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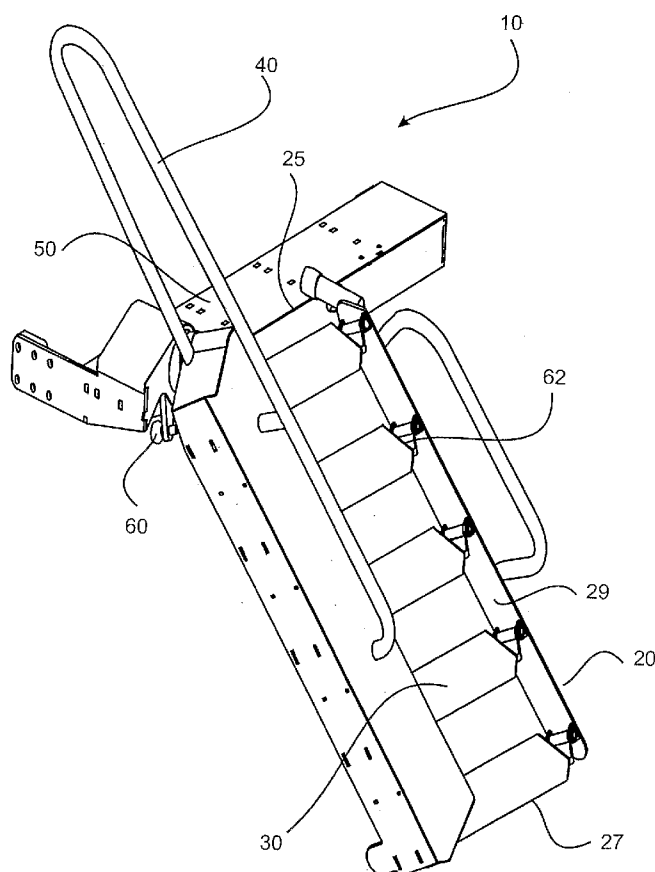
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[Continued on next page]

(54) Title: ACCESS DEVICE



(57) Abstract: An access system (10) for earthmoving equipment to allow a person to move from ground level to an elevated position, said access system having an access means (20) mounted to the earthmoving equipment via a pivot, and a retraction mechanism (50) therefor, said pivot allowing the access means to be retracted through a compound angle from a downwardly and outwardly deployed position to a retracted position generally adjacent and aligned beside the vehicle, the access means may be collapsible, such as with steps (30) pivotably mounted to the sides of the access means via secondary pivots (62).



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ACCESS DEVICE

FIELD OF THE INVENTION

The present invention relates to access devices for earth moving equipment and in particular to a movable or retractable access device, such as a ladder or stair.

BACKGROUND OF THE INVENTION

Most earth moving equipment vehicles such as bulldozers generally includes a chassis, a variety of front-mounted blades, protective driver cabin, a hatch and a form of access or access system. The chassis includes all the mechanical parts that form the structural frame of the earth moving equipment vehicle. The driver operates the earth moving equipment vehicle from the protective driver cabin. A hatch is located behind the driver cabin and typically houses many of the important control units of the earth moving equipment vehicle such as hydraulic controls, hydraulic pump, fuse box, electrical circuit breakers etc. The form of access or access devices provides access between the ground level and the cabin. Walkways are provided around the cabin area for an operator to access the hatch located behind the driver cabin of the earth moving equipment vehicle. The access device may be attached to the walkway near the entry door to the cabin.

Retractable access systems of different configurations are presently known and have two final positions namely the deployed position and the retracted position. The major types of access devices are the vertical variable height access system and the swing access system.

The vertical variable height access system would generally be used for large excavators and earth moving equipment. In the vertical variable height access system, the ladder or stairs would be operated vertically and would remain vertical both in the deployed position and retracted position. In the swing access system the ladder or stairs when operated will swing up or down to reach either the retracted position or deployed position respectively.

The basic constituents of any access system include a ladder or stairs and a mechanism to actuate the ladder or stairs. The ladder or stairs are generally made of metal such as steel or aluminium. The movement of the ladder or stairs in any access system is controlled by an actuator mechanism. The actuator

mechanism moves the ladder or stairs between the deployed and the retracted position. This actuator is usually operated either mechanically or hydraulically. The combination of both means is also in practice.

As mentioned earlier the walkways allow an operator to gain access to the driver cabin and the hatch located behind the cabin. The access device is attached to the walkway; therefore the walkway must carry the weight of the access device. Consequently, the walkway must be built stronger to take the weight of the access device. This results in the requirement for wider walkways which possess the major problem of space management. The wider walkways also means that the weight of the walkway and access device exert a large lever on the side of the equipment. Most equipment has been designed to reduce weight and increase efficiency and is constructed as light as possible, the addition of a walkway and access ladder can damage the structure of the equipment.

In earth moving equipment, the ladder or stairs possess a problem of access management near the hatch area. The two major members of the ladder (the two lengthy vertical stiles and a number of horizontal rungs) when in a retracted position can block access to the hatch of the earth moving equipment vehicle. If any of the control units in the hatch area break down, trouble shooting is difficult until the access system is in a deployed position.

As mentioned, actuator systems of the access system are generally housed in the hatch of the vehicle and in situations wherein the actuator mechanism of the access systems fails, the operator has restricted or no access to the hatch. Hence the operator has to attend to the problem by removing the ladder mechanically, which adds to the down time of the vehicle.

The access device can be electrically powered or powered by a separate hydraulic system and hence requires an equipment cabinet in close proximity to the access device. The location of the equipment cabinet in close proximity to the access device adds to the space management problem.

SUMMARY OF INVENTION

With the aforementioned in mind, according to one aspect the present invention provides an access system for an earthmoving equipment to allow a person to move from ground level to an elevated position, said access system having a retraction mechanism rotating about a said pivot allowing movement in

two dimensions said pivot being adapted to allow the access ladder to be retracted from a deployed position 90° to the direction of movement of the earthmoving equipment and at an angle to the ground to a retracted position being parallel to the direction and movement of the earthmoving equipment thus, minimizing the overhang of the ladder beyond the extremes of the earthmoving apparatus when retracted.

A further aspect provides an access system for an earthmoving equipment to allow a person to move from ground level to an elevated position, said access system including an access means and a retraction mechanism to retract the access means about a pivot allowing movement in two dimensions, said pivot allowing the access ladder to be retracted through a compound angle from a deployed position generally 90° relative to the direction of movement of the earthmoving equipment and at a downward incline with respect to the ground, to a retracted position being generally parallel to the direction of movement of the earthmoving equipment thereby reducing the overhang of the ladder beyond the extremes of the earthmoving apparatus when retracted. Thus, advantageously, one or more forms of the present invention enables a vehicle access means, such as a ladder, to be pivotably retracted from a deployed position extending from a height downwardly and outwardly of the vehicle to a retracted position in line with and adjacent the vehicle. Consequently, the access means, which when deployed extends downwardly and outwardly from the vehicle is conveniently retracted through a compound angle to a safe position beside the vehicle, and reduces risk of the retracted access means being damaged when the vehicle is moving but, when deployed, allows the vehicle operator or other person to safely access or leave the vehicle away from vehicle parts and wheels without needing to use a vertical ladder. The downwardly and outwardly inclined deployed access means permits easier, safer access to and from the vehicle in being less steep than a vertical access ladder, thereby allowing a user to walk up rather than vertically climb the access means.

A still further aspect of the present invention provides an access system for earthmoving equipment, the system including access means mounted to the equipment via at least one pivot, and an access means retraction mechanism arranged to retract the access means from a deployed position to a retracted

position by pivoting the access means about at least one said pivot, the access means including spaced elongate members and at least one foot support extending therebetween, wherein said at least one foot support is pivotably mounted to the elongate members, and wherein the access means collapses with
5 the elongate members closing relative to one another by relative pivoting with respect to the at least one foot support when pivoted to a retracted position,

Advantageously, collapsing the access means thereby reduces the overall height and space occupied by the access means when retracted. This can allow the access means to be fitted outside of the cabin door while still enabling the
10 cabin door to be opened or closed with access system in any position.

Preferably the access means may include a ladder, with one or more rungs providing the at least one foot support extending between the elongate rails of the ladder. Alternatively, the access means may be stairs with one or more steps extending between side members and providing the at least one foot
15 support.

Preferably, the rungs/steps and side members/rails may be arranged so as to overlay each other in the retracted position. More preferably the steps and side members/rails may overlay each other when retracted to a generally horizontal position.

20 In one or more further embodiments, the access system may include secondary pivots between the rung(s)/step(s) and elongate side members/rails which enhances collapsibility of the ladder when retracted.

A further aspect provides an access system for an earthmoving equipment to allow a person to move from ground level to an elevated position, said access
25 system having a ladder or steps and a retraction mechanism therefor, said pivot allowing the access ladder or steps to be retracted through a compound angle from a deployed position to a retracted position.

Preferably the ladder or steps may include side beams and at least one rung or step, wherein; in a retracted and collapsed position, said rung(s) or
30 step(s) and the side beams are constructed so as to overlay each other.

Thus, the overall dimensions and space occupied by the ladder when retracted are reduced.

Preferably the access means retracts from a generally upright deployed

position through to a generally horizontal retracted position, such as retraction through approximately 90° from a generally upright deployed position. More preferably, retraction is through a compound angle, whereby the access means extends outwards at a lower end thereof when deployed, and the lower end swings/pivots towards the equipment to the retracted position.

Preferably deployment is a reversal of one or more of the retraction arrangements.

A further aspect provides a method of retracting an access means for earthmoving equipment, including the steps of; rotating an access ladder or steps about a pivot point from an outwardly and downwardly extending position with respect to at least part of the vehicle to a retracted position with the access ladder or steps substantially adjacent and aligned with respect to the earth moving equipment.

The method may advantageously include the step of collapsing the access ladder or steps in width between deployed and retracted positions.

Preferably the step of collapsing the ladder or steps further includes bringing the elongate side members closer together and pivoting the at least one foot support relative thereto such that the elongate side members overlay the at least one foot support when in the retracted position. More preferably the step of collapsing the ladder or steps further includes pivoting the at least one foot support with respect to the elongate side members using secondary pivot means attaching the respective at least one foot support to each elongate side member.

BRIEF DESCRIPTION OF THE DRAWINGS

The following figures explain the preferred embodiments of the inventions

Figure 1 illustrates the access device in deployed position;

Figure 2 illustrates the access device in a deployed position showing a outline of the tracks of a piece of earthmoving equipment;

Figure 3 illustrates the access device swinging back to a partially retracted position;

Figure 4 illustrates the access device in retracted position;

Figure 5 illustrates a close up of the hydraulic ram and pivot of the access device;

Figure 6 illustrates an embodiment of the collapsible access device in deployed position;

Figure 7 illustrates an end view of an embodiment of the collapsible access device in the deployed position absent one of the rails.

5 Figure 8 illustrates an embodiment of the collapsible access device in a deployed position showing an outline of the body of a piece of earthmoving equipment;

10 Figure 9 illustrates an embodiment of the collapsible access device swinging back to a partially retracted position along with the outline of the earth moving equipment.

Figure 10 illustrates an embodiment of the collapsible access device in retracted position along with the outline of the earth moving equipment.

DETAILED DESCRIPTION OF THE INVENTION

15 It will now be convenient to describe the present invention with reference to the accompanying figures. The figures show a preferred embodiment of the present invention and it would be apparent to a person skilled in the art that modifications and adaptations are possible that fall within the scope of the present invention.

20 Referring now to figure 1, there is shown an overview of the access device (10). The access device consists of a ladder (20) with a series of rungs (30). The ladder also has a pair of handrails (40) to assist the user in steadying themselves when using the access device (10).

25 In figure 1 the access device (10) is in a deployed position with upper end (25) of the access device (10) adjacent to the cabin (not shown) and lower end (27) near the ground level. The access device (10) is made up of a ladder (20), a pivot (60), and mechanism (80) to actuate the access device (10).

30 The ladder (20) is made up of long members (29) and interconnected by a number of rungs (30). The actuating mechanism moves the ladder (20) between a deployed position allowing an operator easy access to the ladder (20) and a retracted position locating the ladder (20) in a location inside the extremes of the equipment and not accessible from the ground.

The access device (10) is used in applications where an operator needs to reach the cabin, on a piece of equipment, where the cabin is located some

distance off the ground. The operator will therefore approach a piece of earthmoving equipment with the access device (10) in a deployed position as shown in figure 1 and walk up the rungs (30) to an elevated platform (50) adjacent to the operating cabin of the earthmoving equipment.

5 The use of inclined access devices are required as under modern safety requirements, it is not desirable to use vertical access systems to gain entry to an elevated cabin. The chances of falling from a vertical access system are significantly greater than when using an inclined ladder or a staircase (access device (10)).

10 Once the operator has entered the cabin and is about to operate the earthmoving equipment, the access device (10) must be moved from the deployed position to a retracted position. Having an access device (10) extending beyond the side of the earthmoving equipment raises many dangers. These dangers include not only the possibility of a person attempting to board the
15 access device (10) while the equipment is in motion but there is also the possibility of impacting the extended access device (10) into the walls of the quarry or having the access device (10) run into some other fixed object.

 When an operator of a machine is involved in the primary job of moving earth, they are often fully task loaded and therefore do not need the extra
20 considerations of managing access to their machine.

 The access device (10) is retracted by rotating about a pivot (60). In this application the pivot (60) has been set up in such a way as to provide rotation in two dimensions. If the pivot (60) was merely horizontal and the access device (10) rotated around that point, the access device (10) would rotate about the pivot
25 (60) and then be pointing out from the machine when retracted. By having the pivot (60) set up to allow the access device (10) to move in two dimensions, it allows the access device (10) to pivot (60) around a single point moving from a deployed position to a retracted position, the access device (10) when retracted is positioned parallel to the body of the earthmoving apparatus as opposed to 90° to
30 a body of the earthmoving apparatus when the access device (10) is deployed. It was found that this two dimensional motion could be achieved in a single pivot (60) without the need of complex multiple axis movement arrangements. It has been found that there is a relationship between the angle of the pivot (60), the

angle of the ladder (20) and the amount of rotation required to retract the access device (10).

In the example shown in the figures, the access device (10) is at an angle of approximately 60° from the horizontal and the pivot (60) is inclined at 14° above the vertical and 14° towards the direction of rotation of the access device (10) to the retracted position. In preferred embodiments the pivot (60) of the access device (10) is inclined between 12° - 30° to the horizontal direction (ground level). The pivot (60) is also inclined between 12° - 30° in the direction normal to the retracting direction. This helps the ladder to make an angle of between 70 and 45 to the ground.

When the access device (10) is retracted it moves from a position of being at approximately 90° to the side of the machine and at an angle of between 45° and 70° from the elevated platform (50) to the surface to a position of being parallel with the machine, with the rungs (30) running in a vertical plane thus, limiting the access to the equipment by third parties and the extent to which the access device (10) extends beyond the equipment extremes.

Figure 2 shows an example of the access device (10) with an outline of a track (70), it can be seen that the access device (10) in the fully deployed position (as shown) allows for an operator to move from the ground level (45) to an elevated platform (50) adjacent the cab of the machine.

Figure 3 shows the access device (10) in a partially retracted position and it can be seen that the access ladder is retracting in two dimensions about a single pivot (60).

Figure 4 shows an example of the access device (10) in the fully retracted position and it can be seen that the access device (10) has not only rotated about the pivot (60) but also from an angle of 45° to 70° to the machine between the elevated platform (50) and ground level (45) to a position parallel with the machine.

Figure 5 shows the hydraulic mechanism (80) used to actuate the access device (10), it can be seen from this hydraulic mechanism (80) that the access device (10) is actuated from a lever arm (85) attached to the inboard end (65) of the pivot (60). The lever arm (85) is attached to a link bar (90) connecting the lever arm (85) to a link (95). The link (95) is attached to a first end (100) of a

hydraulic ram (110) with the second end (120) of the hydraulic ram (110) being attached to a fixed part (130) of the body (140) of the access device (10). The pressure used in applying the force to the hydraulic ram is specifically chosen so that in the event of the access ladder being retracted with somebody standing on it, the movement of the access ladder can be stopped without supplying significant force. This is a safety feature to limit the possibility of a person being lifted off the ground and being tipped off of the access device (20).

Referring now to figure 6, there is shown the access device (10) is used in applications where an operator needs to reach the cabin, on a piece of equipment that is located some distance off the ground. The operator will therefore approach a piece of earthmoving equipment with the access device (10) in a deployed position as shown in figure 1 and walk up the rungs (30) to an elevated platform (50) adjacent to the operating cabin of the earthmoving equipment.

The upper end (25) of the access device (10) is connected to the elevated platform (50) of Earth Moving equipment (70) (not shown). The rungs (30) of the ladder (20) are connected to stiles (29) through a series of secondary pivots (62). The other end of the ladder near the ground level (40) is at an angle to the horizontal and the vertical plane. The primary pivot (60) rotates to produce a compound angle with the secondary pivot (62) rotating in a different plane to produce a different compound angle. The primary pivot (60) and secondary pivots (62) are manufactured by advanced machining techniques such as wire cut machining, laser cut machining or similar techniques.

The access device (10) moves from a deployed position to a retracted position by rotation about the primary pivot (60). During retraction, the rungs (30) as well rotate about their respective secondary pivots (62) to align themselves almost parallel to horizontal plane there by collapsing the whole ladder.

When the access device (10) is retracted, it moves from a position of being at approximately 90° to the side of the machine and at an angle of between 45° and 70° from the elevated platform (50) to the surface to a position of being parallel with the machine, with the rungs (30) running at a slight angle to the horizontal thus, limiting the extent to which the access device (10) extends beyond the equipment extremes.

During the retraction of the access device (10), the primary pivot (60)

movement is simultaneously complimented by the movement of the rungs (30) about the secondary pivots (62). The rungs (30) rotate about the respective secondary pivots (62) during movement of the ladder from the deployed position to a retracted position to finish up being near parallel with the stiles (29) in the final retracted position. This also allows the stiles (29) to move to a position wherein the stiles (29) are located in close proximity to each other which reduces the amount of space taken up by the access device (10). There is a relation between the primary pivot (60) angle and the secondary pivot (62) angles.

Figure 7 shows a side view of the access device (10) in the deployed position showing one of the stiles (29) and also the secondary pivots (62) at each rung (30).

Figure 8 shows an example of the access device (10) with an outline of a the top section of an excavator (70), it can be seen that the access device (10) in the fully deployed position (as shown) allows for an operator to move from the ground level (45) to an elevated platform (50) adjacent the cab of the machine.

Figure 9 shows the access device (10) in a partially retracted position and it can be seen that the access ladder is retracting in two dimensions about a single primary pivot (60) and the rungs (30) are rotating about the secondary pivots (62), which rotate in a different plane to the main pivot (60) to finish up being near parallel with the stiles (29) in the final retracted position.

Figure 10 shows an example of the access device (10) in the fully retracted position and it can be seen that the access device (10) has not only rotated about the primary pivot (60) but also the whole access device (10) is collapsed due to rotation of the secondary pivots (62).

The weight of the access device (10) is significantly reduced; in this particular example the weight of the access device is 140 kg where as in a conventional access device the weight would be about 200 kg.

The other significant advantage of the present invention is that it enables the access walkway to be reduced because the ladder does not interfere with cabin access when retracted. The reduction in the walkway decreases the overall weight of the walkway equipment and the leaver forces applied to the mounting point thus minimising the potential damage to the equipment when the access device is in operation. It also reduces the width of the machine when having to be transported.

CLAIMS:

1. An access system for earthmoving equipment to allow a person to move from ground level to an elevated position, said access system having an access means mounted to the earthmoving equipment by a pivot, and a retraction mechanism therefor, said pivot allowing the access means to be retracted through a compound angle from a deployed position to a retracted position.
2. An access system as claimed in claim 1, wherein the access means is at least one ladder tread or steps.
3. An access system as claimed in claim 1 or 2 wherein the retraction mechanism rotates the access means about said pivot to allow the access means to be retracted from a deployed position approximately 90° to the direction of movement of the earthmoving equipment and at an angle to the ground to a retracted position being generally parallel to the direction and movement of the earthmoving equipment thus, minimizing the overhang of the ladder beyond the extremes of the earthmoving apparatus when retracted.
4. An access system as claimed in any one of claims 1 to 2, wherein said pivot allowing the access means to be retracted through a compound angle from a deployed position generally 90° relative to the direction of movement of the earthmoving equipment and at a downward incline with respect to the ground, to a retracted position adjacent to and generally inline with the earthmoving equipment.
5. An access system for earthmoving equipment, the system including access means mounted to the equipment via at least one pivot, and an access means retraction mechanism arranged to retract the access means from a deployed position to a retracted position by pivoting the access means about at least one said pivot, the access means including spaced elongate members and at least one foot support extending therebetween, wherein said at least one foot support is pivotably mounted to the elongate members, and wherein the access means collapses with the elongate members closing relative to one another by

relative pivoting with respect to the at least one foot support when pivoted to a retracted position,

6. An access means as claimed in claim 5 wherein the at least one foot support includes a series of rungs or steps arranged so as to overlay each other in the retracted position.

7. An access means as claimed in claim 5 or 6 wherein the elongate members include side members or rails arranged to overlay each other when retracted to a generally horizontal position.

8. An access system as claimed in any one of claims 5 to 7 further including a secondary pivot between each the at least one foot support and respective elongate side members which enhances collapsibility of the ladder when retracted.

9. An access system as claimed in any one of the preceding claims, wherein deployment is a reversal of retraction arrangements.

10. A method of retracting an access means for earthmoving equipment, including the steps of; rotating an access ladder or steps about a pivot point from an outwardly and downwardly extending position with respect to at least part of the vehicle to a retracted position with the access ladder or steps substantially adjacent and aligned with respect to the earth moving equipment.

11. A method as claimed in claim 10, further including the step of collapsing the access ladder or steps in width between deployed and retracted positions.

12. A method as claimed in claim 11, wherein the step of collapsing the ladder or steps further includes bringing the elongate side members closer together and pivoting the at least one foot support relative thereto such that the elongate side members overlay the at least one foot support when in the retracted position.

13. A method as claimed in claim 9 or 10, wherein the step of collapsing the ladder or steps further includes pivoting the at least one foot support with respect to the elongate side members using secondary pivot means attaching the respective at least one foot support to each elongate side member.

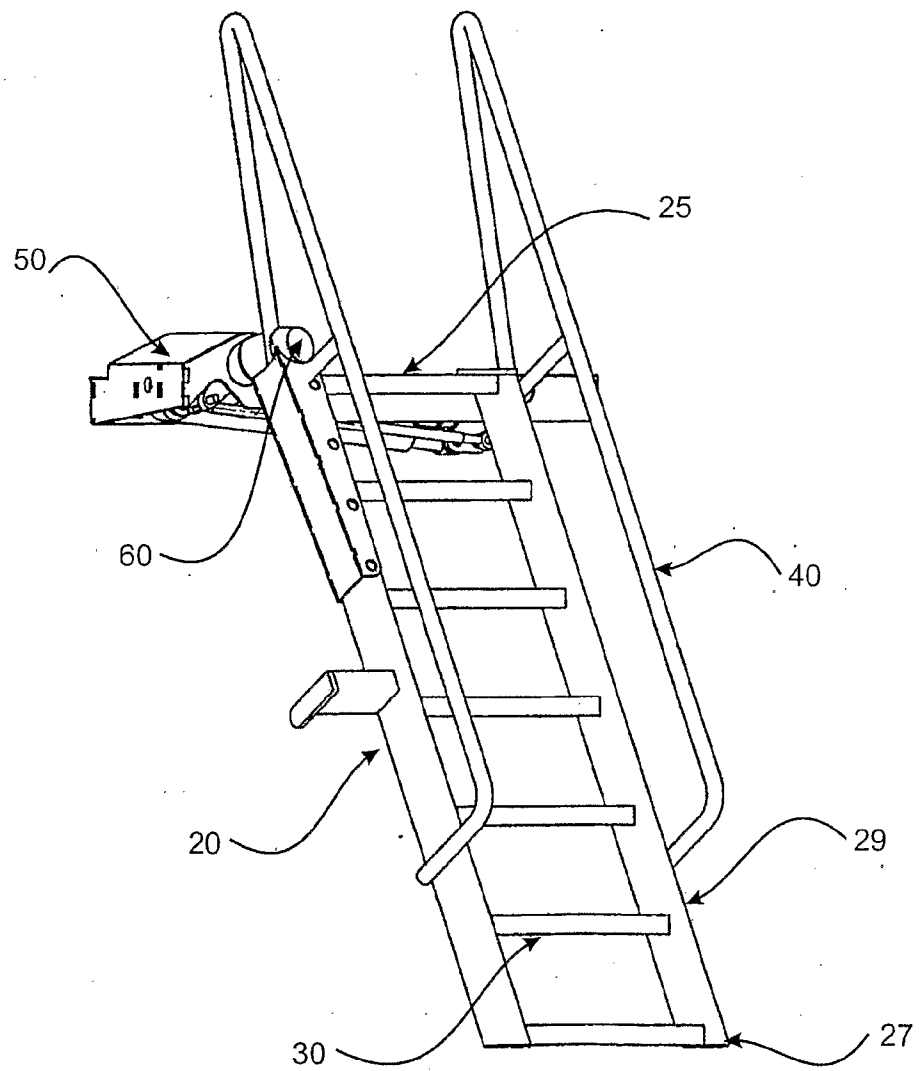


Fig 1

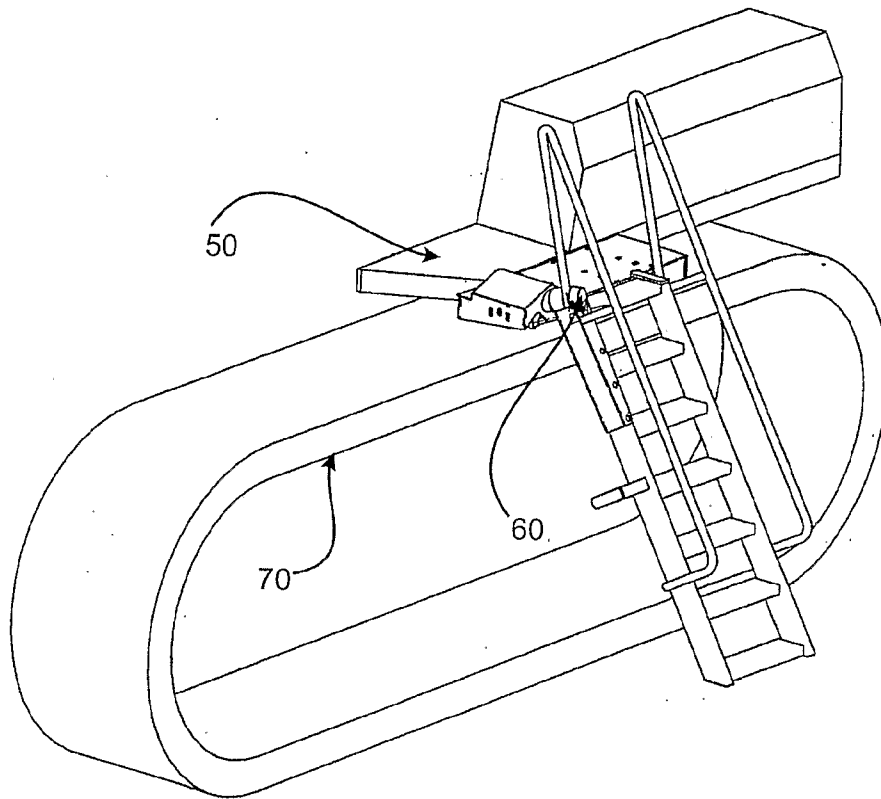


Fig 2

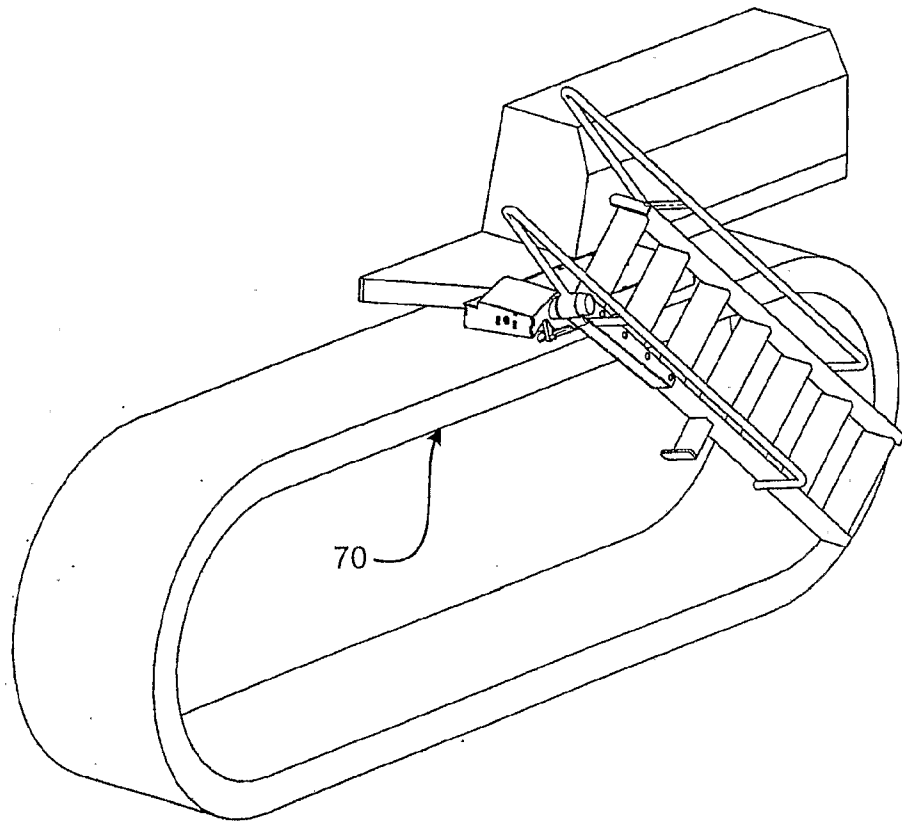


Fig 3

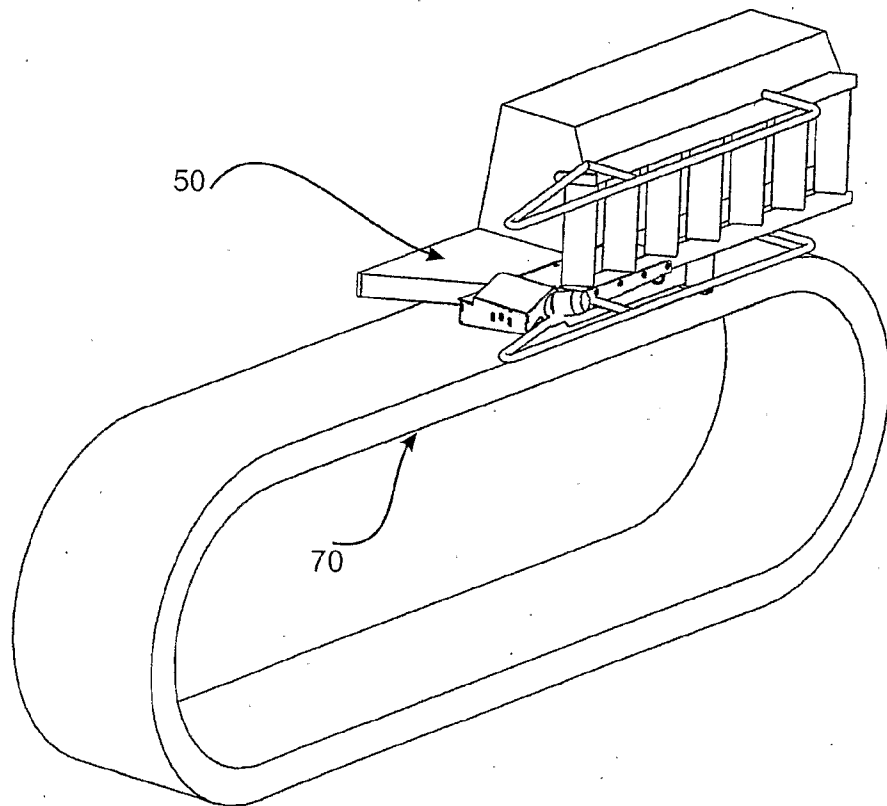


Fig 4

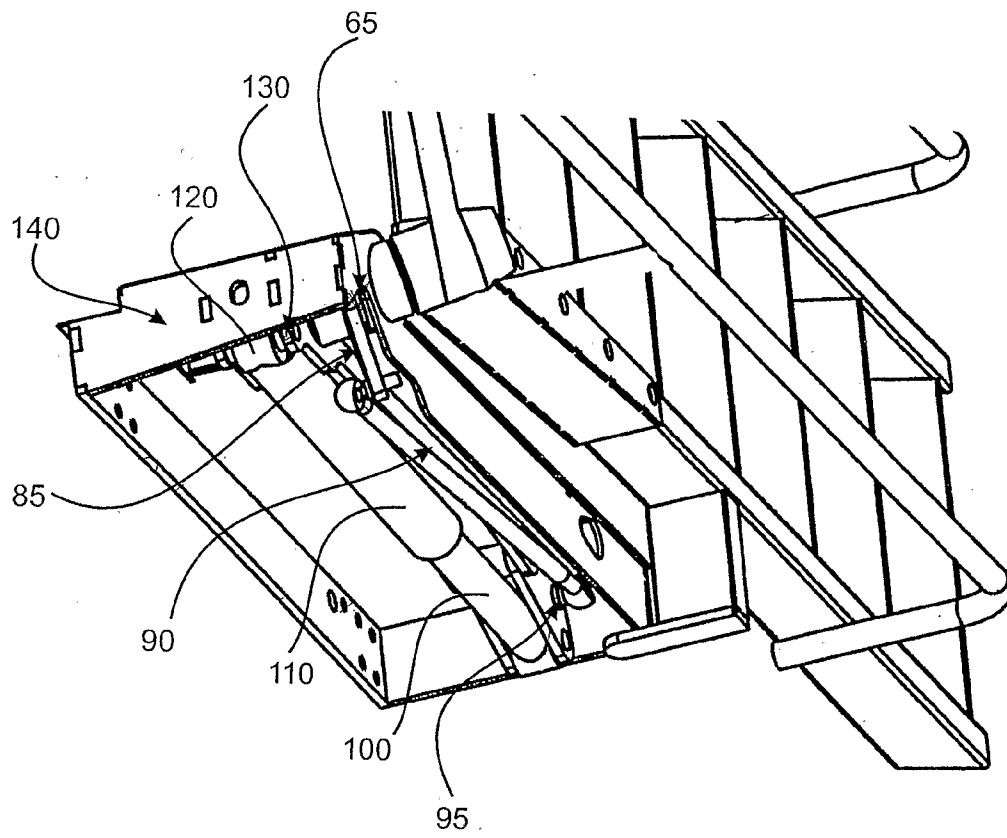


Fig 5

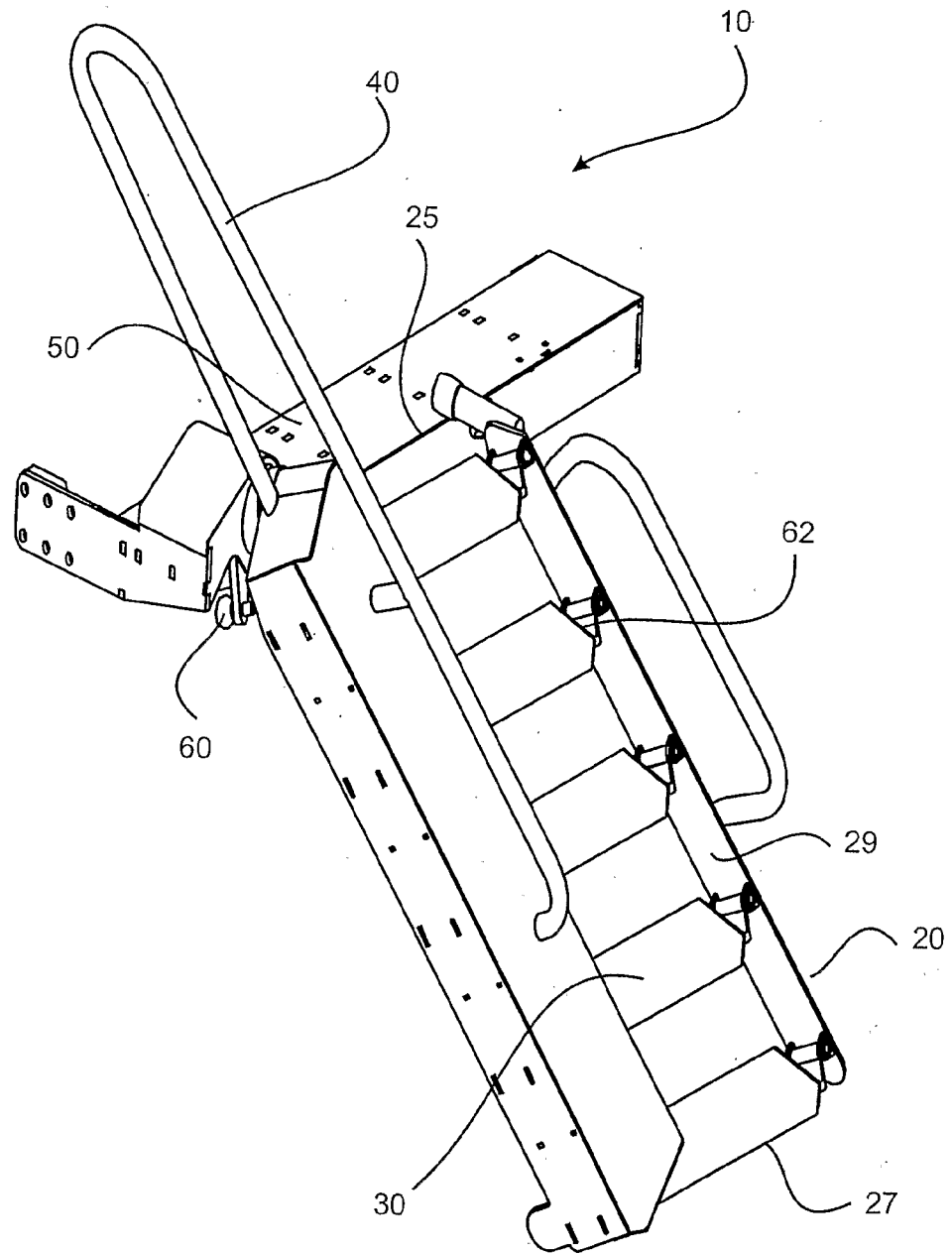


Fig 6

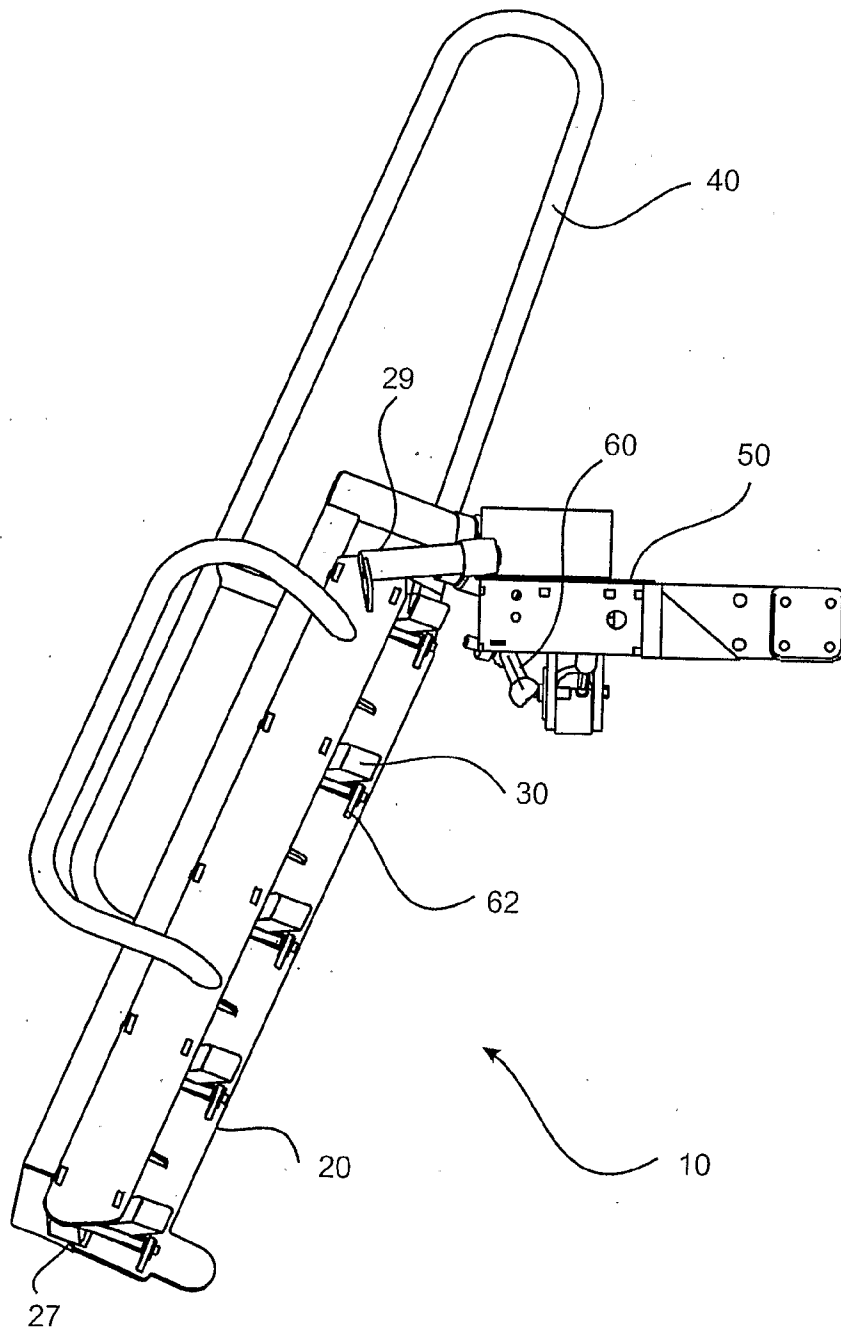


Fig 7

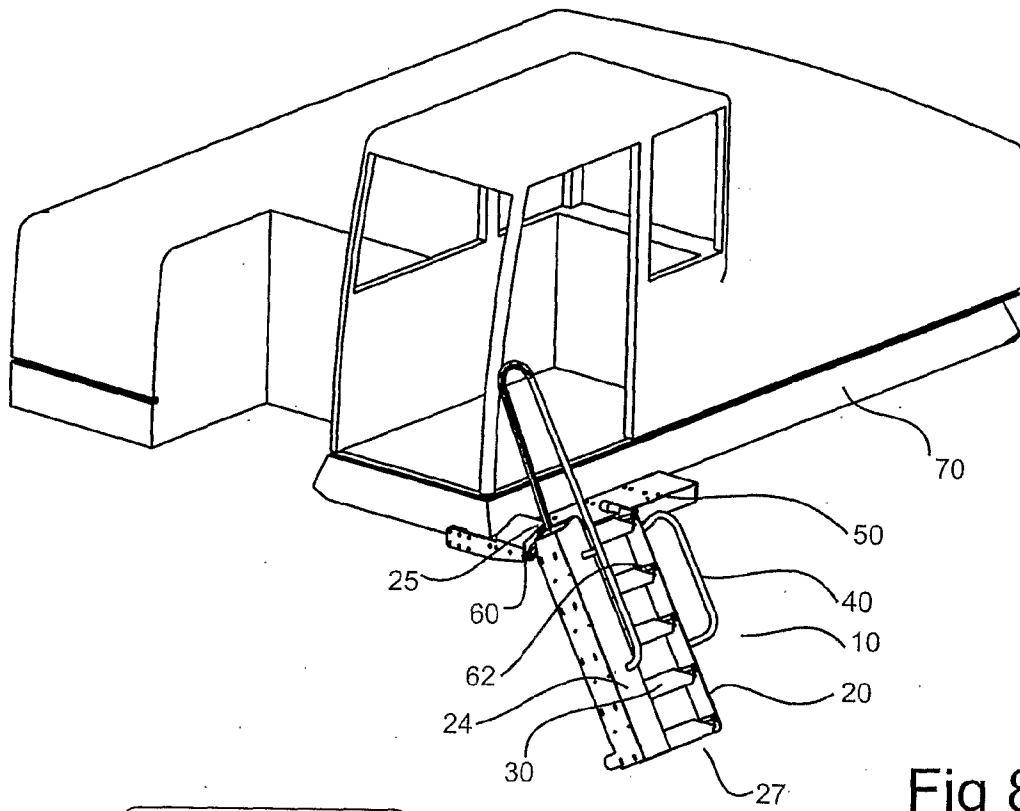
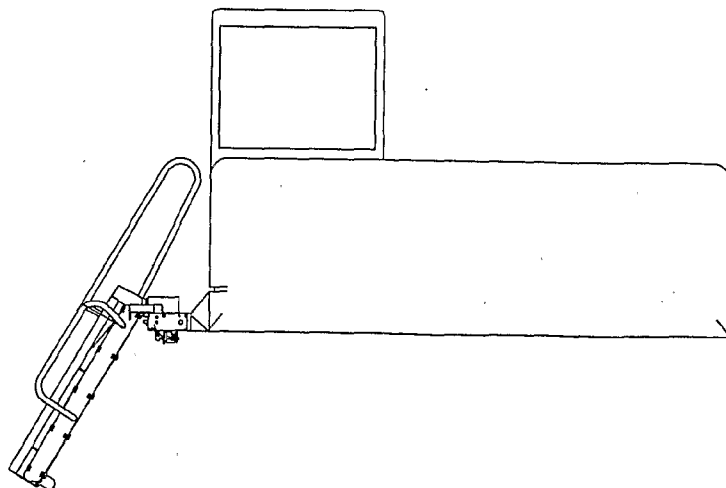
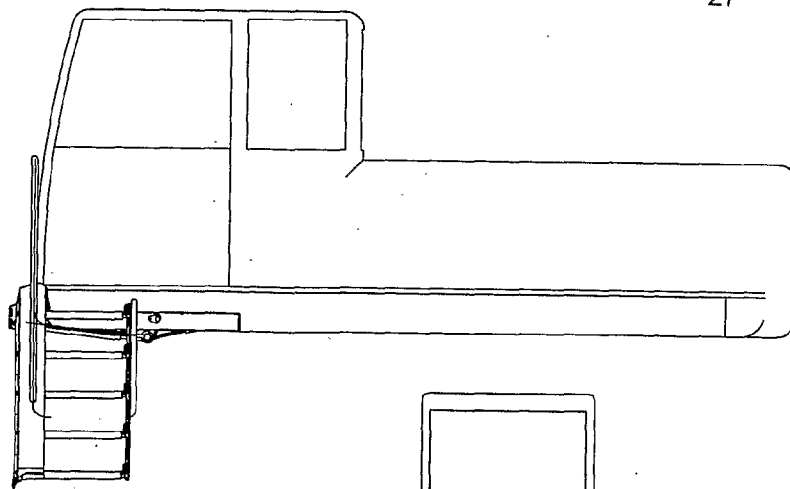


Fig 8



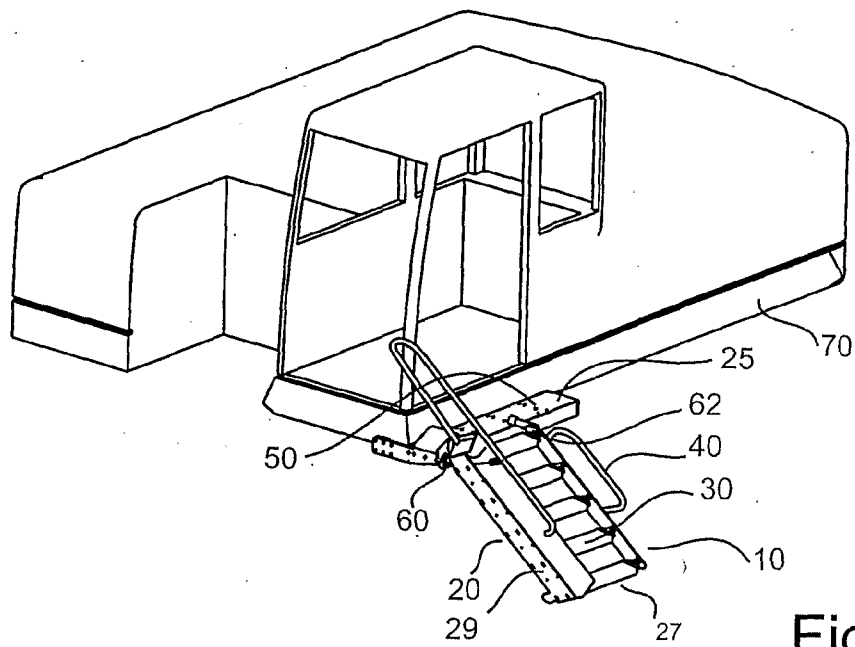
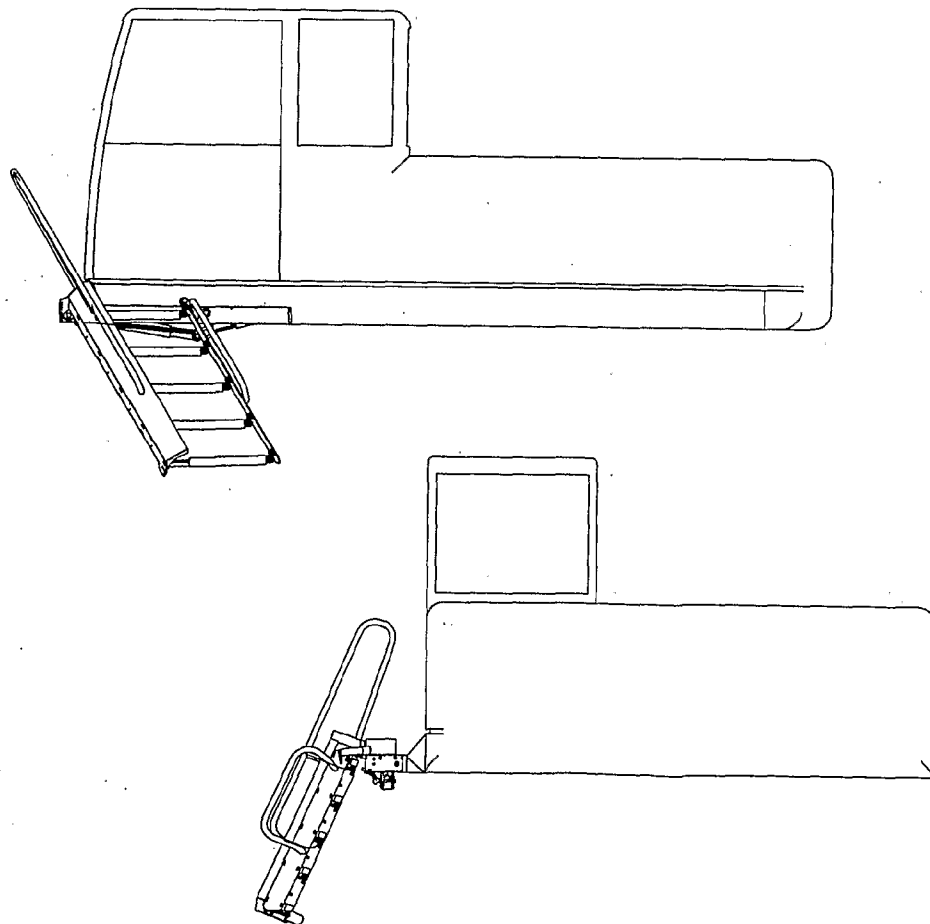
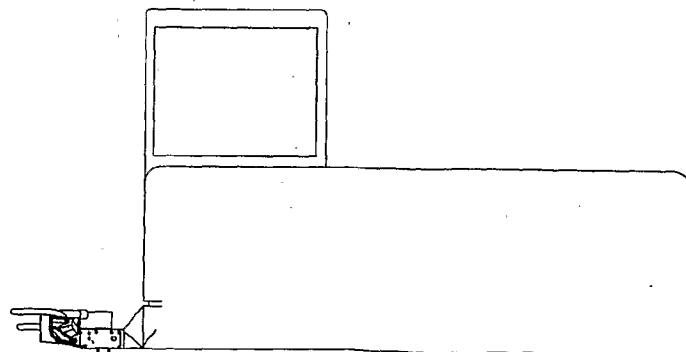
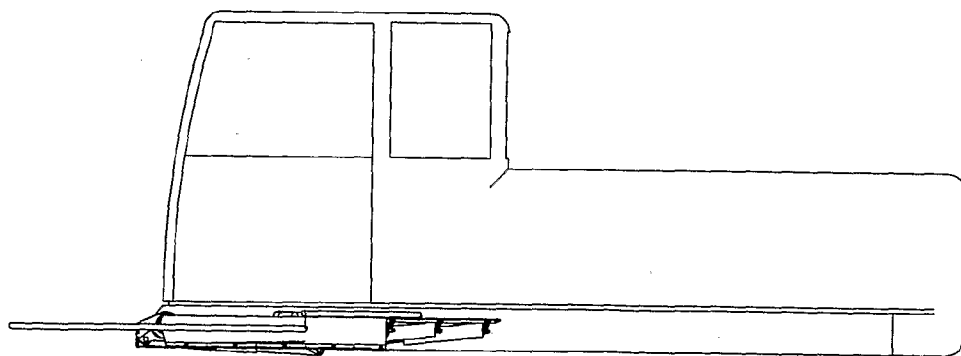
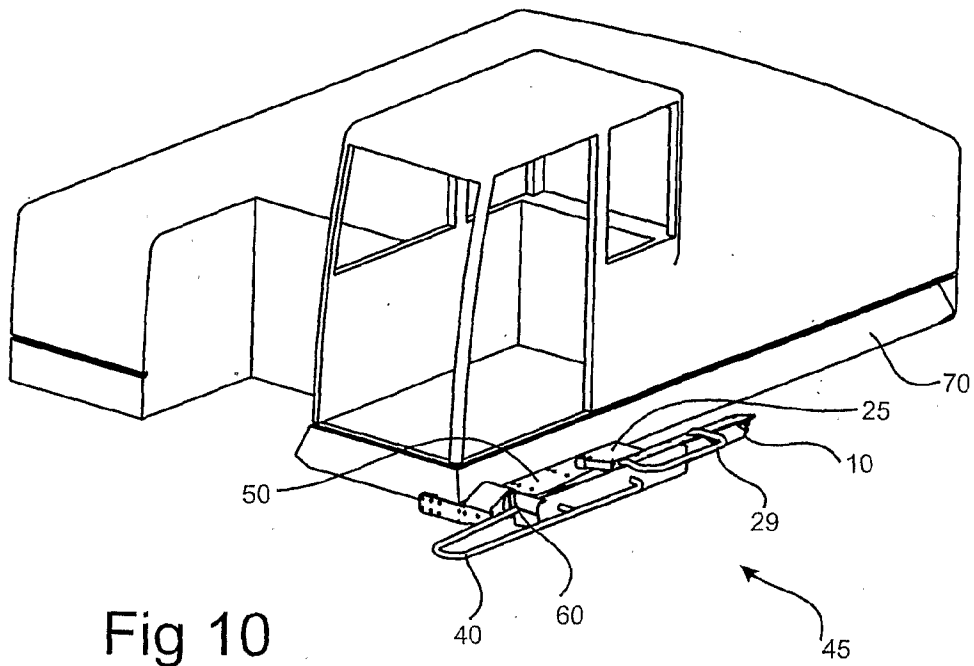


Fig 9





INTERNATIONAL SEARCH REPORT

International application No.

PCT/AU2006/001807

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl. **B60R 3/02** (2006.01), **E06C 5/02** (2006.01)

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)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

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

DWPI: IPC /IC B60R-003, E06C-005, B63B-027, B62D-025/22 and keywords PIVOT, SWING, DEPLOY, ALIGN, INLINE and several terms.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6029775 A (HEDLEY et al.) 29 February 2000 Whole document	1-4, 9-10
X	US 4217971 A (RIVINIUS) 19 August 1980 Whole document	1-5, 9-10
A	US 2005/0263976 A1 (BROCKWAY) 1 December 2005 Whole document	1

☒ Further documents are listed in the continuation of Box C

☒ See patent family annex

* "A"	Special categories of cited documents: document defining the general state of the art which is not considered to be of particular relevance	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"E"	earlier application or patent but published on or after the international filing date	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"O"	document referring to an oral disclosure, use, exhibition or other means	"&"	document member of the same patent family
"P"	document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search
28 February 2007

Date of mailing of the international search report
07 MAR 2007

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/AU2006/001807

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	2005263976	US	2003230867		
US	4217971	CA	1126175		
US	6029775	AU	15451/99	CA	2261359 ZA 9901025
Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001.					
END OF ANNEX					