of the body, characterised in that the pivot member is pivotally mounted, for movement about a first axis, on a torsion member, which extends transversely across the body, by first pivotal mounting means disposed at positions which are spaced apart transversely of the torsion member and the torsion member is pivotally mounted on the body, for movement about a second axis which is parallel to the first axis and which extends transversely of the body, by second pivotal mounting means disposed at positions which are spaced apart transversely of the body.

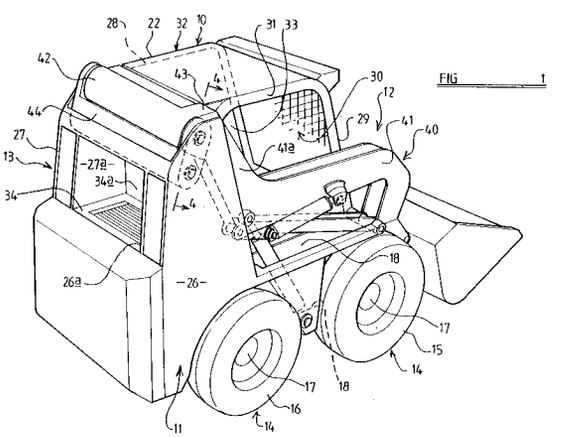

FIG 1

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This invention relates to a loader vehicle, hereinafter referred to as "of the kind specified" comprising a body having a front end and a rear end and provided with ground engageable propulsion means, an operator's compartment and a boom assembly, comprising a lift arm assembly and a pivot member which projects transversely from the inner end of the lift arm assembly on one side thereof and extends transversely across the body from said one side of the lift arm assembly and which is pivotally mounted on the body, adjacent the rear end thereof, for movement of the lift arm assembly between a raised position and a lowered position in which the lift arm assembly extends forwardly alongside the operator's compartment and means for carrying a material handling implement at an outer end of the boom assembly so as to be disposed forward of the front end of the body.

Hitherto, in such a vehicle, the material handling implement has moved in an arcuate path as the lift arm assembly has been raised or lowered. This results in drawbacks such as when the implement is in a fully or nearly fully raised position it is vertically above or close to the front of the vehicle so that dumping of material from the implement into, for example, a truck, is difficult. Another drawback is a limitation on the shape of a vertical or substantially vertical excavation made by the vehicle. A further disadvantage is the change in the position of the centre of gravity of the vehicle as the loader arm assembly is raised and lowered which causes large variations in lifting ability to occur as well as rendering the vehicle susceptible to instability.

An object of the invention is to provide a new and improved loader vehicle of the kind specified wherein the above mentioned problems are overcome or are reduced.

According to the invention we provide a loader vehicle wherein the pivot member is pivotally mounted, for movement about a first axis, on a torsion member, which extends transversely across the body, by first pivotal mounting means disposed at positions which are spaced apart transversely of the torsion member and the torsion member is pivotally mounted on the body, for movement about a second axis which is parallel to the first axis and which extends transversely of the body, by second pivotal mounting means disposed at positions which are spaced apart transversely of the body.

The vehicle may have a single operator's compartment which may be provided at a fixed location on the body.

The operator's compartment may comprise an enclosure.

The boom assembly may comprise a unitary generally L-shaped member comprising the lift arm assembly and the pivot member which projects from the inner end of the lift arm assembly on one side thereof and extends transversely across the body on said one side of the lift arm assembly to a position adjacent the opposite side of the body.

The pivot member may be a substantial member which is rigid with the lift arm assembly.

The torsion member may be pivotally mounted on the body by pivotal mounting means disposed at fixed positions which are spaced apart transversely of the body and are adjacent an upper rear end part of the body and are on opposite sides of the body.

The distance between the first and second axes of pivot may be substantially shorter than the length of the lift arm assembly.

A lifting means may be connected between the lift arm assembly and the body.

The lifting means may be connected at one end to the body at a position between the forward end and the rearward end of the ground engageable propulsion means and at its other end to the lift arm assembly at a position intermediate the forward end thereof and the pivot member so as to extend upwardly and rearwardly from the body to the lift arm assembly at least when the lift arm assembly is in a lowered position.

The lifting means may be a hydraulic ram.

A guide link may be connected between the body and the lift arm assembly to constrain the forward end of the lift arm assembly to move in a predetermined path that may be substantially vertical as the forward end is moved between a lowered and a raised position.

The control link may have one end pivotally connected to the body adjacent the forward end of the body and a second end disposed rearwardly of the first end and pivotally connected to the lift arm assembly at a position between the forward end and the pivot member.

The guide link may be pivotally connected to the body at a position which is below the position which the torsion member is pivotally mounted on the body.

The guide link may be pivotally mounted on the body at a position above the position of connection of the lifting means to the body.

The control link may extend from the position of pivotal connection of its first end to the body rearwardly and upwardly in all positions of the lift arm assembly.

When the lift arm assembly is in a lowered position the guide link may be disposed wholly below the position of pivotal connection of the torsion member to the body.

The pivotal connection of the lifting means to the body may be disposed at a position which is between the forward and rearward ends of the guide link when the lift arm assembly is in a lowered position and is preferably adjacent a position which is below the mid-point of the guide link.

The guide link may be longer than the distance between the axes of pivot of the torsion member to the body and the lift arm assembly to the torsion member.

The guide link may constrain the torsion member initially to pivot rearwardly as the forward end of the lift arm assembly is raised from a lowered position so that an included angle between a line joining the first and second axes of pivot and a line joining the first axis of pivot and the pivotal connection of the implement to the lift arm assembly decreases as the lift arm assembly is raised over a first portion of its range of movement and the second link then pivots forwardly so that said included angle increases as the lift arm assembly moves over a second portion of said range of movement.

The guide link may be connected to the lift arm assembly at a position which is disposed below a line joining the first axis of pivot member and the pivotal connection of the implement to the lift arm assembly.

The lift arm assembly may comprise a first part which extends generally downwardly from the first axis of pivot, a second part which extends forwardly generally horizontally from the lower end of the first part, and a third part which extends downwardly from the forward end of the second part.

The guide link may be connected to the lift arm assembly in the region where the first and second parts of the lift arm assembly meet.

The lifting means may also be connected to the lift arm assembly in said region.

The position of connection of the guide link to the lift arm assembly may be disposed below a line joining the position of pivotal connection of the forward end of the guide link to the body and the first pivotal axis when the lift arm assembly is in a lowered position and may move to a position above said line as the lift arm assembly is moved to its uppermost position.

The guide link may be substantially horizontal when the lift arm assembly is in its lowermost position.

The boom assembly may comprise an implement levelling ram means hydraulically connected to an implement crowd ram means to maintain the material handling implement in a fixed orientation relative to the body irrespective of raising and lowering of the lift arm assembly.

The implement levelling ramp means may have a first end connected to the lift arm assembly and extend rearwardly therefrom to have a second end connected to the guide link at a position adjacent to and spaced from the pivotal connection of the guide link to the lift arm assembly.

When the lift arm assembly is in its lowermost position the implement levelling ramp means may extend substantially horizontally.

The position of pivotal connection of the second end may be disposed slightly below the position of pivotal connection of the first end when the lift arm assembly is in its lowermost position and the position of pivotal connection of the second end may be disposed below and forwardly of the position of pivotal connection of the second end of the guide link to the lift arm assembly.

The guide link may comprise a pair of spaced parallel guide link elements and the lifting means may be disposed so as to extend between the elements.

The implement levelling ram means may be disposed on the outer side of the lifting means and may be pivotally connected to an outer one of said pair of link elements.

An access opening to the operator's compartment can conveniently be provided on the other side of the operator's compartment to that alongside which the lift arm assembly extends.

The body may comprise a pair of transversely spaced side members on which the ground engageable propulsion means are mounted, said mounting means are supported by a pair of transversely spaced upright members disposed adjacent the rear of the body and which extend upwardly from said side members at the rear of, and on opposite sides of the operator's compartment, the mounting means being disposed at a top rear part of the operator's compartment and there being an opening in the compartment below the pivot member whereby an operator can see horizontally rearwardly beneath the pivot member.

If desired the pivotal mounting means may comprise a pair of discrete mounting means or may comprise a single transversely extending elongate mounting means.

The lift arm assembly may comprise a single member or a plurality of members which extend(s) forwards along said one side only of the operator's compartment.

The lift arm assembly may have an implement carrying member which projects from the outer end of the lift arm assembly and extends transversely in front of the body and has said material handling implement carried thereon.

The body may be provided with an abutment means adapted to engage the implement carrying member to support the implement carrying member against displacement in a direction rearwardly of the vehicle when the boom assembly is in a

lower position.

The abutment means may comprise an abutment surface provided at the front end of the side member disposed on the opposite side of the vehicle to the side on which the lifting arm assembly is disposed.

The lift arm assembly, including the pivot member and the implement carrying member may comprise a unitary component.

The body may comprise a pair of transversely spaced side members on which said ground engageable propulsion means are mounted.

The ground engageable propulsion means may comprise wheels or tracks.

The ground engageable propulsion means may comprise a front wheel assembly disposed forwardly of a rear wheel assembly, at least one of said wheel assemblies may comprises a pair of wheels spaced apart transversely of the vehicle and at least one of said wheel assemblies being turnable about a steering axis to permit the vehicle to be steered.

Alternatively, the ground engageable transporter means may comprise a pair of wheel assemblies disposed on opposite sides of the vehicle and each pair comprising a front wheel disposed forwardly of a rear wheel and means to permit the vehicle to be propelled and steered by driving the wheels on one side of the vehicle at the same or a different speed and/or in a different direction of rotation from those on the other side of the vehicle.

Alternatively, the ground engageable transporter means may comprise a pair of endless tracks disposed one on one side and one on the other side of the vehicle and means to permit the vehicle to be propelled and steered by driving the track on one side of the vehicle at the same or a different speed and/or a different direction from the track on the other side of the vehicle.

A portion of the operator's compartment may be disposed between said side members.

The body may have a transmission compartment at least a portion of which is disposed between said side members and below the operator's cab and said transmission compartment housing a transmission to transmit drive from an engine of the vehicle to the ground engageable propulsion means.

The body may be provided with an engine compartment rearwardly of the operator's compartment and transmission compartment and said engine compartment housing the engine of the vehicle.

The mounting means may be supported by a pair of transversely spaced upright members disposed adjacent the rear of the body and which extend upwardly from said side members at the rear of the operator's compartment.

A part of said upright members may provide a part of the side walls of the operator's cab.

A part of the side members and of the upright members may be formed integrally with each other and the top wall of the operator's compartment may also be integrated therewith.

The side members may comprise loop case compartments comprising a transversely inner wall and a tranversely outer wall joined by top and bottom walls and end walls and a member providing one of said walls, preferably the outer wall, may be provided integrally with the member which provides at least part of one plate, and preferably an inner plate, of each upstanding member.

The mounting means torsion member may be disposed on or adjacent a top rear part of the operator's compartment at a level whereby an operator can see horizontally rearwardly beneath the torsion member.

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

FIGURE 1 is a perspective view of a skid steer loader vehicle embodying the invention,

FIGURE 1a is a fragmentary perspective view of a torsion member of the vehicle of Figure 1,

FIGURE 2 is a side elevation of the vehicle of Figure 1 showing the boom assembly in a different position,

FIGURE 3 is a section on the line 3-3 of Figure 2,

FIGURE 4 is a section on the line 4-4 of Figure 2, and

FIGURE 5 is a side elevation of the vehicle of Figure 1 to an enlarged scale showing the boom assembly in a lowered position.

Referring now to the drawings, a skid steer loader vehicle 10 comprises a body 11 having a front end 12 and a rear end 13. The body 11 is provided with ground engageable propulsion means 14 comprising a pair of front wheels 15 disposed forwardly of a pair of rear wheels 16. The vehicle 10 is propelled in a straight line forwardly or rearwardly by driving all four wheels or, to steer the vehicle, by driving the wheels 15 and 16 on one side at a different speed and/or direction than those on the other side. Such skid steer loaders have a high degree of manoeuvrability and to facilitate skid steering and in particular, for example, the ability of the vehicle to turn about a central axis of the ground engageable propulsion means the wheel base is made, in the present example, slightly shorter than the track of the vehicle although, if desired, the wheel base may be the same or longer than the track if desired.

The wheels 15,16 are carried on stub axles 17 which project outwardly from a pair of transversely spaced side members 18 of the body 10 and which

extend fore and aft of the vehicle. Between the side members 18 is a transmission compartment which houses a transmission, whilst above and forwardly of the transmission compartment is an operator's compartment 22 in which is provided an operator's seat, manually operable propulsion controls for controlling the speed, selecting forward and reverse movement, and steering the vehicle and manually operable loader controls for controlling a loader arm and material handling implement as hereinafter to be described.

The operator's compartment 22 is also defined by a pair of upstanding members 26, 27 which extend upwardly from the side members, 18, 19 on opposite sides of the vehicle and by a roof 28 which extends forwardly and adjacent its forward end is supported by posts 29. If desired the operator's component may be structurally separate from the members 26, 27.

A wire mesh screen 30 is provided on one side 31, of the operator's compartment 22 for protection of an operator, whilst the other side, 32 of the operator's compartment is unobstructed and provides an access opening 33 whereby an operator can enter and leave the operator's compartment 22.

Behind the transmission compartment 20 and operator's compartment 22 is provided an engine compartment 34 in which an engine of any suitable type is housed. In the present example the engine is an air-cooled diesel engine but any other suitable engine may be provided.

The vehicle is provided with a loader arm boom assembly 40 which is disposed adjacent the one side 31 of the operator's compartment 22. The boom assembly 40 comprises a lift arm assembly 41 which has a pivot member 42 projecting from an inner end 43 of the lift arm assembly 41 and extends transversely of the body and is pivotally mounted on the body by means of a torsion member 44.

The torsion member 44 comprises a torsionally rigid beam 45 of welded box-section configuration provided with end plates 46.

The beam 45 has an inclined surface portion 45a in the way of the lift arm assembly 41 so as to permit the lift arm assembly 41 to pivot to its lowermost position.

As shown in Figure 4, the upstanding members 26, 27 have a boss 47 welded on opposite sides thereof and a pivot pin 48 is received within the bosses 47 and prevented from rotation relative thereto by a locking bolt 49 which passes through the pin 48 and is threadedly received adjacent its free end in a threaded opening in the boss 49. The pin 48 projects inwardly of the respective plates 26, 27 and is received within a pair of bosses 50 welded to the respective side plate 46 of the torsion member 45, the bosses 50 and the side plate 46 being provide with an appropriate aperture so as to pivotally receive the pivot pin 48 therein.

The respective side plates 46 are provided with a further pair of bosses 51 in which a further pivot pin 52 is non-rotatably received, again being locked with a locking bolt 53. The pin 52 projects through an aperture in an end plate 52 of the pivot member 42 and into an aperture provided in a boss 53 welded to the inner side thereof so as to be pivotally received therein.

Consequently the lift arm assembly 41 is pivotally mounted for movement about a first axis A-A relative to the torsion member 45 whilst the torsion member 45 is pivotally mounted about an axis B-B relative to the body. The axes A-A and B-B are parallel and extend transversely of the body perpendicular to a fore and aft axis of the body.

As can be seen from Figure 1, the axis B-B is disposed at the upper ends of the uprights 26 and are therefore disposed adjacent the upper end of the operator's compartment 22.

The loader arm assembly 41 has three parts which, when the loader arm assembly 41 is in its lowermost position, shown in Figure 2, has a first part 41a which extends substantially downwardly from the first pivot axis A-A, although with a minor forward component, a second part 41b which extends forwardly, although with a small downward component, from the lower end of the part 41a, and a third part 41c which extends substantially downwardly, although with a small forward component, from the forward end of the part 41b. The third part 41a is provided with pivot means 54 to mount a material handling implement, which in this case is an excavator bucket 55 but which may be any other material handling equipment such as forks, on the front end of the lift arm assembly. Crowd ram means 56 are provided to cause crowd movement of the implement 55 about a horizontal axis 56.

It will be noted that the distance between the axes A-A and B-B is substantially smaller than the overall length of the lift arm assembly 41a.

A lifting means comprising a hydraulic lifting ram 60 is pivotally connected at one end to the body 10 at a position 61 which is disposed between the wheels 15, 16 and adjacent a plane containing their axes of pivot. The ram 60 extends upwardly and rearwardly from the first end connected to the body at 61 and is connected at a second end to the lift arm assembly 41 adjacent the junction of the first and second parts 41a and 41b, as shown at 62. As shown in Figure 2, the lifting means 60 extends upwardly and rearwardly from the pivotal connection 61 in all positions on the lift arm assembly.

A guide link 70 is pivotally connected at its forward end to the body 10, as shown at 71, at a position which is adjacent the forward end of the body and closely spaced above the top of the ground engageable propulsion means 14. The guide link 70 extends rearwardly from the position 71 and is connected at its rearward or second end to the lift arm assembly 41, as shown at 72, again at the junction between the first and second parts 41a and 41b.

An implement levelling ram means 80 is pivotally connected at its forward end to the link arm assembly 41, as shown at 81, and extends rearwardly, substantially horizontally but slightly inclined downwardly so as to be connected to the guide link 70 at a position shown at 82. The implement levelling ram means 80 is hydraulically connected to the crowd ram means 56 so as to maintain the implement 55 in a constant orientation relative to the ground as the lift arm assembly is raised and lowered.

Referring now to Figure 4, the lift arm assembly 41 in the region of the junction between parts 41a and 41b comprises spaced parallel side plates 90 to which bosses 91 are welded and which receive a pivot pin 93. The pivot pin 93 is prevented from rotation relative to the bosses 91 by a locking screw 94 which passes through a transverse passage in the pin 93 and which at its free end is received in a threaded opening in the respective boss 91. The pivot pin 93 is received in a passage 95 provided in a mounting block 96 fixed to the ram 97 of the lifting ram 60 so as to provide the hereinbefore mentioned pivotal connection 62 between the ram 60 and the lift arm assembly 41.

Also welded to the side plates 90 are further bosses 100, 101. Each pair of bosses 100, 101 receive therein a pivot pin 102, 103 respectively, the pivot pins being retained from rotation relative to the bosses 100, 101 by locking screws 104, 105 similar to the locking screw 94. The pivot pins 102, 103 are pivotally received in apertures 106, 107 respectively in guide link elements 108, 109 which extend parallel to each other and which together comprise the guide link 70 described hereinbefore. As shown in Figure 4, the ram 60 extends between the link elements 108, 109.

The outer link element 109 is provided with a boss 110 which has a pivot pin 111 locked therein by a locking screw 112 similar to the locking screw 94. The pivot pin 111 pivotally mounts a mounting block 113 provided on the ram 114 of the levelling ram 80 and thus provides pivotal connection 82 thereof to the guide link 70, the mounting block 113 being retained on the pin 111 by a circlip 115. At its other end the levelling ram 80 is pivotally connected to the lift arm assembly 41 by a pivot pin extending between bosses provided on the outer side plate of the lift arm assembly 41 and a bracket 116 welded thereto, in a similar manner to the bosses described hereinbefore.

In use, when the ram 60 is pressurised in conventional manner from the usual hydraulic supply of the vehicle, the lift arm assembly 41 is raised at its outer end and, as shown in Figure 2, the path of travel is substantially vertical throughout the range of movement.

It will be noted that the guide link 7 extends generally horizontally from its pivotal connection 71 when the boom is in the lowered position shown in Figure 2.

During an initial position of the range of movement, i.e. from the lowermost position shown in Figure 2 to the intermediate position shown in Figure 2, the pivotal connection 72 will move upwardly and rearwardly which will cause the torsion member 45 to pivot rearwardly, i.e. in an anticlockwise direction in Figure 2, so that an included angle X in a line joining the first and second axes of pivot and a line joining the first axis of pivot A-A and the pivotal connection 54 of the implement to the assembly 41 decreases. As a result of the rearward movement of the torsion member 45 the path of movement of the pivotal connection 54 is displaced rearwardly from the position it would otherwise follow, which is shown at P in Figure 2.

As the loader arm assembly moves further upwardly into a second part of the range, so that the position of pivotal connection 72 of the guide link 70 to the lift arm assembly 41 passes through a line joining the first pivot axis A-A and the axis of pivotal connection 71 of the guide link to the body the torsion member 45 is caused to pivot forwardly, i.e. in a clockwise direction in Figure 2, and the above mentioned included angle X increases. Of course, the lowering movement of the lift arm assembly is the reverse of that described hereinbefore. By appropriate selection of the parameters of the hereinbefore described components and their relative positioning, the connecting means 54 can be caused to move in the above described substantially vertical path, shown at I in Figure 2, although variations from this path can be achieved as desired by appropriate selection of the above mentioned parameters.

In addition, as the lift arm assembly is raised and lowered as described hereinbefore, the piston rod of the levelling ram 80 is moved relative to its cylinder to displace hydraulic fluid between it and the crowd ram 56 so as to cause the crowd ram to operate to maintain the implement 55 in a fixed orientation relative to the ground during the range of movement of the lift arm assembly.

From the foregoing it will be seen that boom assembly 40 extends forwardly from a position adjacent the rear end of the body 11 alongside the

one side 31 of the operator's compartment 22 whilst the other side 32 is unobstructed so that an operator can gain accesss to the compartment through the access opening 33.

By providing the axis of pivot of the lift arm assembly 41 adjacent the top rear corner of the operator's compartment the operator is provided with the ability to lift the bucket to a relatively great height and at the same time provide the bucket with good reach and the vehicle with a stability. For example, the axis of pivot of the lift arm assembly is approximately 1.5m above the ground in the example illustrated, whilst the distance between the axis of pivot of the lift arm assembly and the axis of pivot of the bucket about the axle 75 is approximately 2.5m. Hence the vehicle has a total lift of approximately 3m and over the whole of this range of lift the pivotal connection 75 to the bucket lies forwardly of the front end 12 of the vehicle.

The operator's compartment 22 is defined in part by inner plates 26a, 27a of the upstanding members 26, 27, the roof 28 and the posts 29 which together provide the enclosure with one side, 31 and a top and rear wall which include means for preventing access therethrough. In the case of the one side 31 this is by virtue of the presence of the boom assembly and also the wire mesh protective screen 30. At the rear, the operator's compartment is defined in part by the front wall 34a of the engine compartment 34. The space between the front wall 34a and the underside of the torsion member 44 whilst preventing access to the operator's compartment does permit the operator to look out of the compartment to the rear beneath the torsion member 44.

The inner plates 26a, 27a which in substance define part of the operator's compartment are themselves integral continuations of the outer walls of the hereinbefore described side members 18, 19.

Thus it will be seen that the main structural parts of the operator's compartment which provide the wall thereof are formed integrally with other structural elements of the vehicle and in particular the side members 18, 19 and the upstanding members 26, 27 which carry the boom assembly pivots and thus the operator's compartment is integrated with the remainder of the machine and hence has a high ability to withstand forces exerted thereon during roll-over conditions.

The features disclosed in the foregoing description, or the accompanying drawings, expressed in their specific forms or in terms of a means for performing the disclosed function, or a method or process for attaining the disclosed result, or a class or group of substances or compositions, as appropriate, may, separately or in any combination of such features, be utilised for realising the invention in diverse forms thereof.

Claims

1. A loader vehicle comprising a body having a front end and a rear end and provided with ground engageable propulsion means, an operator's compartment and a boom assembly, comprising a lift arm assembly and a pivot member which projects transversely from the inner end of the lift arm assembly on one side thereof and extends transversely across the body from said one side of the lift arm assembly and which is pivotally mounted on the body, adjacent the rear end thereof, for movement of the lift arm assembly between a raised position and a lowered position in which the lift arm assembly extends forwardly alongside the operator's compartment and means for carrying a material handling implement at an outer end of the boom assembly so as to be disposed forward of the front end of the body, characterised in that the pivot member is pivotally mounted, for movement about a first axis, on a torsion member, which extends transversely across the body, by first pivotal mounting means disposed at positions which are spaced apart transversely of the torsion member and the torsion member is pivotally mounted on the body, for movement about a second axis which is parallel to the first axis and which extends transversely of the body, by second pivotal mounting means disposed at positions which are spaced apart transversely of the body.

2. A vehicle according to claim 1 wherein the boom assembly comprises a unitary generally L-shaped member comprising the lift arm assembly and the pivot member which projects from the inner end of the lift arm assembly on one side thereof and extends transversely across the body on said one side of the lift arm assembly to a position adjacent the opposite side of the body.

3. A vehicle according to claim 1 or claim 2 wherein the torsion member is pivotally mounted on the body by pivotal mounting means disposed at fixed positions which are spaced apart transversely of the body and are adjacent an upper rear end part of the body and are on opposite sides of the body.

4. A vehicle according to any one of the preceding claims wherein the distance between the first and second axes of pivot is substantially shorter than the length of the lift arm assembly.

5. A vehicle according to any one of the preceding claims wherein a lifting means is connected at one end to the body at a position between the forward end and the rearward end of the ground engageable propulsion means and at its other end to the lift arm assembly at a position intermediate the forward end thereof and the pivot member so as to

extend upwardly and rearwardly from the body to the lift arm assembly at least when the lift arm assembly is in a lowered position.

6. A vehicle according to any one of the preceding claims wherein a lifting means is connected between the lift arm assembly and the body and a guide link is connected between the body and the lift arm assembly to constrain the forward end of the lift arm assembly to move in a predetermined path that may be substantially vertical as the forward end is moved between a lowered and a raised position.

7. A vehicle according to claim 6 wherein the guide link has one end pivotally connected to the body adjacent the forward end of the body and a second end disposed rearwardly of the first end and pivotally connected to the lift arm assembly at a position between the forward end and the pivot member. that said included angle increases as the lift arm assembly moves over a second portion of said range of movement.

14. A vehicle according to any one of claims 6 to 13 wherein the lift arm assembly comprises a first part which extends generally downwardly from the first axis of pivot, a second part which extends forwardly generally horizontally from the lower end of the first part, and a third part which extends downwardly from the forward end of the second part and the guide link is connected to the lift arm assembly in the region where the first and second parts of the lift arm assembly meet.

15. A vehicle according to claim 14 wherein the lifting means is connected to the lift arm assembly in said region.

16. A vehicle according to any one of claims 6 to 15 wherein the position of connection of the guide link to the lift arm assembly is disposed below a line joining the position of pivotal connection of the forward end of the guide link to the body and the first pivotal axis when the lift arm assembly is in a lowered position and moves to a position above said line as the lift arm assembly is moved to its uppermost position.

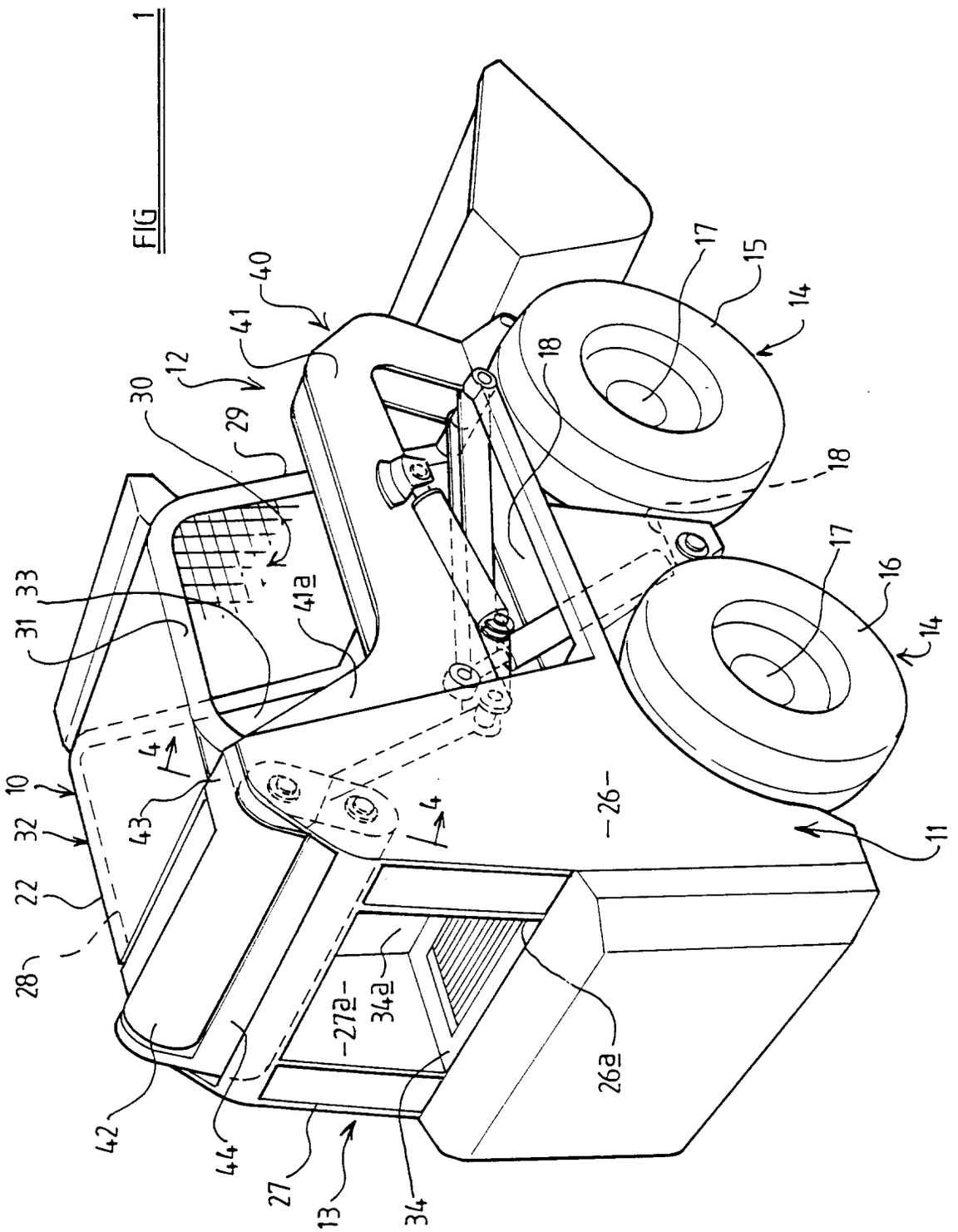
17. A vehicle according to any one of claims 11 to 16 wherein the boom assembly comprises an implement levelling ram means hydraulically connected to an implement crowd ram means to maintain the material handling implement in a fixed orientation relative to the body irrespective of raising and lowering of the lift arm assembly and wherein the implement levelling ram means has a first end connected to the lift arm assembly and extends rearwardly therefrom to have a second end connected to the guide link at a position adjacent to and spaced from the pivotal connection of the guide link to the lift arm assembly.

18. A vehicle according to claim 6, or any one of claims 7 to 17 when directly or indirectly dependent on claim 6 wherein the guide link comprises a pair of spaced parallel guide link elements and the lifting means is disposed so as to extend between the elements.

19. A vehicle according to claim 18 when dependent on claim 17 or claim 18 wherein the implement levelling ram means is disposed on the outer side of the lifting means and is pivotally connected to an outer one of said pair of link elements.

20. A vehicle according to any one of the preceding claims wherein an access opening to the operator's compartment is provided on the other side of the operator's compartment to that alongside which the lift arm assembly extends and the mounting means and torsion member are disposed on or adjacent a top rear part of the operator's compartment at a level whereby an operator can see horizontally rearwardly beneath the torsion member.

FIG 1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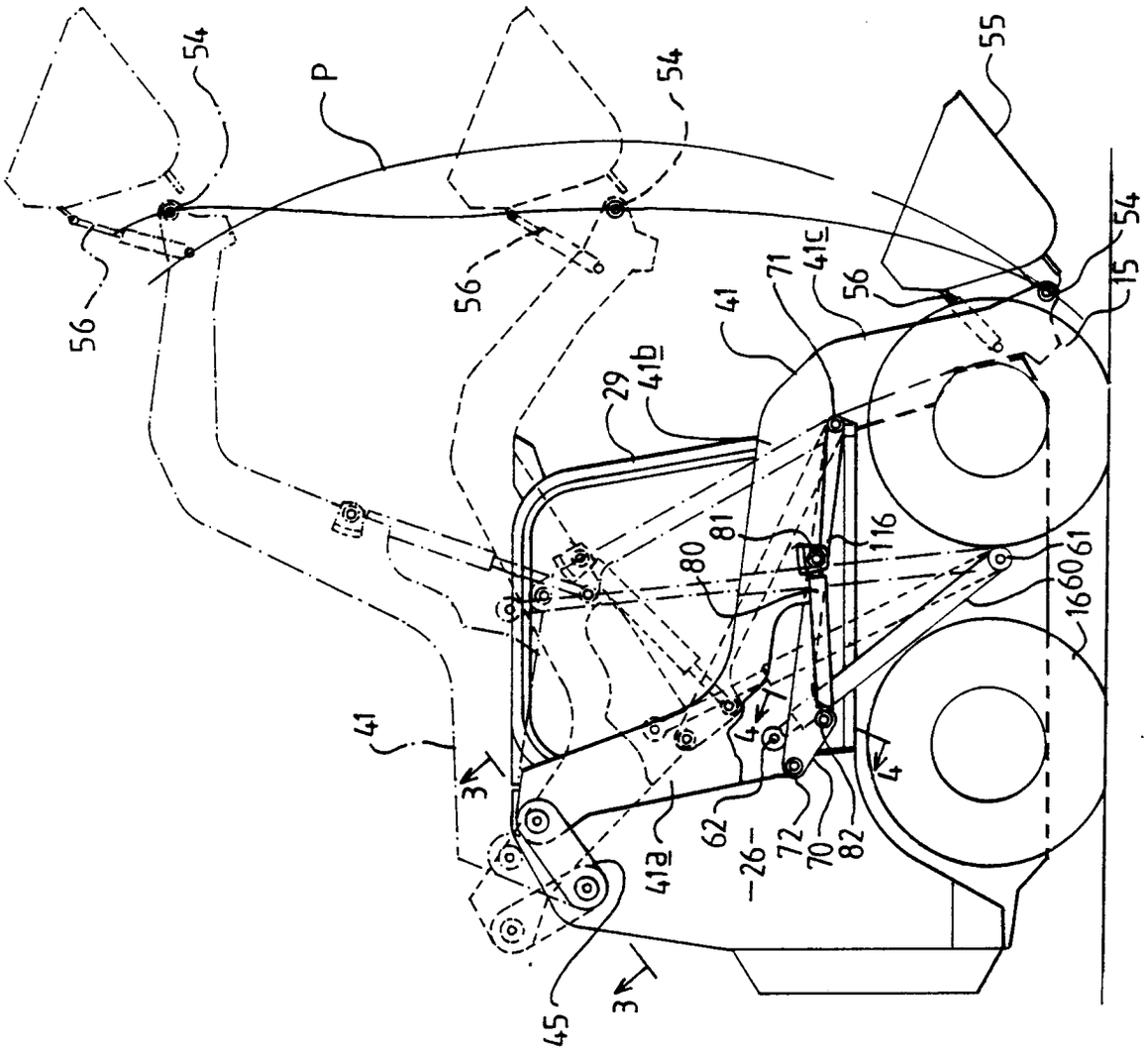
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41c
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41a
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FIG 2

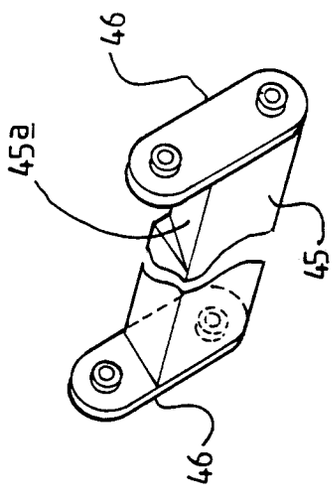
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FIG 1a

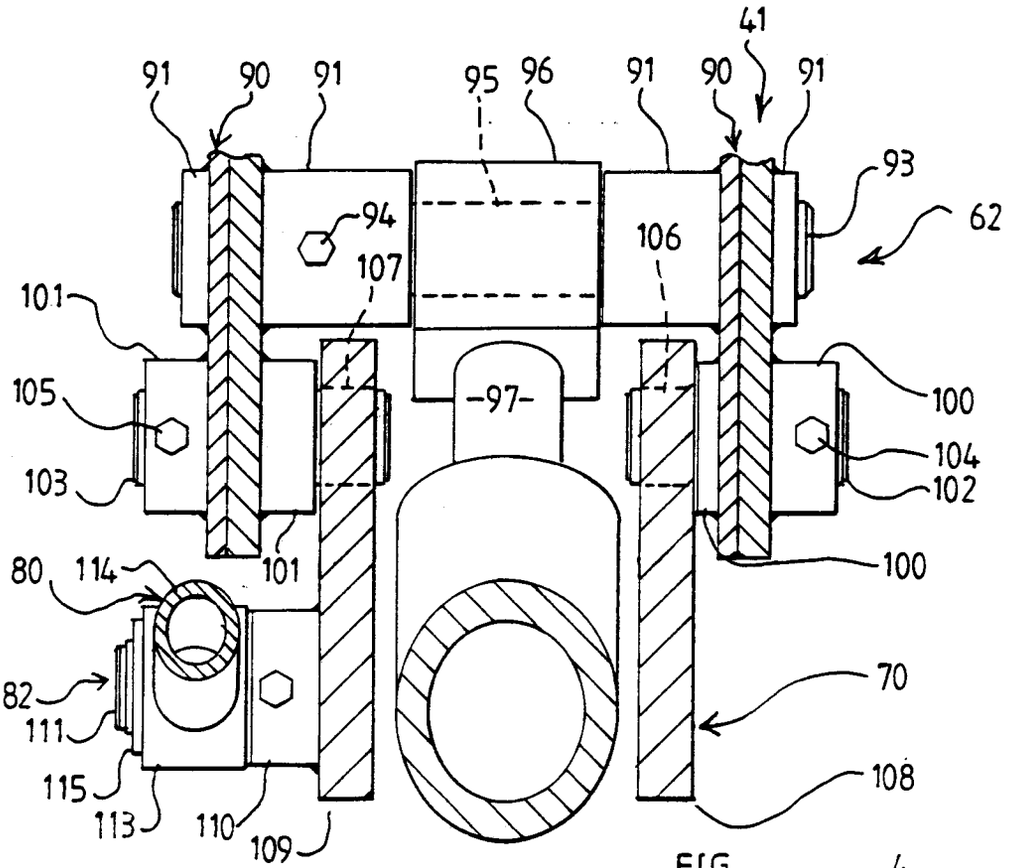
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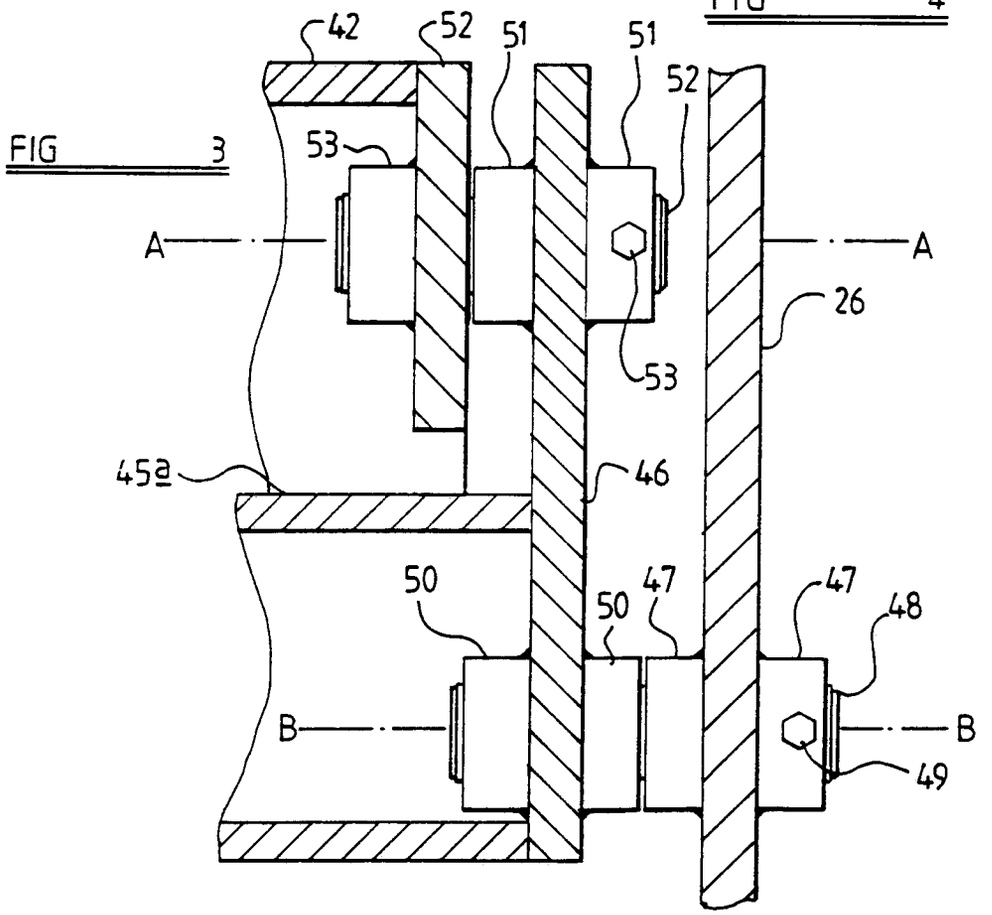
FIG 4

FIG 3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B
B
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FIG 5