(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 705 108 A1

(12) # EUROPEAN PATENT APPLICATION

(43) Date of publication:
27.09.2006 Bulletin 2006/39

(51) Int Cl.:
B62D 65/18 *(2006.01)* ***B66F 7/06*** *(2006.01)*

(21) Application number: **05006311.4**

(22) Date of filing: **22.03.2005**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU MC NL PL PT RO SE SI SK TR
Designated Extension States:
AL BA HR LV MK YU

(71) Applicant: **ROFA Rosenheimer Förderanlagen GmbH**
83059 Kolbermoor (DE)

(72) Inventor: **Meinzinger, Bruno**
81477 München (DE)

(74) Representative: **Hartz, Nikolai**
Wächtershäuser & Hartz
Patentanwälte
Weinstrasse 8
80333 München (DE)

(54) **Lifting device and lift carrier containing the same**

(57) A lifting device (1), comprising an overhead support means (2) hoisting means (3) mounted on the support means (2), which has a longitudinal axis extending in hoisting direction from a lower end (31) of the hoisting means toward the support means, and -load receiving means (4) provided at the lower end (31) of the hoisting means (3); characterized in that the hoisting means (3) comprises hoisting subassemblies, said hoisting subassemblies (31, 32, 33, 34) being assembled to a laterally and longitudinally rigid hoisting assembly (35) when passing the support means (2) in the downward direction and said hoisting assembly (35) is being disassembled when passing the support means in the upward direction.

EP 1 705 108 A1

Description

Field of the invention

[0001] The present invention relates to a lifting device comprising an overhead support means, a hoisting means mounted on the support means and a load receiving means. The lifting device according to the present invention may be used for an overhead lift carrier for assembling vehicles, in particular automobiles. The present invention also relates to a process for lowering a load, in particular with a lifting device according to the invention, which provides enhanced control and stability of the load. The present invention, furthermore, provides a process for lifting a load with a lifting device, in particular with a lifting device according to the invention, which provides enhanced control and stability of the load.

Background of the invention

[0002] Lift carrier systems in the automobile industry must meet a number of strict requirements in order to be useful in an industrial setting. Most importantly, the lift carrier systems must be suitable for high precision transportation of large and heavy loads such as car bodies. In particular, lateral stability of the load receiving means must be assured independent of the vertical position of the load receiving means in order to allow precise positioning despite forces acting on the loads in a lateral direction during assembly procedures. Given that a vertical lift of up to 7 m is frequently required, the resistance of the lifting device against lateral displacement of the load must be extremely high. Typically, at a maximum lowering position, a lateral displacement of less than 15 mm is required.

[0003] Moreover, lift carrier systems must be reliable and require limited maintenance in order to avoid any interference with the highly integrated production processes of an industrial setting in the automotive industry. Accordingly, lift carrier systems must be simple and cost effective in design so as to justify an investment in an ever shortening product cycle in the automotive industry. Lift carrier systems must be adaptable to the constraints of a production facility where space is precious and a large vertical lift is often essential despite a limited available height of the facility. Finally, lift carrier systems must meet strict safety requirements, in order to be accepted by regulatory or safety authorities, in particular when overhead assembly procedures are intended.

[0004] Lifting devices, in particular for lift carriers used in the automotive industries for assembling automobiles and other vehicles, are known. Conventional lift carrier systems comprising an overhead support means may be moved along an overhead rail system. Fig. 1 shows a typical conventional lift carrier system. Such conventional lift carrier systems comprise hoisting means having belt assemblies and scissors guide assemblies for lifting a load receiving means. The belt assemblies are used for actively lifting the load by driving the belts using a plurality of synchronized drive means. The scissors assemblies are required for passively providing stability to the hoisting means and thereby to the load attached to the load receiving means. Given that a failure of the belt assembly inevitably results in a maximum extension of the scissor assembly, a further means for stopping and securing the load receiving means at a predetermined level of the vertical lift in case of catastrophic belt failure is required by most regulatory or safety authorities in order to allow overhead assembly.

[0005] The severe requirements imposed on a lift carrier are only partly met by conventional lift carrier devices comprising belt assemblies and scissors guide assemblies. On the one hand, stability and control over a heavy load and the strict safety requirements call for redundant design features whereby multiple scissors guide and belt elements lead to an excessively heavy and costly design. Accordingly, conventional lift carriers for use in the automotive industry for transporting a load of about 2.0 tons have a weight of about 3.7 tons. Accordingly, the entire lifting device including the load has about the triple weight as compared with the load alone. The weight problem is even more aggravated when a large vertical lift is required, since the increase of the vertical lift by using a scissors guide assembly increases rapidly the space requirements and the weight of the lifting device.

[0006] Conventional lifting devices use belts of about 40 m in length in order to provide a vertical lift of only about 2 to 5 m. However, belts usually use resin based materials reinforced by metal wires. Due to the presence of resin based materials, problems of aging of the resin based materials frequently occur, whereby additional maintenance and adjustment of the belts is necessary. Due to the great length of the belts, even a small elasticity of the belt translates into an inaccuracy of the vertical position of the load and into problems in synchronizing the drive means. Moreover, the use of a scissors guide element provides non-uniform lateral stability properties over the distance of the vertical lift when the load is lifted. Therefore, the overall performance of conventional scissor and belt based systems is further limited.

[0007] The manufacture of scissors guide elements useful for a lifting device of a generic lifting device is a highly complex task and increases significantly the costs for the lifting device. Moreover, the belt assemblies require extensive maintenance since a highly precise length adjustment of the belts is necessary for an acceptable performance. Finally, it is usually not possible to transfer a lifting device from the original assembly line setting to a different assembly line setting or even to change the existing assembly line setting when different vertical lift requirements must be met, since the change of the vertical lift of a given scissors guide assembly is usually impossible.

[0008] Departing from the conventional lifting devices for lift carrier as used for assembling automobiles and other vehicles, it is the problem of the present invention to provide a lifting device useful in the automotive industry, which comprises an overhead support means, hoisting means mounted on the support means and a load receiving means provided at the lower end of the hoisting means, which does not need to rely on scissors guide and belt assemblies, and which at the same time provides a light and highly versatile design, a uniform control of the load over the entire vertical lift, and an enhanced lateral stability in any position of the load.

[0009] This problem is solved according to the invention by a lifting device according to claim 1. The present invention provides a lifting device, comprising an overhead support means, a hoisting means mounted on the support means, which has a longitudinal axis extending in hoisting direction from a lower end of the hoisting means toward the support means, and load receiving means provided at the lower end of the hoisting means. A lifting device according to the present invention is characterized in that the hoisting means comprises hoisting subassemblies, said hoisting subassemblies being assembled to a laterally and longitudinally rigid hoisting assembly when passing the support means in the downward direction and said hoisting assembly is being disassembled when passing the support means in the upward direction.

[0010] According to the present invention, a scissors guide and belt assembly of a conventional lifting device is avoided. Instead simple and cost effective hoisting subassemblies are employed which may contain segments which can be standardized and exchanged between different lifting devices, if desired, independent from the specific vertical lift requirements of the different lifting devices. The hoisting subassemblies are assembled to a laterally and longitudinally rigid hoisting assembly supported by the support means when passing the support means in the downward direction. Accordingly, the hoisting subassemblies are driven by drive means provided at the support means and guided into a predetermined relative position while being supported by the support means so that adjacent hoisting subassemblies approach and releasably engage in a locking position, wherein lateral movement of the hoisting assembly is excluded. The hoisting assembly is being disassembled when the hoisting subassemblies are driven by drive means provided at the support means in the opposite direction. The previous movement is reversed so that adjacent hoisting subassemblies disengage from the locking position. The hoisting subassemblies are driven and guided to a storage position. Preferably, the hoisting subassemblies comprise segments which are pivotally connected so that during storage, the hoisting subassembly may be efficiently stowed in the storage means.

[0011] Accordingly, the hoisting assembly provides a uniform and improved lateral stability over the entire distance of the vertical lift. Moreover, since belt failure is excluded, additional safety measures for catastrophic belt failure may be avoided.

[0012] The present invention also provides a process for lowering a load with a lifting device, said process comprises the steps of providing a hoisting means comprising hoisting subassemblies, which is mounted on a support means, said hoisting means having a longitudinal axis extending in hoisting direction from a lower end of the hoisting means toward the support mean assembling the hoisting subassemblies to a laterally and longitudinally rigid hoisting assembly by moving the hoisting subassemblies across the support means in the downward direction.

[0013] Moreover, the present invention provides a process for lifting a load with a lifting device, said process comprises the steps of providing a hoisting means comprising hoisting subassemblies, which is mounted on a support means, said hoisting means having a longitudinal axis extending in hoisting direction from a lower end of the hoisting means toward the support means; disassembling the hoisting assembly my moving the hoisting subassemblies across the support means in the upward direction.

[0014] The lifting device according to the invention is preferably used in the automotive industry such as for the manufacture of vehicles, in particular automobiles.

[0015] The present invention is based on the concept of providing a lifting device which does not need to rely on conventional scissors guide assemblies and/or belt assemblies. The lifting device according to the invention relies on a plurality of hoisting subassemblies preferably comprising segments which are pivotally connected. Accordingly, each subassembly represents a structure having lateral stability at least in a first direction perpendicular to the longitudinal axis of the hoisting subassembly while at the same time being laterally pivotally in a second direction which is perpendicular to the first direction. If each subassembly comprises segments which are pivotally connected, the subassembly may be folded above the support means so as to minimize the space required for storage of the segments. A lifting device of the present invention comprises a plurality of hoisting subassemblies. The hoisting subassemblies cooperate when guided through the support means with adjacent hoisting subassemblies so as to form a stable hoisting assembly.

[0016] The hoisting means according to the present invention has a highly uniform structure. Accordingly, it is possible to provide an extended vertical lift while at the same time maintaining the high stability and control over the entire distance of the vertical lift. Moreover, it is possible to change the vertical lift by increasing or reducing the number of segments without having to resort to a fundamental change of the design.

[0017] Moreover, the segments are light in design so that the overall weight of a lifting device may be significantly reduced. An embodiments may be provided which is capable of replacing a conventional lift carrier having a weight of 3.7 tons, whereby the weight of the lift carrier of the invention is only in the range of 2.3 tons, which represents a significant reduction as compared to the prior art.

[0018] The hoisting subassemblies are assembled into three-dimensional hoisting means having lateral stability in any direction perpendicular to the longitudinal axis of the hoisting means.

Description of the preferred embodiments

[0019] Fig. 1 shows a conventional lift carrier system comprising a scissors guide assembly and a belt assembly.

[0020] Fig. 2 shows a perspective side view of a lifting device according to the invention, wherein the load receiving means is in the lowermost position.

[0021] Fig. 3 shows a schema tical representation of the assembly of hoisting subassemblies to a hoisting means.

[0022] Fig. 4 shows a perspective side view of a lifting device according to the invention, wherein the load receiving means is in the uppermost position.

[0023] The present invention will now be described with regard to preferred embodiments. Fig. 2 shows a lifting device (1) according to the present invention. The lifting device (1) comprises an overhead support means (2). The overhead support means (2) may be mounted on a conventional overhead carrier system. Alternatively, the overhead support means (2) may be mounted on a static structure. The lifting device may comprise tappet means (201) connected to a drive means, which engages and actuates a segment of a hoisting subassembly. The overhead support means (2) comprises a drive means (20) for actuating hoisting subassemblies. Accordingly, drive means (20) actuate tappet means (not shown in Fig. 2) which engage segments (301) of a hoisting subassembly (31, 32, 33, 34) for moving the hoisting subassemblies in a vertical direction.. The overhead support means (2) further comprises guiding means (22) for guiding the hoisting subassemblies from a storing means (23) towards the location were hoisting subassemblies are assembled to a hoisting means. The overhead support means (2) further comprises storing means for folding the hoisting subassemblies when the hoisting means is lifted.

[0024] The lifting device (1) comprises a hoisting means (3). The hoisting means (3) comprises a lower end (30) and a plurality of hoisting subassemblies (31, 32, 33, 34) assembled to form a hoisting assembly. Each hoisting subassembly comprises a plurality of segments (301). Segments may comprise cam means (311) for engaging tappet means of the drive means (20).

[0025] The lifting device also comprises a load receiving means (4) for receiving and holding a load such as a car body.

[0026] According to a preferred embodiment of the lifting device according to the invention, the hoisting subassemblies (31, 32, 33, 34) comprise segments (301) which are pivotally connected. It is especially preferred that the segments are frame-work segments. Accordingly, the lifting device may be provided with and increased stability in vertical and lateral direction while having a reduced weight. The segments are preferably pivotally around an axis perpendicular to the longitudinal axis of the hoisting means. Even more preferably, the hoisting assembly (35) is a load-bearing structure.

[0027] In a preferred embodiment, a tappet means (201) engages a segment of a hoisting subassembly when the hoisting means moves in the upward direction and pivots the segment around an axis perpendicular to the longitudinal axis, thereby decoupling the hoisting subassembly from adjacent hoisting subassemblies (31, 32, 33, 34). Furthermore, the support means (2) of the lifting device according to the invention may comprise a guiding means (22) for receiving a cam means (311) provided on a segment (301). According to the invention, the lifting device comprises at least two subassemblies (31, 32, 33, 34) which may be directly actuated by a drive means and the remaining subassemblies (31, 32, 33, 34) are indirectly actuated by a drive means via a directly actuated subassembly (31, 32, 33, 34).

[0028] According to the most preferred embodiment, the lifting device according to the invention comprises a hoisting assembly (35) having four subassemblies (31, 32, 33, 34).

[0029] The lifting device may be part of a lifting carrier comprising the lifting device, whereby the overhead support means is contained in a trolley mounted on a horizontal member. The lifting carrier may be an electrified monorail system (EMS). In a preferred embodiment, the lifting device may comprise a lifting-swing mechanism or a lifting-swing-tilting mechanism for positioning the load. The lifting carrier according to the invention may have a maximum lifting height of 2 to 7 m and a pivot of 40° to 150°.

[0030] The process for lowering a load with a lifting device comprises the steps of:

> providing a hoisting means (3) comprising hoisting subassemblies, which is mounted on a support means (2), said hoisting means having a longitudinal axis extending in hoisting direction from a lower end (30) of the hoisting means toward the support means;
>
> assembling the hoisting subassemblies to a laterally and longitudinally rigid hoisting assembly (35) by moving the hoisting subassemblies across the support means (2) in the downward direction.

[0031] As shown in Fig. 3, subassemblies (31, 32, 33, 34) are guided into close proximity so that adjacent subassemblies may engage, thereby forming a three-dimensional hoisting assembly.

[0032] The process for lifting a load with a lifting device comprises the steps of:

> providing a hoisting means (3) comprising hoisting subassemblies, which is mounted on a support means (2), said hoisting means having a longitudinal

axis extending in hoisting direction from a lower end (30) of the hoisting means toward the support means;
disassembling the hoisting assembly (35) my moving the hoisting subassemblies across the support means in the upward direction.

[0033] Fig. 4 shows a representation of a lifting device according to te present invention, wherein the load receiving means (4) is in the uppermost position. Accordingly, the hoisting means is completely lifted whereby the hoisting assembly is disassembled and the hoisting subassemblies are stored in the storing means (23). Given that the present invention is not constrained by the presence of a scissors guide means which needs to be accommodated between the support means and the load receiving means of conventional lifting devices, the lifting device requires less space in a vertical direction for lifting a load to a predetermined level. Moreover, due to the absence of a heavy scissors guide assembly, the lifting device according to the present invention may be mounted on a lift carrier device which relies on only two support rollers instead of four as in the conventional lifting devices, which additionally reduces the weight of the device.

[0034] In general. the present invention relates according to a first aspect to a lifting device (1), comprising

(a) overhead support means (2)

(b) hoisting means (3) mounted on the support means (2), which has a longitudinal axis extending in hoisting direction from a lower end (30) of the hoisting means toward the support means, and

(c) load receiving means (4) provided at the lower end (30) of the hoisting means (3);
characterized in that

- the hoisting means (3) comprises hoisting subassemblies,
- said hoisting subassemblies (31, 32, 33, 34) being assembled to a laterally and longitudinally rigid hoisting assembly (35) when passing the support means (2) in the downward direction and said hoisting assembly (35) is being disassembled when passing the support means in the upward direction.

2. The lifting device according to aspect 1, wherein the hoisting subassemblies (31, 32, 33, 34) comprise segments (301).

3. The lifting device according to aspect 2, wherein the segments are pivotally connected.

4. The lifting device according to aspect 2 or 3, wherein the segments are frame-work segments.

5. The lifting device according any one of aspects 3 or 4, wherein the segments are pivotal around an axis perpendicular to the longitudinal axis of the hoisting means.

6. The lifting device according to any one of the preceding aspects, wherein the hoisting assembly (35) is a load-bearing structure.

7. The lifting device according to any one of the preceding aspects, wherein the overhead support means comprises a drive means (20) for actuating one or more hoisting subassemblies (31, 32, 33, 34).

8. The lifting device according to any of the preceding aspects, wherein the drive means comprises tappet means (201) engaging and actuating a segment of a hoisting subassembly.

9. The lifting device according to aspect 8, wherein the tappet means (201) engages a segment of a hoisting subassembly when the hoisting means moves in the upward direction and pivots the segment around an axis perpendicular to the longitudinal axis, thereby decoupling the hoisting subassembly from adjacent hoisting subassemblies (31, 32, 33, 34).

10. The lifting device according to aspect 9, wherein the support means (2) comprises a guiding means (22) for receiving a cam means (311) provided on a segment (301).

11. The lifting device according to aspect 9 or 10, wherein the support means (2) further comprises a storing means (23) for accommodating a portion of a subassembly (31, 32, 33, 34) which has been decoupled from adjacent subassemblies (31, 32, 33, 34).

12. The lifting device according to any one of the preceding aspects wherein at least two subassemblies (31, 32, 33, 34) are directly actuated by a drive means and the remaining subassemblies (31, 32, 33, 34) are indirectly actuated by a drive means via a directly actuated subassembly (31, 32, 33, 34).

13. The lifting device according to any one of the preceding aspects, wherein the hoisting assembly (35) contains four subassemblies (31, 32, 33, 34).

14. A lifting carrier comprising the lifting device according to any one of the preceding aspects.

15. The lifting carrier according to aspect 14, wherein the overhead support means is a trolley mounted on a horizontal member.

16. The lifting carrier according to aspect 15, which is an electrified monorail system.

17. The lifting carrier according to aspect 16, wherein the lifting device comprises a lifting-swing mechanism or a lifting-swing-tilting mechanism.

18. The lifting carrier according to any one of aspects 14 to 17, which has a maximum lifting height of 2 to 7 m.

19. The lifting carrier according to any one of aspects 17 or 18, which has a pivot of 40° to 150°.

20. A process for lowering a load with a lifting device, said process comprises the steps of:

(a1) providing a hoisting means (3) comprising hoisting subassemblies, which is mounted on a support means (2), said hoisting means having a longitudinal axis extending in hoisting direction from a lower end (31) of the hoisting means toward the support means;
(b1) assembling the hoisting subassemblies to a laterally and longitudinally rigid hoisting assembly (35) by moving the hoisting subassemblies across the support means (2) in the downward direction.

21. A process for lifting a load with a lifting device, said process comprises the steps of:

(a1) providing a hoisting means (3) comprising hoisting subassemblies, which is mounted on a support means (2), said hoisting means having a longitudinal axis extending in hoisting direction from a lower end (31) of the hoisting means toward the support means;
(b2) disassembling the hoisting assembly (35) my moving the hoisting subassemblies across the support means in the upward direction.

22. The process of any one of aspects 20 or 21, wherein the hoisting subassemblies (31, 32, 33, 34) comprise segments (301).

23. The process according to aspect 22, wherein the segments are pivotally connected.

24. The process according to aspect 22 or 23, wherein the segments are frame-work segments.

25. The process according any one of aspects 23 or 24, wherein the segments are pivotal around an axis perpendicular to the longitudinal axis of the hoisting means.

26. The process according to any one of aspects 20 to 25, wherein the hoisting assembly (35) is a load-bearing structure.

27. The process according to any one of aspects 20 to 26, wherein the overhead support means comprises a drive means (20) for actuating one or more hoisting subassemblies (31, 32, 33, 34).

28. The process according to aspects 20 to 27, wherein the drive means comprises tappet means (201) engaging and actuating a segment of a hoisting subassembly.

29. The process according to aspect 28, wherein the tappet means (201) engages a segment of a hoisting subassembly when the hoisting means moves in the upward direction and pivots the segment around an axis perpendicular to the longitudinal axis, thereby decoupling the hoisting subassembly from adjacent hoisting subassemblies (31, 32, 33, 34).

30. The process according to aspect 29, wherein the support means (2) comprises a guiding means (22) for receiving a cam means (311) provided on a segment (301).

31. The process according to aspect 29 or 30, wherein the support means (2) further comprises a storing means (23) for accommodating a portion of a subassembly (31, 32, 33, 34) which has been decoupled from adjacent subassemblies (31, 32, 33, 34).

32. The process according to any one of the preceding aspects wherein at least two subassemblies (31, 32, 33, 34) are directly actuated by a drive means and the remaining subassemblies (31, 32, 33, 34) are indirectly actuated by a drive means via a directly actuated subassembly (31, 32, 33, 34).

33. The process according to any one of the preceding aspects, wherein the hoisting assembly (35) contains four subassemblies (31, 32, 33, 34).

34. Use of a lifting device according to any one of aspects 1 to 13 for the manufacture of vehicles.

35. The use according to aspect 34, wherein the vehicles are cars.

Claims

1. A lifting device (1), comprising

(a) overhead support means (2)
(b) hoisting means (3) mounted on the support means (2), which has a longitudinal axis extending in hoisting direction from a lower end (30) of

the hoisting means toward the support means, and
(c) load receiving means (4) provided at the lower end (30) of the hoisting means (3);
characterized in that

- the hoisting means (3) comprises hoisting subassemblies,
- said hoisting subassemblies (31, 32, 33, 34) being assembled to a laterally and longitudinally rigid hoisting assembly (35) when passing the support means (2) in the downward direction and said hoisting assembly (35) is being disassembled when passing the support means in the upward direction.

2. The lifting device according to claim 1, wherein the hoisting subassemblies (31, 32, 33, 34) comprise frame-work segments (301) pivotal around an axis perpendicular to the longitudinal axis of the hoisting means.

3. The lifting device according to any one of the preceding claims, wherein the hoisting assembly (35) is a load-bearing structure.

4. The lifting device according to any one of the preceding claims, wherein the overhead support means comprises a drive means (20) for actuating one or more hoisting subassemblies (31, 32, 33, 34), which comprises tappet means (201) engaging and actuating a segment of a hoisting subassembly.

5. The lifting device according to claim 4, wherein the tappet means (201) engages a segment of a hoisting subassembly when the hoisting means moves in the upward direction and pivots the segment around an axis perpendicular to the longitudinal axis, thereby decoupling the hoisting subassembly from adjacent hoisting subassemblies (31, 32, 33, 34).

6. A lifting carrier comprising the lifting device according to any one of the preceding claims.

7. The lifting carrier according to claim 6, wherein the overhead support means is a trolley mounted on a horizontal member.

8. A process for lowering a load with a lifting device, said process comprises the steps of:

(a1) providing a hoisting means (3) comprising hoisting subassemblies, which is mounted on a support means (2), said hoisting means having a longitudinal axis extending in hoisting direction from a lower end (31) of the hoisting means toward the support means;
(b1) assembling the hoisting subassemblies to a laterally and longitudinally rigid hoisting assembly (35) by moving the hoisting subassemblies across the support means (2) in the downward direction.

9. A process for lifting a load with a lifting device, said process comprises the steps of:

(a1) providing a hoisting means (3) comprising hoisting subassemblies, which is mounted on a support means (2), said hoisting means having a longitudinal axis extending in hoisting direction from a lower end (31) of the hoisting means toward the support means;
(b2) disassembling the hoisting assembly (35) my moving the hoisting subassemblies across the support means in the upward direction.

10. Use of a lifting device according to any one of claims 1 to 5 for the manufacture of vehicles.

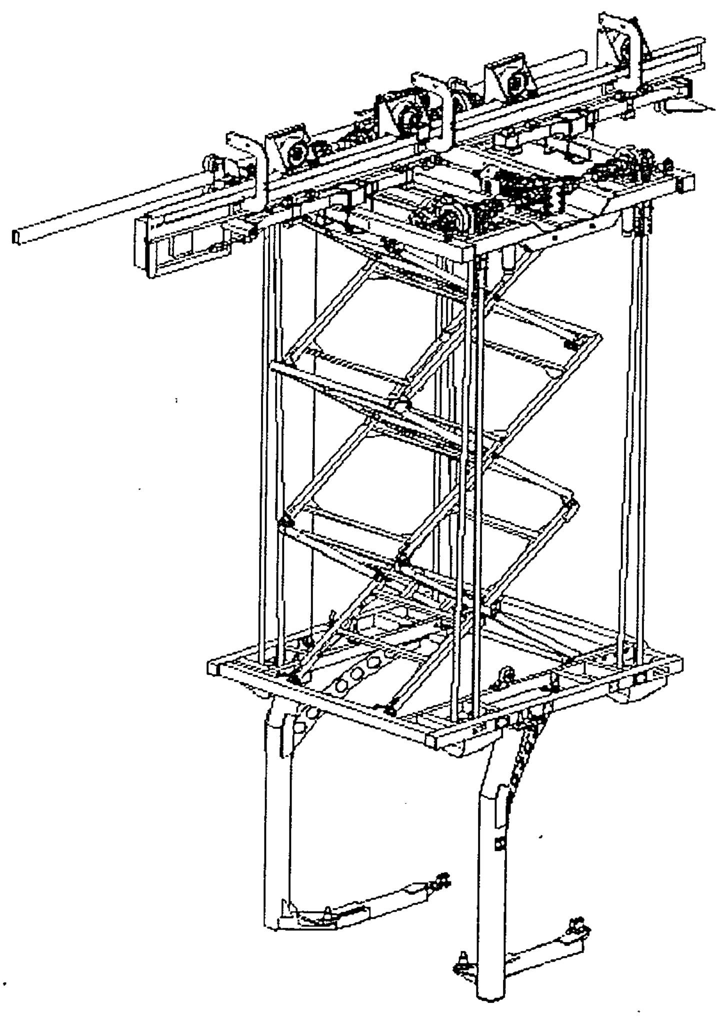
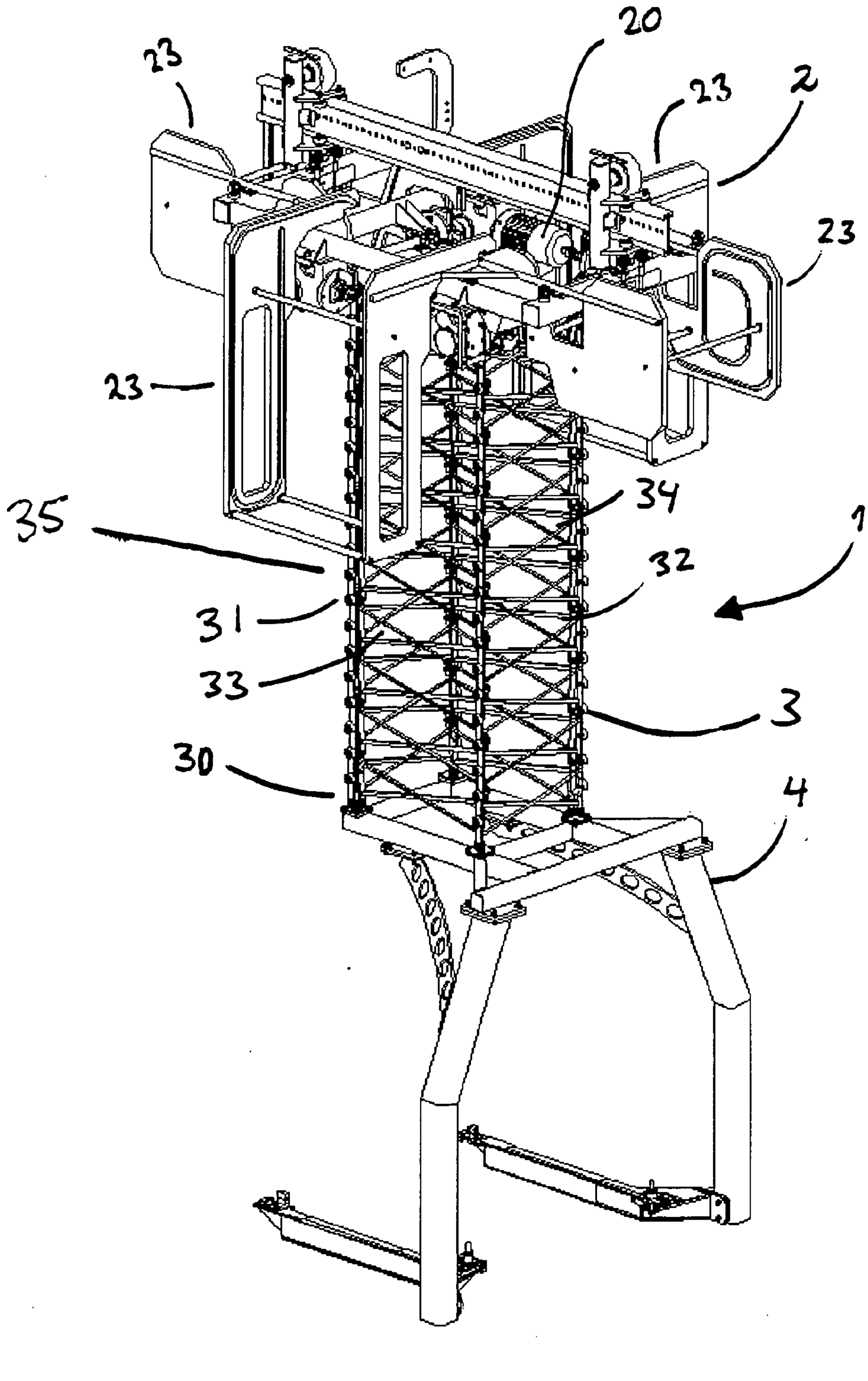


Fig 1 (PRIOR ART)

Fig 2



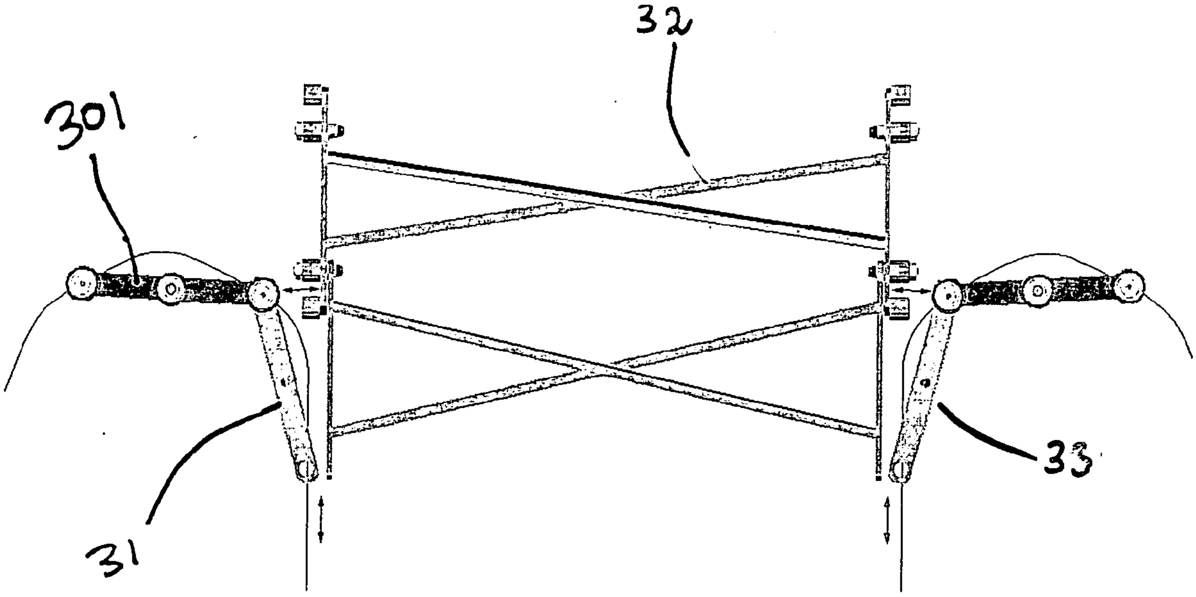


Fig. 3

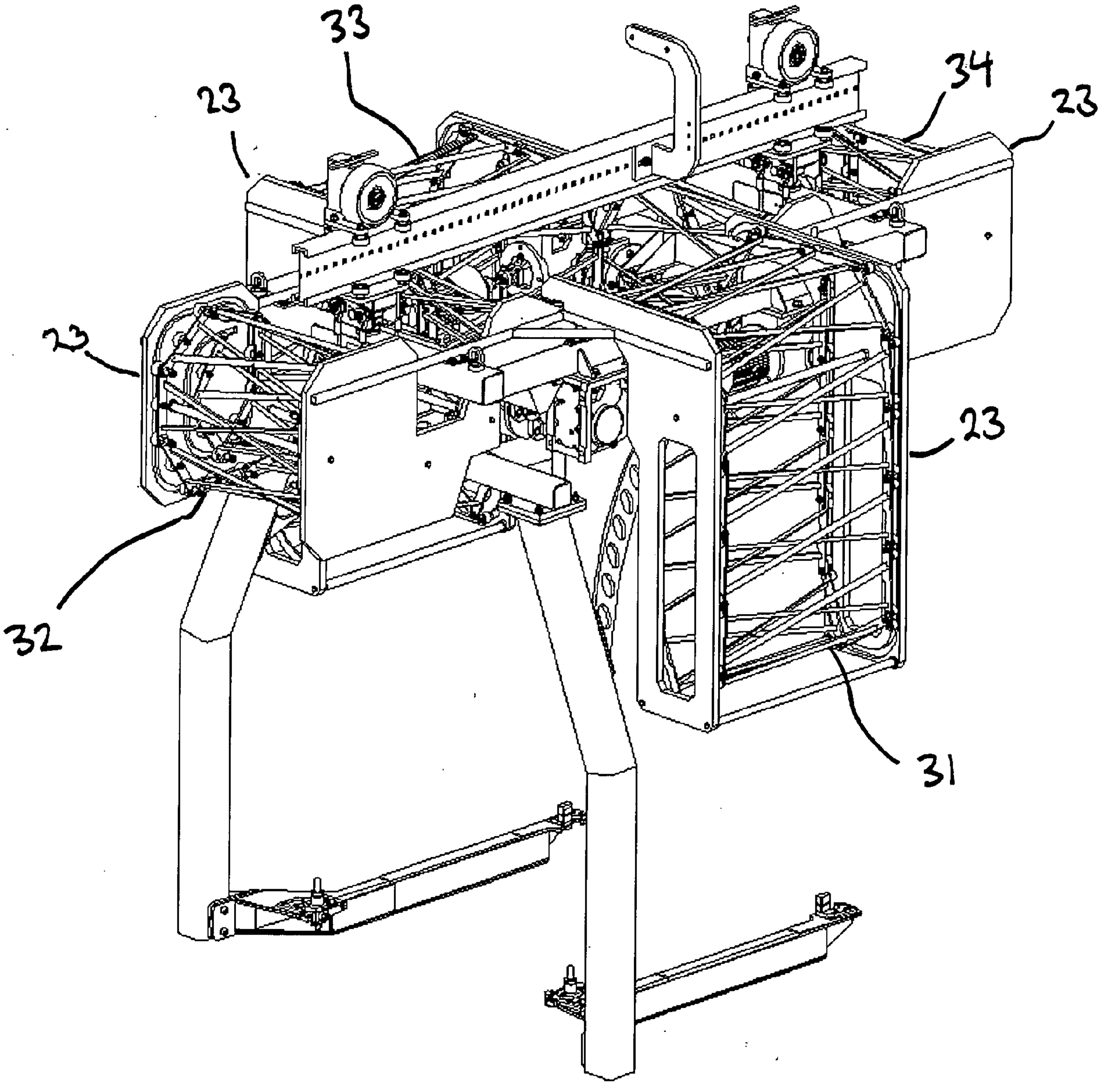


Fig 4

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 05 00 6311

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
A	DE 199 57 468 A1 (MANNESMANN AG) 13 June 2001 (2001-06-13) * figures 1-3; compounds 1-5,17A,17B,18-20,23-25 *	1-4,6-10	B62D65/18 B66F7/06
A	US 2 767 812 A (BOGER RAY E) 23 October 1956 (1956-10-23) * figures 1,5,12 *	1-3,8,9	
A	EP 0 963 904 A (LOPEZ ALBA, ADELARDO) 15 December 1999 (1999-12-15) * figures 1,3; compounds 10A-10C *	1-3,6-10	
A	US 6 571 970 B1 (SPOELER HANS-GERD ET AL) 3 June 2003 (2003-06-03) * figures 1,2 *	1,3,6-10	

TECHNICAL FIELDS SEARCHED (Int.Cl.7)

B62D
B66F
B65G

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	1 September 2005	Masset, M

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons
& : member of the same patent family, corresponding document

1

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 05 00 6311

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

01-09-2005

Patent document cited in search report		Publication date	Patent family member(s)			Publication date
DE 19957468	A1	13-06-2001	AT	252012	T	15-11-2003
			AU	2349201	A	04-06-2001
			BR	0015792	A	09-07-2002
			WO	0138162	A1	31-05-2001
			DE	50004109	D1	20-11-2003
			EP	1240071	A1	18-09-2002
			ES	2208456	T3	16-06-2004
			MX	PA02005167	A	07-11-2002
			US	2005186058	A1	25-08-2005
US 2767812	A	23-10-1956	NONE			
EP 0963904	A	15-12-1999	EP	0963904	A1	15-12-1999
			AT	252998	T	15-11-2003
			DE	69819304	D1	04-12-2003
			DE	69819304	T2	29-07-2004
			ES	2210658	T3	01-07-2004
			PT	963904	T	31-03-2004
US 6571970	B1	03-06-2003	DE	20102052	U1	26-07-2001

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82