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Tilt unit for a vehicle cab

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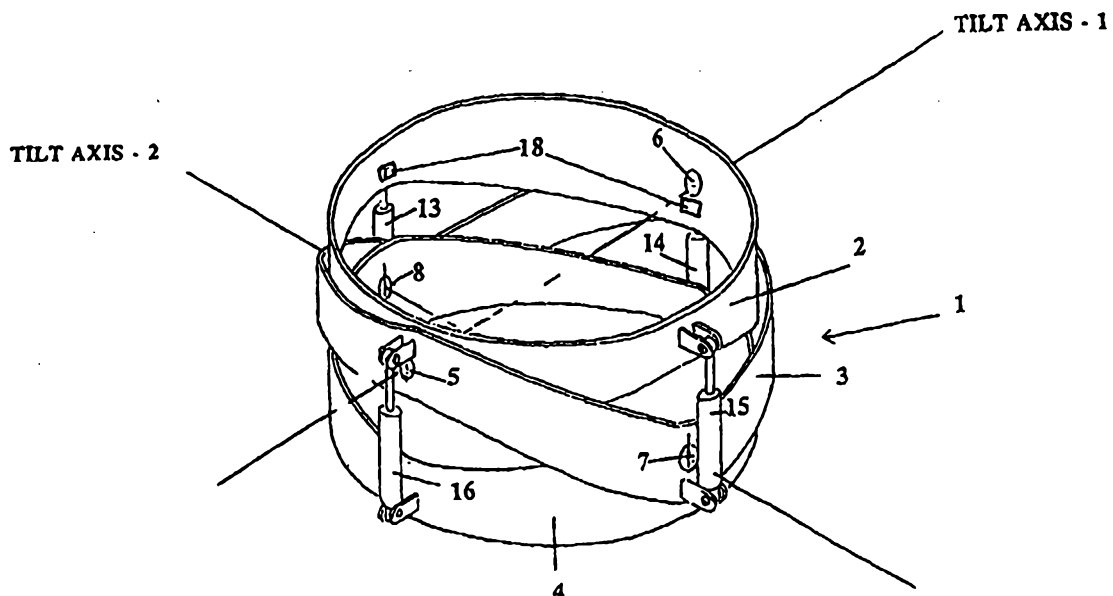
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(54) Title: TILT UNIT FOR A VEHICLE CAB



(57) Abstract

A tilt unit for a vehicle cab which is rotatable with respect to the chassis of the vehicle about a rotatable joint, the unit being characterised in that the rotatable joint is connected to a mounting which is tiltable about both the longitudinal and transverse axes of the vehicle in the horizontal plane.

TILT UNIT FOR A VEHICLE CAB

Technical Field

This invention relates to a tilt unit for the cab of a vehicle.

Background Art

- 5 In particular, this invention relates to a tilt unit for the cab of an excavator/digger. However this should not be seen as limiting as the present invention may be applied to the cabs of the other vehicles.

For ease of reference only, the vehicle will now be referred to as being an excavator.

- 10 Existing excavators have their cabs rotatable about a swing (slew) bearing which is fixedly connected to the track chassis of the excavator as is shown in Figures 1 and 2.

Figure 1 shows a side view of an excavator generally indicated by arrow 1000 which has its cab 1001 rotatable about a slew bearing 1002. The slew bearing
15 1002 is attached to the chassis 1003 of the excavator 1000.

Figure 2 shows in more detail the slew bearing 1002 mounted on the chassis 1003.

- However, the disadvantage, with cabs mounted on conventional slew bearings as shown, is that the orientation of the excavator's chassis with respect to the
20 horizontal, also dictates the orientation of the cab of the excavator with respect to the horizontal. Accordingly, it is difficult for operators of excavators to excavate a level region of earth when the chassis of the excavator is not in a horizontal plane.

In order to overcome this difficulty a number of methods/devices have been

devised. However, these all suffer from a number of disadvantages.

One method for overcoming this problem involves the use of a laser positioned remote from the excavator. The laser is positioned at a height which enables a receiver on the dipper arm of the excavator to become
5 activated on contact with said laser beam, when it is at the correct height for excavating to begin.

However, a disadvantage with this laser system occurs if the chassis of the excavator is on an angle to the horizontal, as the height of the laser is not usually adjusted to compensate for the dipper arm being on an angle with
10 respect to the vertical (as this is not always the case). The net result of this failure to adjust the height at which the laser is positioned is that the excavator levels the ground at a region higher than originally intended. This occurring due to the skew of the dipper arm effectively shortening its length in the vertical direction.

15 A further disadvantage with the above laser system is the unnecessary, time and expense, involved in implementing this system.

A further device which has been developed in order to overcome the problem of excavating, when the chassis excavator is on an angle with respect to the horizontal, is the tilt bucket. The tilt bucket assembly allows for the cutting
20 edge of the bucket to be tilted so as to remain in the horizontal plane, via the action of hydraulic rams.

A disadvantage however with tilt buckets, is that the tilt bucket assembly increases the normal length of the dipper arm - bucket assembly. Thus, the minimum size of hole that can be excavated is increased, due to the larger arc
25 of the dipper arm - bucket assembly.

A further disadvantage with the slew bearings of existing excavators is that when the chassis of the excavator is on an angle with respect to the horizontal,

the slew motor is unable to slew the arm of the excavator back when this is fully extended in a downhill direction. This is due to gravity increasing the force required by the motor to slew the arm back.

It would also be an advantage if there could be provided an excavator which is also able to excavate a gradient, for example a 3° fall to the North without the use of a laser system, and without the need for the operator of the excavator to get out of the cab.

It is an object of the present invention to address the foregoing problems or at least to provide the public with a useful choice.

Further aspects and advantages of the present invention will become apparent from the ensuing description which is given by way of example only.

DISCLOSURE OF INVENTION

According to one aspect of the present invention there is provided a tilt unit for a vehicle cab which is rotatable with respect to the chassis of the vehicle about a rotatable joint the unit being characterised in that the rotatable joint is connected to a mounting which is tiltable about both the longitudinal and transverse axes of the vehicle in the horizontal plane.

The rotatable joint may come in a variety of different forms without limiting the scope of the present invention.

In preferred embodiments the rotatable joint may be a slew bearing.

For ease of reference only the rotatable joint will now be referred to as a slew bearing.

It is envisaged that the vehicle cab may be any cab which is not integral with the vehicle chassis, so that the orientation of the cab can be varied with respect to the vehicle chassis.

In preferred embodiments the vehicle cab may be that of an excavator.

For ease of reference only, the vehicle may be thought of being that of an excavator.

It is envisaged that the slew bearing mounting may take a variety of different
5 forms.

In preferred embodiments, the slew bearing mounting may be in the form of a substantially ring shaped frame. However, this should not be seen as limiting the scope of the present invention.

For ease of reference only, the slew bearing mounting will now be referred to
10 simply as the mounting.

The slew bearing may be connected to the mounting in a variety of different manners.

In some embodiments the slew bearing may be integrally formed as part of the mounting itself.

15 In preferred embodiments, the slew bearing may be attached to the mounting by way of welding or bolts. Other means of attachment may of course be used.

The tilting of the mounting about both the longitudinal and transverse axes of the vehicle in the horizontal plane, may be achieved in a variety of different ways.

20 In some other embodiments the mounting may be pivotally attached to a tilt frame which is pivotally attached to the chassis of the vehicle. In general, if the tilt frame is pivotally attached to the vehicle along the transverse axis thereof, the mounting will be pivotally attached to the tilt frame along the longitudinal axis of the vehicle, or vice versa.

25 In preferred embodiments, the mounting may be pivotally attached to a tilt

frame. The tilt frame being pivotally attached to a support frame which is connected to the chassis of the vehicle. The pivotal attachments of the mounting to the tilt frame, and the tilt frame to the support frame, again being along the respective longitudinal and transverse axes of the vehicle, as
5 described above.

In preferred embodiments the tilt frame may be connected to a load frame. The function of the load frame being to ensure the structural rigidity of the tilt frame is maintained, as this is the main load bearing structure for the weight of the cab.

10 In preferred embodiments both the tilt and load frames may be substantially ring shaped frames when viewed in plan view although other configurations are possible.

The support frame may be connected to the track chassis of the vehicle in a variety of ways.

15 In some embodiments the support frame may be integrally formed with the track chassis of the vehicle.

In preferred embodiments the support frame may be either bolted or welded to the chassis. Other ways of attaching the support frame may be used.

To control the tilting of the mounting and tilt frame about their respective
20 longitudinal and transverse axes lifting devices may be attached to the mounting and tilt frames in positions that allow the lifting devices to tilt same.

In preferred embodiments the lifting devices may hydraulic rams.

However, other suitable lifting devices may be employed.

For ease of reference only, the lifting devices will now be referred to as being
25 hydraulic rams.

In preferred embodiments the hydraulic rams of the mounting and tilt frames respectively may be arranged in pairs so that each pair can respectively control the tilting of the mounting and tilt frame about their respective axes of rotation. Thus, this configuration allows for the effective tilting of the mounting in both the clockwise and anticlockwise direction with respect to both the longitudinal and transverse axes.

In general, the hydraulic fluid supply for the hydraulic rams may be sourced from the existing hydraulic fluid supply of the excavator. However, this should not be seen as limiting.

- 10 The orientation of the cab of the excavator with respect to the chassis of the excavator, may be determined by mercury solenoid switches or other level sensors. In preferred embodiments the mercury switches/level sensors may be attached to the mounting. The mercury switches/level sensors sense the orientation of the cab and relay this to a suitably programmed CPU. The CPU then controls the hydraulic fluid supply to the hydraulic rams connected to both the mounting and tilt frame via action of solenoid valves. Thus, it is this arrangement which helps enable the cab to be maintained in a horizontal plane, or any other predetermined gradient, which may be selected by the operator of the excavator.
- 15
- 20 In preferred embodiments the CPU may be connected to a graphic display apparatus suitably positioned for viewing by the operator of the excavator.

However, it should be appreciated that other methods for controlling the hydraulic rams may be used without departing from the scope of the present invention.

- 25 In order for the present invention to be used to excavate a gradient, for example a 3° fall to the north, the cab may also include a compass or other direction sensor(s) to precisely indicate the direction in which the arm of the

excavator is directed.

In preferred embodiments of the present invention there may also be provided a manual override system, so that the orientation of the cab can be fixed with respect to the chassis of the excavator. This allowing the excavator to be
5 operated in the same manner as a conventional excavator.

The level sensors and solenoid valves may be capable of communication with the CPU located in the cab of the vehicle. In preferred embodiments this communication may be achieved via radio-waves. This thereby avoids rotation of the cab about the slew bearing twisting any wires which would
10 otherwise connect these devices with the CPU in the cab.

Thus the present invention may have a number of advantages over the prior art.

One advantage of the present invention is that it allows for a level region of earth to be excavated easily without the use of lasers even when the chassis of
15 the excavator is on an angle with respect to the horizontal.

A further advantage of the present invention is that it dispenses with the need for a tilt bucket, so the minimum size of hole that can be excavated is not increased.

Yet another advantage of the present invention is that it may be used to
20 excavate a gradient without lasers and without the operator having to get out of the cab.

Another advantage of the present invention is that it allows for excavation to be undertaken quickly and in a cost effective manner.

A further advantage of the present invention is the fact the tilt unit can be
25 easily retro-fitted to existing excavators. Simply by fitting it under existing slew bearings and linking it to the hydraulic system.

Another advantage of the present invention is the cab can be rotated in the same direction for virtually unlimited revolutions.

Yet another advantage of the present invention is its relatively low cost of manufacture and cost of installation onto an excavator.

5 **BRIEF DESCRIPTION OF DRAWINGS**

Further aspects of the present invention will become apparent from the following description which is given by way of example only and with reference to the accompanying drawings in which:

- Figure 1 illustrates a side view of a prior art excavator;
- 10 Figure 2 illustrates a slew being mounted to chassis of a prior art excavator, and
- Figure 3 shows a perspective view of a slew bearing, and
- Figure 4 shows a perspective view of a preferred embodiment of the present invention, and
- 15 Figure 5 is a top plan view of the embodiments shown in Figures 4 and 6, and
- Figure 6 is a side view of the embodiment shown in Figure 4, and
- Figure 7 is a top plan view of one embodiment illustrating a slip-ring charging arrangement, and
- 20 Figure 8 is a side view of an excavator fitted with a tilt unit in accordance with one preferred embodiment of the present invention.

BEST MODES FOR CARRYING OUT THE INVENTION

With respect to the drawings (with the exception of the PRIOR ART drawings

previously described above) there is provided a tilt unit generally indicated by arrow 1.

The tilt unit 1 (shown in Figure 4) has a mounting 2, a tilt frame 3 and support frame 4.

- 5 The mounting 2 is pivotally connected at points 5 and 6 to the tilt frame 3 along tilt axis-1.

The tilt frame 3 is pivotally attached at points 7 and 8 to the support frame 4 along tilt axis-2. The support frame 4 is attached to the track chassis (not shown) via bolts (not shown).

- 10 A slew bearing 9 (shown in figure 3) is attached to the mounting 2 via bolts 10 which locate in apertures 11 located on radially directed flange 12 connected to the mounting 2 (as shown in figure 5).

- The mounting 2 may be effectively tilted about the two tilt axes by hydraulic rams 13, 14, 15 and 16. Thus, tilting of the mounting about tilt axis-1 may be
15 achieved via co-operative movement of rams 13 and 15, and about tilt axis 2, via rams 14 and 16.

In embodiments where the present invention is applied to a 20 tonne excavator, the applicant envisages 5 inch hydraulic rams being utilised to control tilting of the mounting 2 about its axes.

- 20 The supply of hydraulic fluid to the rams 13, 14, 15 and 16 is undertaken by a conventional centre swivel hydraulic and electric unit 17 (shown in figure 5) such is used in existing excavators. The flow of hydraulic fluid to and from the rams 13, 14, 15 and 16 may be controlled by solenoid valves (not shown). The solenoid valves being activated after level sensors 18 (shown in figure 4) relay
25 a signal to a CPU (not shown). The CPU will generally be located in the cab of the vehicle and associated with a graphic display apparatus (not shown).

The level sensors and solenoid valves (not shown) are capable of communication with the CPU (not shown) located in the cab of the vehicle via radio-waves. This thereby avoids rotation of the cab about the slew bearing twisting any wires which would otherwise connect these devices with the CPU
5 in the cab.

However, the above arrangement should not be seen as limiting as the CPU may also be situated near the hydraulic and electrical unit 17 within the tilt unit 1. In such embodiments the CPU and graphic display apparatus should be capable of communicating via radio-waves.

10 In some preferred embodiments, the tilt unit may include a load frame 19 (shown in figure 5) which substantially corresponds in shape to the tilt frame 3. The load frame 19 being connected to the tilt frame 3 via extension of the lugs 20 which attach hydraulic rams 14 and 16 to the tilt frame 3.

With respect to Figure 7 power for the solenoid valves (not shown), level
15 sensors 18 is provided by a battery 500 shown in Figure 7.

The battery 500 may be attached to the track chassis (not shown) of the excavator.

The battery 500 may be charged via a slip ring 501 made of a conductive material. The slip ring 501 having a top and bottom surface which are
20 separated via an insulator (not shown).

Positive and negative leads 505, 506 are connected to the ring 501 via carbon brushes (of which only 502 is shown) on the jaws of a clamp 511. The leads 505, 506 come from the excavators main battery (not shown). The carbon brushes allow the top and bottom surfaces of the ring 501 to be respectively
25 positively and negatively charged via leads 505, 506. By this arrangement the leads 505, 506 from the main battery may rotate with the cab without becoming tangled.

The ring 501 is supported via a support member (not shown) which spans across the mounting block 2.

With respect to Figure 8 there is shown an excavator 700 which has a dipper arm 701, a cab 702 attached to the chassis 703 of the excavator 700.

- 5 The cab 702 is attached to the chassis 703 via a tilt unit 705.

Aspects of the present invention have been described by way of example only and it should be appreciated that modifications and additions may be made thereto without departing from the scope of appended claims.

WHAT I CLAIM IS:

1. A tilt unit for a cab of a vehicle which is rotatable with respect to the vehicles chassis; wherein the tilt unit includes a rotatable joint on which the cab can rotate and a mounting to which the rotatable joint is connected, the tilt unit being supported by a support frame which is attached to the chassis of the vehicle, wherein the mounting is configured to be tiltable about both the longitudinal and transverse axis of the vehicle in the horizontal plane, characterised in that the tilt unit has been configured so that all moving parts to the tilt unit are located above the support frame to enable the tilt unit to be retrofitted to the vehicle.
2. A tilt unit as claimed in claim 1 wherein the rotatable joint is a slew bearing.
3. A tilt unit as claimed in claim 2 wherein the slew bearing is integrally formed as part of the mounting itself.
4. A tilt unit as claimed in claim 2 wherein the slew bearing is attached to the mounting.
5. A tilt unit as claimed in claim 1 wherein if the tilt frame is pivotally attached to the vehicle along the transverse axis, the mounting is pivotally attached to the tilt frame along the longitudinal axis of the vehicle, or vice versa.



6. A tilt unit as claimed in claim 1 wherein the mounting is pivotally attached to a tilt frame, the tilt frame being pivotally attached to a support frame.

5 7. A tilt unit as claimed in claim 6 wherein if the pivotal attachment of the mounting to the tilt frame is along transverse axis of the vehicle, the pivotal axis of the tilt frame to the support frame will be along the longitudinal axis of the vehicle, or vice versa.

10 8. A tilt unit as claimed in claim 1 wherein the tilt frame is connected to a load frame.

9. A tilt unit as claimed in claim 6 wherein the support frame is integrally formed with the chassis of the vehicle.

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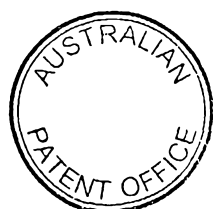
10. A tilt unit as claimed in either claim 5 or claim 7 wherein the tilting of the mounting and tilt frame about their respective axes is controlled by lifting devices attached to the mounting and tilt frame in positions that allow the lifting devices to tilt same.

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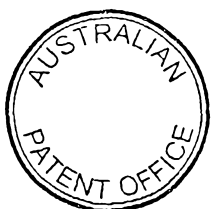
11. A tilt unit as claimed in claim 10 wherein the lifting devices are hydraulic rams.

12. A tilt unit as claimed in claim 10 wherein the lifting devices are arranged in pairs so that each pair can respectively control the tilting of the mounting and tilt frame about their axes of rotation.

25



13. A tilt unit as claimed in claim 11 wherein the hydraulic fluid is sourced from the existing hydraulic fluid supply of the vehicle.
14. A tilt unit as claimed in claim 1 wherein the orientation of the cab is determined by level sensors.
15. A tilt unit as claimed in claim 14 wherein the level sensors communicate with a CPU.
16. A tilt unit as claimed in claims 13 and 15 wherein the CPU is suitably programmed to control the hydraulic fluid supply to the hydraulic rams connected to both the mounting and tilt frames via the action of solenoid valves.
17. A tilt unit as claimed in claim 16 wherein the CPU is connected to a graphic display apparatus.
18. A tilt unit as claimed in claim 1 which includes a manual override system so that the orientation of the cab can be fixed with respect to the chassis of the excavator.
19. A tilt unit as claimed in claims 15 and/or 16 wherein the level sensors and/or solenoid valves, on the tilt unit are capable of communication with the CPU located in the cab of the excavator, via radio-waves.
20. A tilt unit as claimed in claims 15 and/or 16 wherein a power supply for the level sensors and/or solenoid valves is provided either directly or



indirectly via a slip ring arrangement.

21. A tilt unit substantially as described herein with reference to any example and/or drawing thereof.

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DATED this 3rd day of April, 2000.

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By his Patent Attorneys
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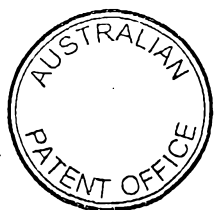
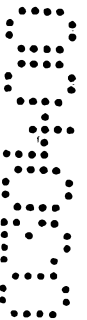
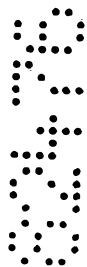
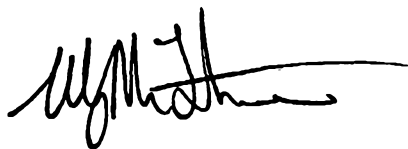
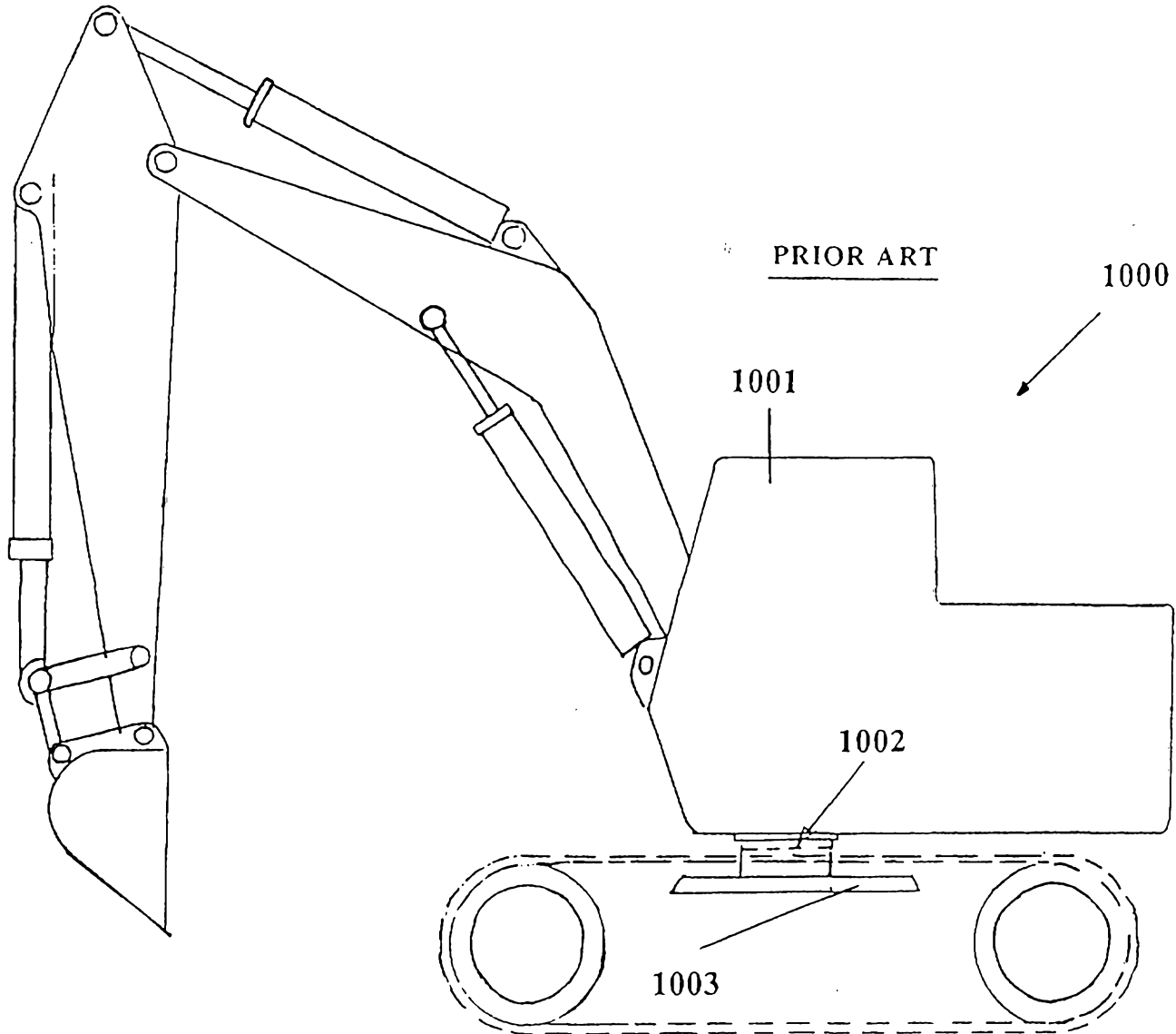


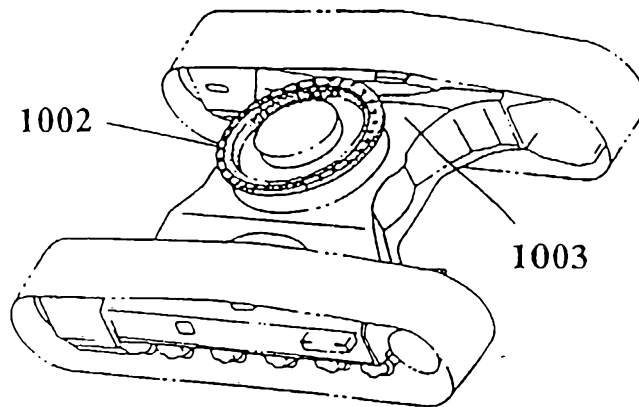
FIG 1



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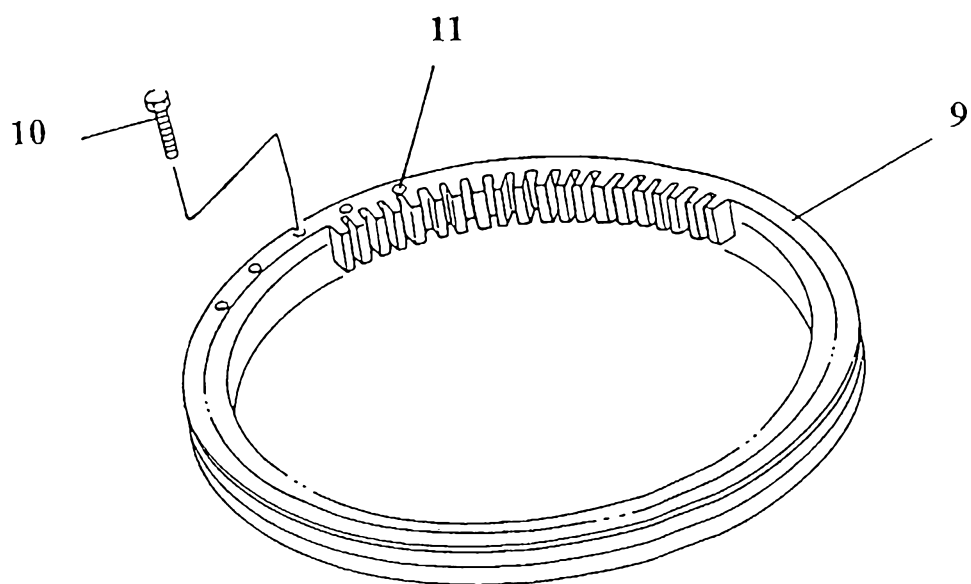
FIG 2

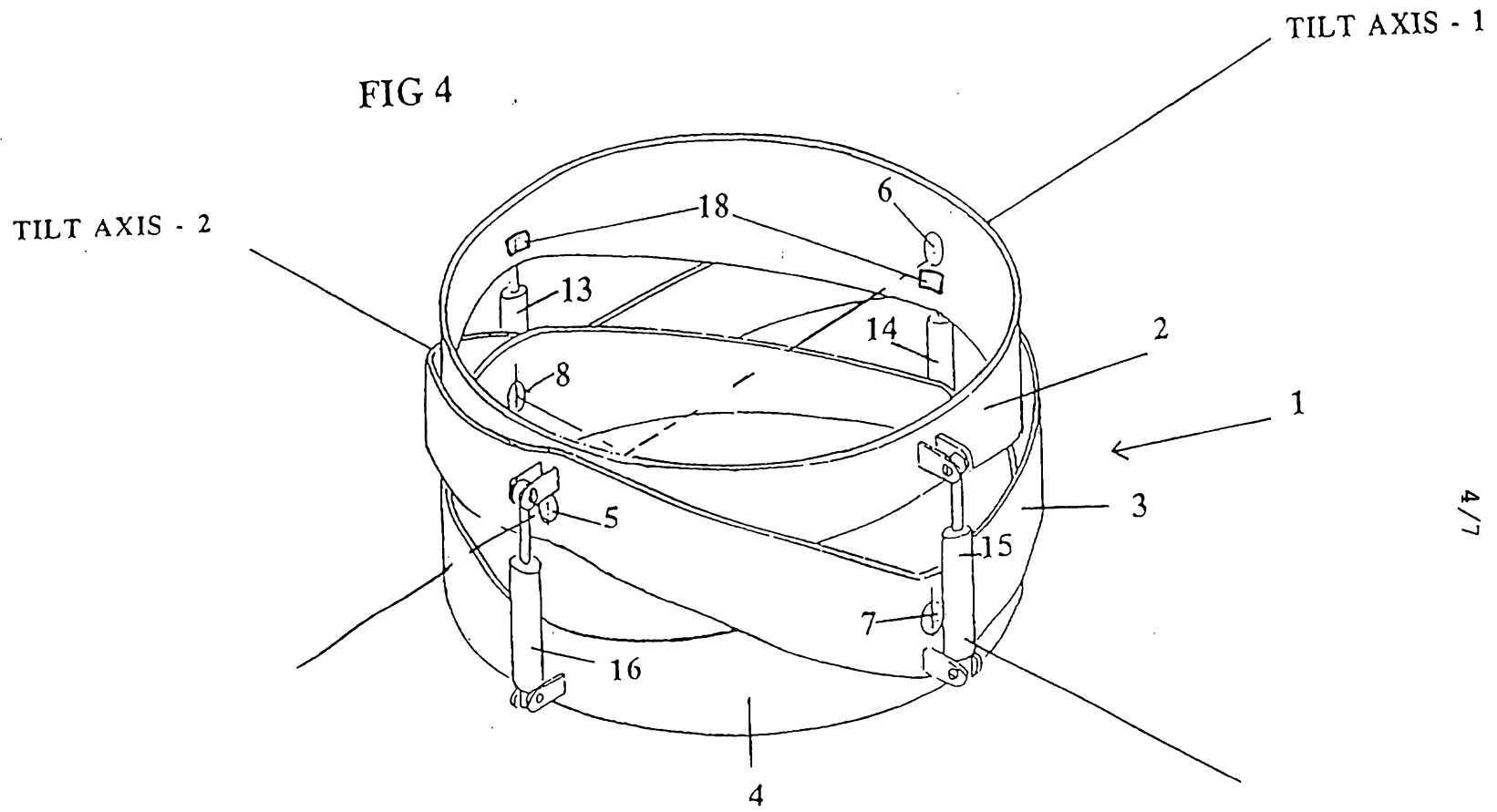
PRIOR ART



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FIG 3





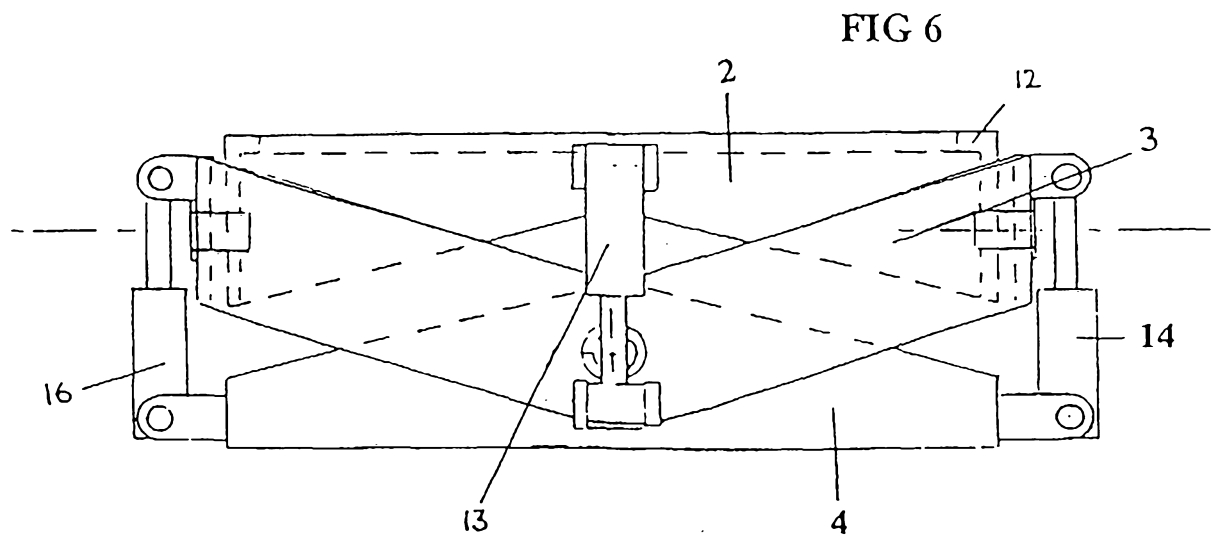
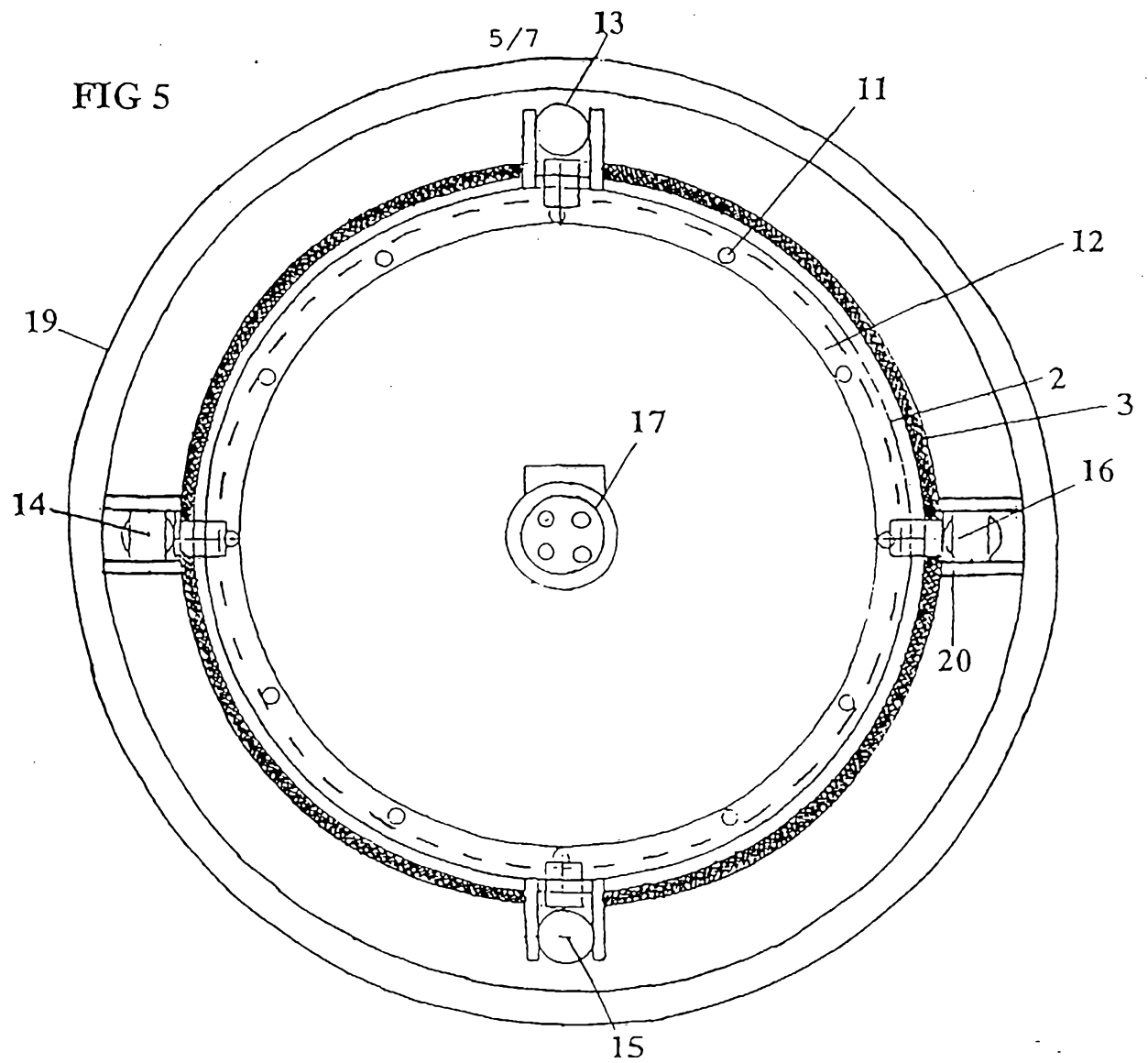


FIG 7

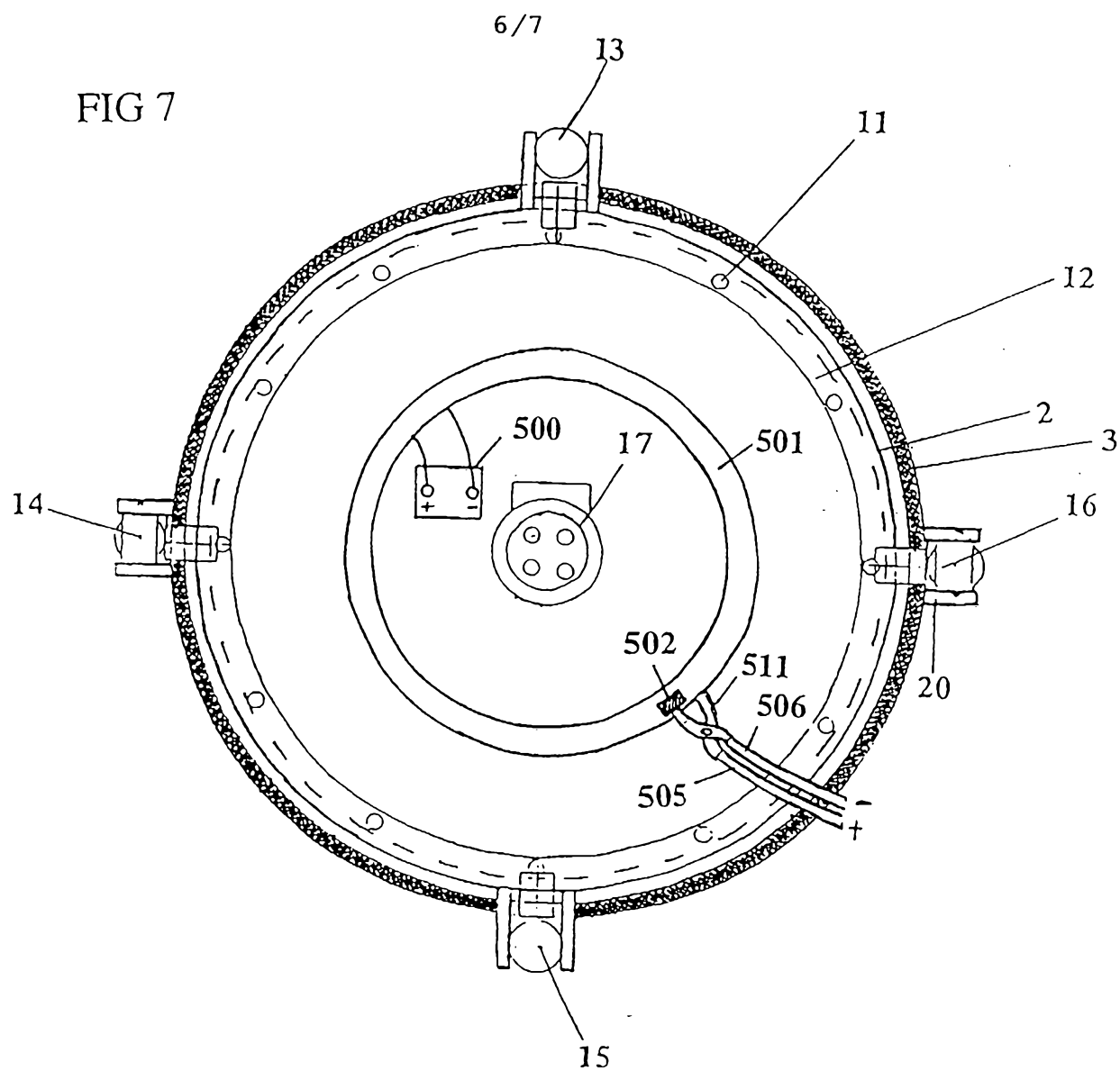


FIG 8

