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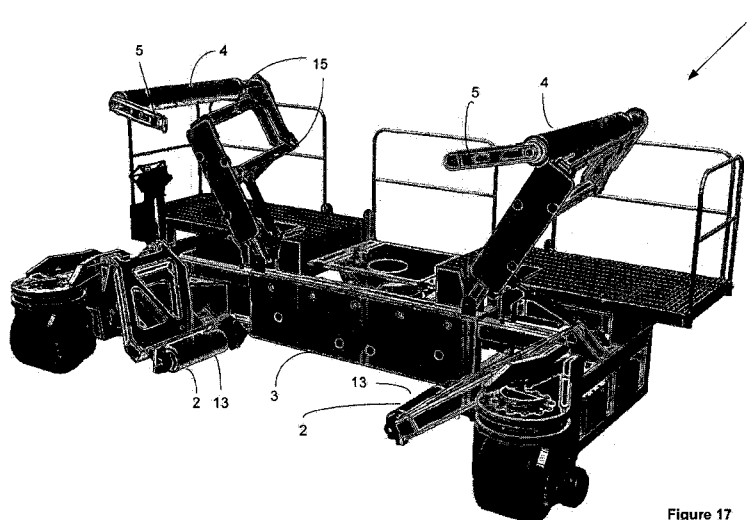


Figure 17

(57) Abstract: An article handling apparatus (1) including a frame (3) adapted to receive the article (7) on a support means; a plurality of wheels attached to said frame (3) for movement of said frame (3) over a substrate surface; and retaining arms (4) operatively coupled to the frame (3) and adapted to releasably secure the article (1) to the frame (1). The secured article (1) is movable in a controlled manner with respect to the frame (3) by movement of the support means and the retaining arms (4).

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HANDLING DEVICE AND METHOD

BACKGROUND OF THE INVENTION

5

The present invention relates to an article handling apparatus. In particular, the present invention relates to an apparatus for transporting an article, such as, but not limited to a wheel or other spare part, and for handling the article in a replacement or installation process. The invention has particular application in the mining and earthmoving fields.

10

DESCRIPTION OF THE PRIOR ART

The reference in this specification to any prior publication (or information derived from it), or to any matter which is known, is not, and should not be taken as, an
15 acknowledgement or admission or any form of suggestion that that prior publication (or information derived from it) or known matter forms part of the common general knowledge in the field of endeavour to which this specification relates.

Large earthmoving vehicles, for example those used in mining, typically have
20 correspondingly large tyres. Replacing these oversized tyres can be an onerous task requiring multiple staff, and in most cases, the assistance of bulky machinery that is often difficult to manoeuvre within the workshop or other space-limited environment. Such lifting equipment is generally not compact and easily transportable.

25 SUMMARY OF THE INVENTION

The present invention seeks to provide an article handling device for handling articles such as tyres or other spare parts, within a workshop environment or other confined space where a small device foot print is required.

30

In one broad form the present invention provides, an article handling apparatus including:

a frame adapted to receive the article on a support means;

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a plurality of wheels attached to said frame for movement of said frame over a substrate surface; and

at least one retaining arm operatively coupled to the frame and adapted to releasably secure the article to the frame,

5 wherein the secured article is movable in a controlled manner with respect to the frame by movement of the support means and the retaining arm.

In one form the support means includes a pair of supporting arms extending from the frame.

10

In one form, the article handling apparatus includes a plurality of retaining arms.

In a further form, the retaining arms extend substantially upwardly from the frame and claw-like end portions of the retaining arms are configured to extend over the article
15 and clamp the article securely to the frame.

In one form, the claw-like end portions are retractable or rotatable to permit the article to be removed.

20

In one form, the retaining arms are hingedly connected to the frame.

In one form, the retaining arms are adapted to tilt relative to the frame.

In one form, the retaining arms are adjustable to accommodate articles of different
25 sizes.

In one form, the apparatus includes three wheels.

In one form, the apparatus includes two front wheels and a rear wheel, the rear wheel
30 being movable independent of the two front wheels.

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In one form, the retaining arms and/or the supporting arms include rollers to allow rotation of the secured article.

In a further form the article handling apparatus includes at least one tilting arm
5 operatively coupled to the rear wheel, the tilting arm operating to tilt the secured article forward and rearward.

In one form the article handling apparatus is configured to handle a tyre.

10 In a further form the retaining arm contactingly engages both walls of the tyre to securely clamp the tyre.

In a further form the rollers contact the tyre tread to rotate the tyre.

15 BRIEF DESCRIPTION OF THE DRAWINGS

Examples of the present invention will now be described with reference to the accompanying drawings, in which:

20 Figure 1 is a perspective view of one example of the article handling apparatus handling a large tyre (frame not shown);

Figure 2 is perspective view of one example of the article handling apparatus handling a small tyre (frame not shown);

25

Figure 3 is a rear view of one example of the article handling apparatus retracted to fit in a standard shipping container envelope;

Figure 4 is a side view of one example of the article handling apparatus retracted to
30 fit in a standard shipping container envelope;

Figure 5 is a table indicating different modes of operation of one example of the

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article handling apparatus;

Figure 6 is a side view of one example of the article handling apparatus showing article tilted forward;

5

Figure 7 is a side view of one example of the article handling apparatus showing article tilted rearward;

Figure 8 is a front view of one example of the article handling apparatus handling a large tyre;

10

Figure 9 is a is a front view of one example of the article handling apparatus handling a small tyre;

Figure 10 is a rear view of one example of the article handling apparatus handling a small tyre;

15

Figure 11 is a rear view of one example of the article handling apparatus handling a large tyre;

20

Figure 12 is a side view of one example of the article handling apparatus handling a large tyre;

Figure 13 is a side view of one example of the article handling apparatus handling a small tyre;

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Figure 14 is a rear view of one example of the article handling apparatus having claw-like end portions retracted;

Figure 15 is a rear view of one example of the article handling apparatus with claw-like end portion extended and securing a tyre.

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- 5 -

Figure 16 is perspective view of one example of the article handling apparatus;

Figure 17 shows a front perspective view of a preferred embodiment of the article handling apparatus in accordance with the present invention;

5

Figure 18 illustrates a rear perspective view of the embodiment shown in Figure 17;

Figure 19 shows an alternative rear perspective view of the embodiment illustrated in Figure 17;

10

Figure 20 shows a front view of the embodiment illustrated in Figure 17;

Figure 21 illustrates a rear view of the embodiment shown in Figure 17;

15

Figure 22 illustrates a side view of the embodiment shown in Figure 17;

Figure 23 illustrates a top view of the embodiment shown in Figure 17;

Figure 24 illustrates a front perspective view of the article handling apparatus, shown in the embodiments illustrated in Figures 17 to 23, but with a large tyre shown being handled by the apparatus;

20

Figure 25 shows a rear perspective view of the apparatus shown in Figure 24;

25

Figure 26 shows a front perspective view of the apparatus shown in Figure 24;

Figure 27 illustrates a top view of the apparatus shown in Figures 24;

Figure 28 illustrates a side elevational view of the apparatus shown in Figure 24;

30

Figure 29 illustrates a smaller tyre being handled by the article handling apparatus of Figures 17 and 24;

- 6 -

Figure 30 illustrates a rear perspective view of the apparatus shown in Figure 29;

Figure 31 illustrates a front perspective view of the apparatus shown in Figure 29;

5

Figure 32 illustrates a top view of the apparatus shown in Figure 29.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

10 Throughout the drawings, like numerals will be used to identify similar features, except where expressly otherwise indicated.

 The foregoing describes only some embodiments of the present invention, and modifications and/or changes can be made thereto without departing from the scope and
15 spirit of the invention, the embodiments being illustrative and not restrictive.

 In the context of this specification, the word "comprising" means "including principally but not necessarily solely" or "having" or "including", and not "consisting only of". Variations of the word "comprising", such as "comprise" and "comprises" have
20 correspondingly varied meanings.

 Embodiments of the present invention provide an article handling apparatus including frame adapted to receive the article on a support means. A plurality of wheels are attached to the frame for movement of the frame over a substrate surface. At least one
25 retaining arm is operatively coupled to the frame and adapted to releasably secure the article to the frame. The secured article is movable in a controlled manner with respect to the frame by movement of the support means and the retaining arm.

 One embodiment of certain aspects of the invention is shown by the article handling
30 apparatus (1) illustrated in Figures 1 to 6, but without the frame of the apparatus, for ease of understanding the other components. An embodiment of the invention, including the frame, is then shown in Figures 17 to 32.

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In the embodiment shown, the article (7) being handled is a tyre. The article handling apparatus (1) includes a support means in the form of a pair of supporting arms (2) extending from a frame (3).

5

Two retaining arms (4) extend substantially upwardly from the frame (3) and claw-like end portions (5) of the retaining arms (4) are configured to extend over the article (7) and clamp the article (7) securely to the frame (3).

10

The claw-like end portions (5) are retractable to permit the article to be removed. The claw-like end portions (5) span the tyre width to provide opposing clamp support to upright portions (8) of the retaining arms. The span length (9) of the claw-like end portions (5) is adjustable to accommodate tyres of different sizes and may be controlled on each side by a set of parallel arms (15) attached to a hydraulic cylinder. As these parallel

15

arms (15) rotate the horizontal portion of the claw portion (10) extend both upwards and inwards towards the tyre.

This extension in length also gives a wide range of higher clamping positions for the larger tyres. Figure 12 shows the claw spanning a larger tyre whilst Figure 13 shows the

20

claw-like portions spanning a relatively smaller tyre.

The claw-like end portions (5) are able to rotate from an approximate position parallel to the upright portions (8) of the retaining arms (4) to a position greater than 90 degrees from the upright portions (8). This enables positioning of the claw-like end

25

portions (5) behind the tyres. Figures 14 and 15 show the claw in both retracted, and extended/engaging positions.

In one example this is achieved by attaching the claw to an extended shaft and then connecting the shaft to a dog-bone arm attached to a hydraulic cylinder.

30

The retaining arms (4) are hingedly connected to the frame and thereby tilt relative to the frame (3) to accommodate articles of different sizes. The two uprights portions (8)

- 8 -

act as the rear half of a tyre support clamp, the claw-like end portions providing the front half. Thus the retaining arm (4) contactingly engages both walls of the tyre to securely clamp the tyre.

5 The upright portions (8) tilt with respect to the frame (3) to provide support for different tyre sizes. The left and right upright portions can function independently as the upright portions (8) might need to be set at different angle configurations to avoid interference with different components on some vehicles. On smaller tyres the upright portions (8) will need to tilt inwards (Figure 10), while on larger vehicles the upright
10 portions (8) of the retaining arms (4) will need to tilt outwards (Figure 11).

In one example the tilt is controlled by a hydraulic cylinder. Motors, pneumatics or other alternative means may instead be used, as will be understood by a person skilled in the art.

15

The apparatus (1) has two front wheels (11) and a rear wheel (12), the rear wheel (12) capable of moving independent of the two front wheels (11). For example, the apparatus has the option to have rear drive only and also the option of combined full drive where all 3 drive wheel can act in unison. By turning front and rear to the steering limits
20 (ie 90 deg) side shift travel may be achieved by driving all 3 wheels at the same rate. Thus the apparatus (1) may be driven with all wheels in a parallel direction allowing side travel or alternatively the rear may be steered independently allowing the vehicle to turn in a tight circle for its footprint.

25 In one example a turntable and dog bone attached to a cylinder (or slew drive) is to be connected to each drive yoke allowing horizontal rotation about its vertical centre axis. The rotation of this arrangement may be 135 deg (nom).

The supporting arms (2) include rollers to allow rotation of the secured article (7).
30 The rollers (13) contact the tyre tread and the rotation of the roller against the tyre (7) causes the tyre (7) to rotate about its centre. The roller allows rotation of tyre assemblies for alignment onto flange supports. The roller length is sufficiently long to support the

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full length of a Cat777 tyre (OD 2340mm, width 750mm) and may be repositioned to support wider or narrower tyres. This may be achieved by the supporting arms (2) including telescopic tubing, thereby allowing manual extension or retraction along the length of the telescopic tube.

5

In some examples the retaining arms (4) may also include rollers to facilitate rotation of the tyre (7). In one example the rollers are controlled by a hydraulic motor and gearbox assembly attached to the roller.

10

The left and right supporting arms (2), complete with rollers (13), are able to raise and support the tyre assemblies. This lift function may be separated by left and right lift or a combined lift by using both controls in unison. These supporting arms may be raised by a hydraulic cylinder.

15

In one example the travel of the supporting arms needs to be low enough to clear under a large tyre (for example a Letorneau L1850, OD:4200mm, width:1500mm) when it is on the ground (Figure 8) but travel high enough to raise a small tyre (eg: Cat777, OD:2340, width 750mm) tyre to a reasonable working height (Figure 9).

20

The article handling apparatus (1) includes at least one tilting arm (14) operatively coupled to the rear wheel, the tilting arm operating to tilt the secured article forward and rearward. For example when the article is a tyre as in figures 1 to 15, front to rear tilt may be required to align the tyre to a wheel axis' that may not be parallel to the horizontal. Figures 6 and 7 show forward and rearward tilting.

25

In one example frontward and rearward tilt is to be achieved by a set of trailing arms attached to the rear wheel. These trailing arms are attached to a hydraulic cylinder that will typically raise the chassis +4/-2 deg (nom) from horizontal.

30

According to one example, the present invention provides a 3 driven wheel vehicle that will consist of a range of hydraulic arms and components that will raise and lower tyres, rotate secured tyres about their axis by a driven roller, stabilise the front and rear of

- 10 -

the tyre by a hydraulic clamp support mechanism and tilt forward or backward by raising and lowering a set of rear trailing arms to allow parallel alignment with the tyres axle. In addition to these requirements the tyre handler is able to retract so that it can fit within a standard shipping container. The tyre handler has the functionality of drive, steer, tilt, rotate, lift, upright tilt, claw retract, claw rotate. These functions can be broken down further to separate left and rear or front and rear to present a control panel similar to the one represented in Fig. 5. As shown in Figures 3 and 4, the tyre handler may be retracted within the 2330 x 2280 shipping container envelope.

Figures 17 to 32 illustrate another embodiment of the invention. Specifically, Figures 17 to 23 show the article handling apparatus in various views, without showing the article itself being supported, whilst Figures 24 to 28 show a large tyre being handled, and Figures 29 to 32 show a smaller tyre being handled by the same apparatus.

Referring to the embodiment shown in Figures 17 to 32, the article handling apparatus 1 includes a support means in the form of a pair of supporting arms 2 extending from a frame 3, two retaining arms 4 extending upwardly from the frame 3 having claw like end portions 5 which are configured to extend about the article 7 shown in Figures 24 to 32. It will be understood that the article 7 is thereby able to be securely clamped to the frame 3. To remove the article 7, the claw like end portions 5 may be retracted/rotated, as desired.

It will be appreciated from viewing Figures 17 to 32 that either extremely large tyres, such as shown in Figures 24 to 28, or smaller tyres such as shown in Figures 29 to 32 may be supported by the apparatus 1. In the embodiment shown in Figures 17 to 32, as opposed to the embodiment shown in Figures 1 to 16, the article does not necessarily need to be tilted in the event that the frame is stable by the provision of the wheels extending on either side of the apparatus.

The apparatus 1 has three wheels for movement of the apparatus over a substrate surface. Each wheel may be independently driven, by a controller. The controller may be either provided in situ on the apparatus, or, may be remotely controlled. Suitable

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electronic and/or hydraulic cylinders or other drive means may be utilised for movement of each of the component parts, rotation of the wheels, etc. It will be appreciated by the provisional of the three wheels, the apparatus 1 may be moved on a very small footprint.

- 5 The supporting arms 2 include rollers which allow for rotation of the tyre 7 or other article. Rotation of the rollers 13 by their contact with the tyre tread permit the tyre to rotate. This is useful in servicing and in installation removal of the tyre from a vehicle. The rollers may be controlled by hydraulic or electric motors. The left and right supporting arms, together with their rollers 13 are adapted to raise and support the tyre.
- 10 This lift function may be performed separately on the left and right supporting arms, or, they may be controlled in unison to raise, lower, rotate and reangle the article supported. It will be appreciated that the article handling apparatus of the present invention has a number of unique advantages over the known prior art which facilitates easy removal or installation of a tyre from a vehicle. The type may be easily manipulated in a wide variety
- 15 of angles, elevations, etc which facilitate servicing of the tyre and its associated vehicle. The apparatus of the present invention may be positioned adjacent the wheel of a vehicle to be serviced. The wheel may be secured or clamped by the apparatus, then detached from the vehicle to be serviced, without requiring any physical interaction by a person. The apparatus, containing the wheel may then be repositioned for servicing the wheel, and then
- 20 the wheel, or a new wheel, may be replaced on the vehicle by simply repositioning the apparatus and resealing the wheel. The low slung configuration of the article handling apparatus 1 of the present invention permits its provision and removal in a tightly confined space for example, in a mining situation. As shown in Figures 17 to 32, the apparatus may further include a working platform together with access ladders which enable service
- 25 personnel good access to the article being handled.

- Finally, it can be understood that the inventive concept in any of its aspects can be incorporated in many different constructions so that generality of the preceding description is not superseded by the particularity of the attached drawings. Various alterations,
- 30 modifications and/or additions may be incorporated into the various constructions and arrangements of parts without departing from the spirit or ambit of the present invention.

CLAIMS

1. An article handling apparatus including:
 - a frame adapted to receive the article on a support means;
 - 5 a plurality of wheels attached to said frame for movement of said frame over a substrate surface; and
 - at least one retaining arm operatively coupled to the frame and adapted to releasably secure the article to the frame;
 - wherein the secured article is movable in a controlled manner with respect to the
 - 10 frame by movement of the support means and the retaining arm(s).
2. An article handling apparatus as claimed in claim 1 wherein a support means includes a pair of supporting arms extending from the frame.
- 15 3. An article handling apparatus as claimed in claim 1 or 2 wherein the apparatus includes a plurality of retaining arms.
4. An article handling apparatus as claimed in claim 3 wherein the retaining arms extend substantially upwards from the frame and claw-like end portions of the retaining
- 20 arms are configured to extend over the article and clamp the article securely to the frame.
5. An article handling apparatus as claimed in claim 4 wherein the claw-like end portions are retractable or rotatable to permit the article to be removed.
- 25 6. An article handling apparatus as claimed in any one of claims 3 to 5 wherein the retaining arms are hingedly connected to the frame and thereby tilt relative to the frame to accommodate articles of different sizes.
7. An article handling apparatus as claimed in any one of claims 3 to 6 wherein the
- 30 apparatus includes two front wheels and a rear wheel, the rear wheel being movable independent of the two front wheels.

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8. An article handling apparatus as claimed in any one of claims 3 to 7 wherein each retaining arm and/or the supporting arm includes rollers to allow rotation of the secured article.
- 5 9. An article handling apparatus as claimed in any one of claims 3 to 8 wherein the article includes at least one tilting arm operatively coupled to the rear wheel, the tilting arm operating to tilt the secured article forward and rearward.
10. An article handling apparatus as claimed in claim 1 configured to handle a tyre.
- 10 11. An article handling apparatus as claimed in claim 10 wherein the retaining arm to contactingly engages both walls of the tyre to securely clamp the tyre.
12. An article as claimed in claim 10 wherein the rollers contact the tyre tread to rotate
- 15 the tyre.
13. An article handling apparatus substantially as herein described with reference to the accompanying figures.

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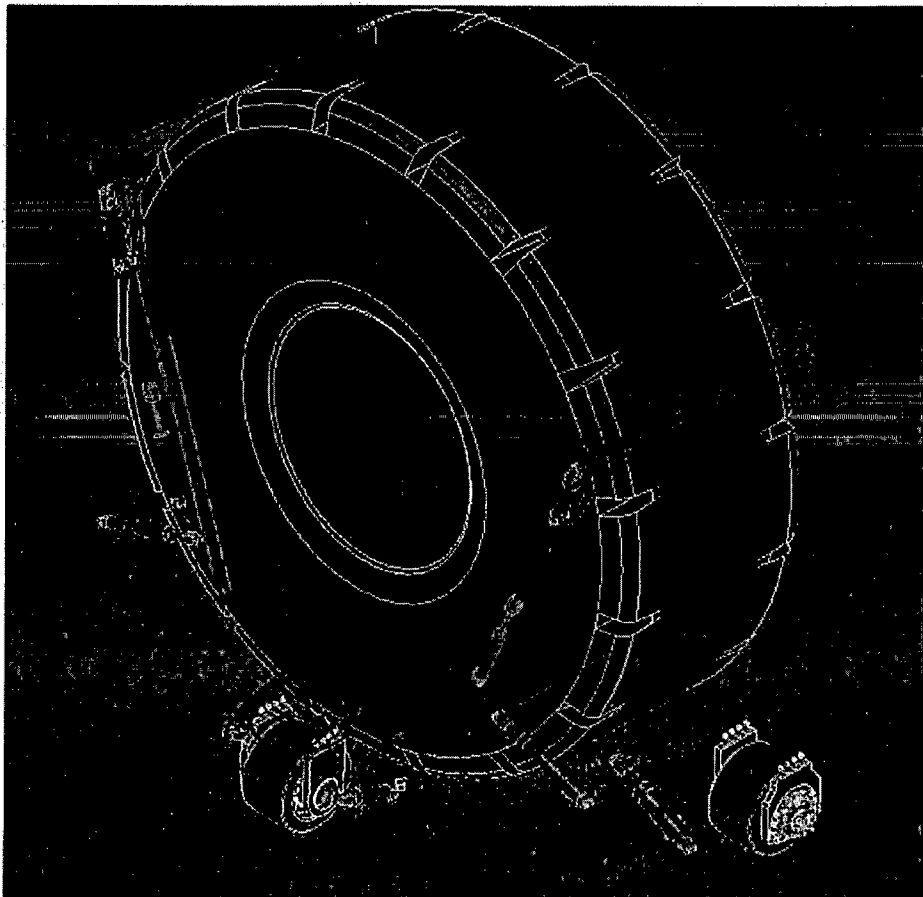


Figure 1

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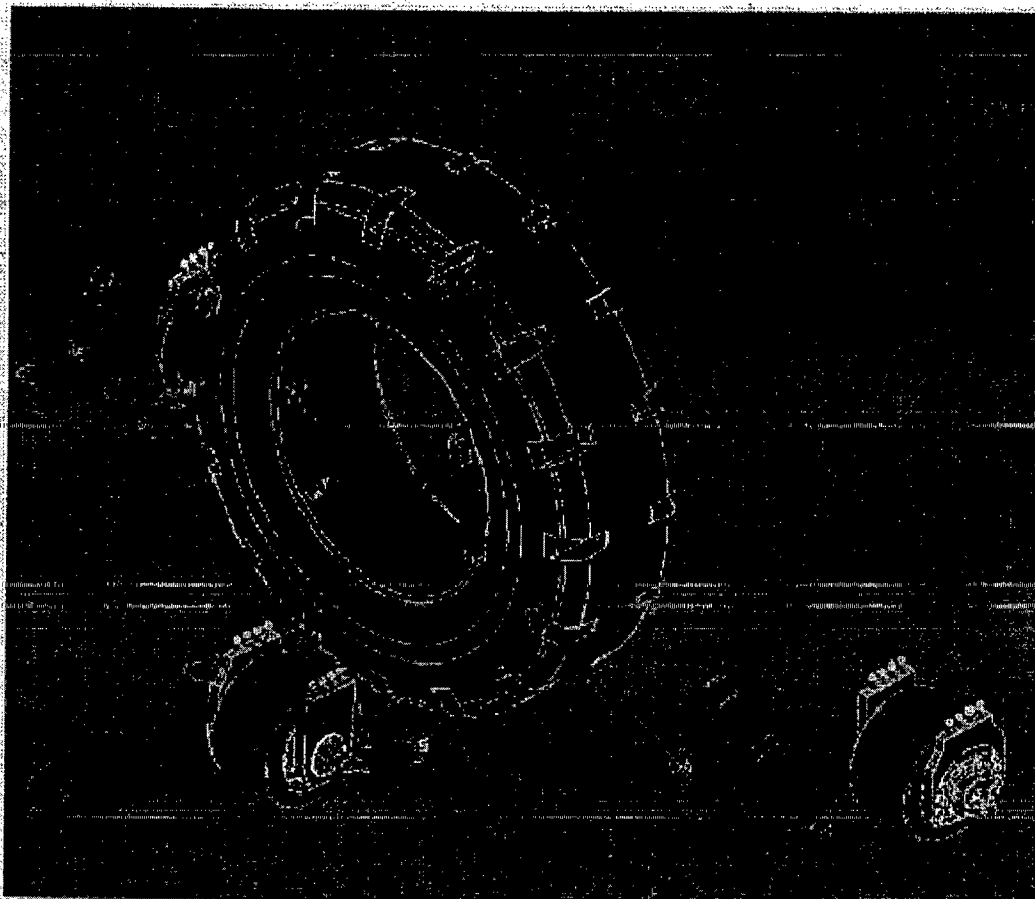


Figure 2



Figure 3

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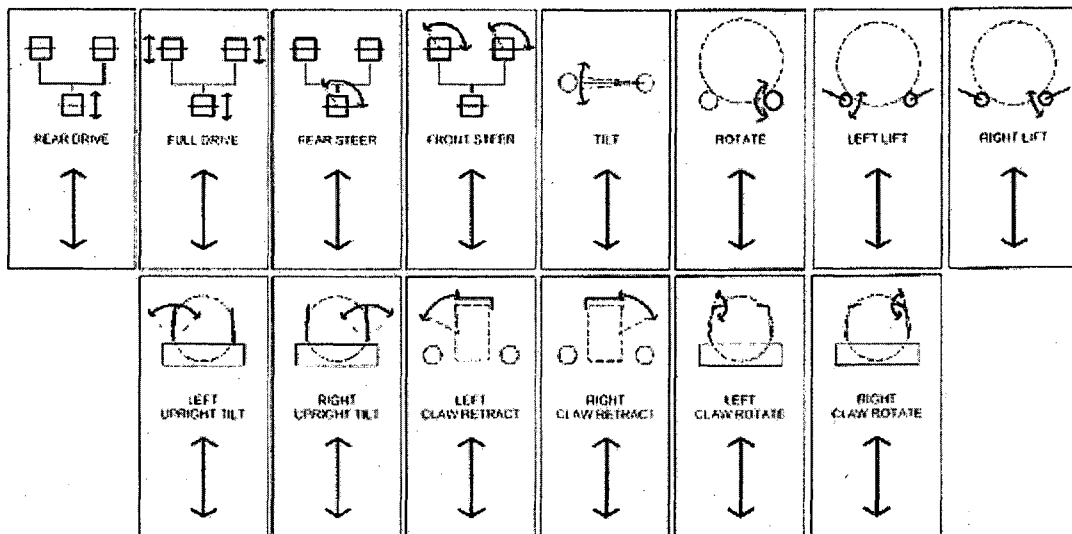


Figure 5

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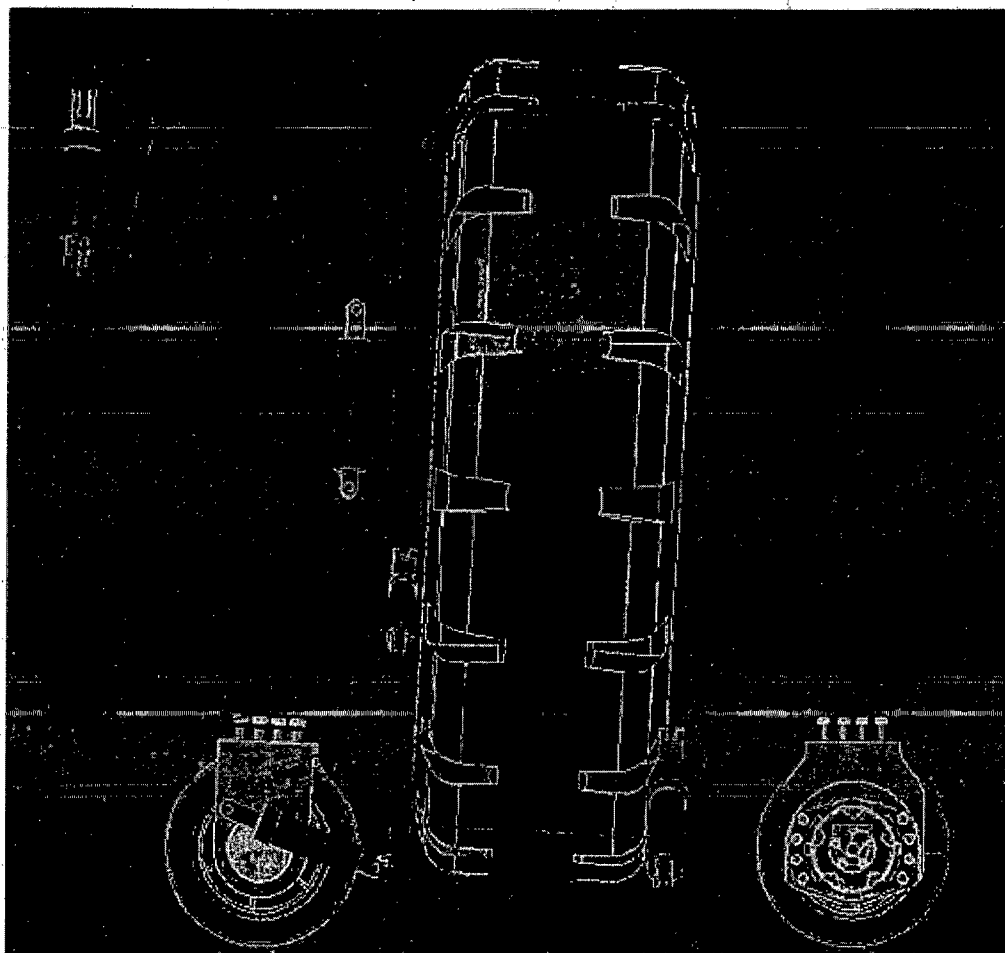


Figure 6

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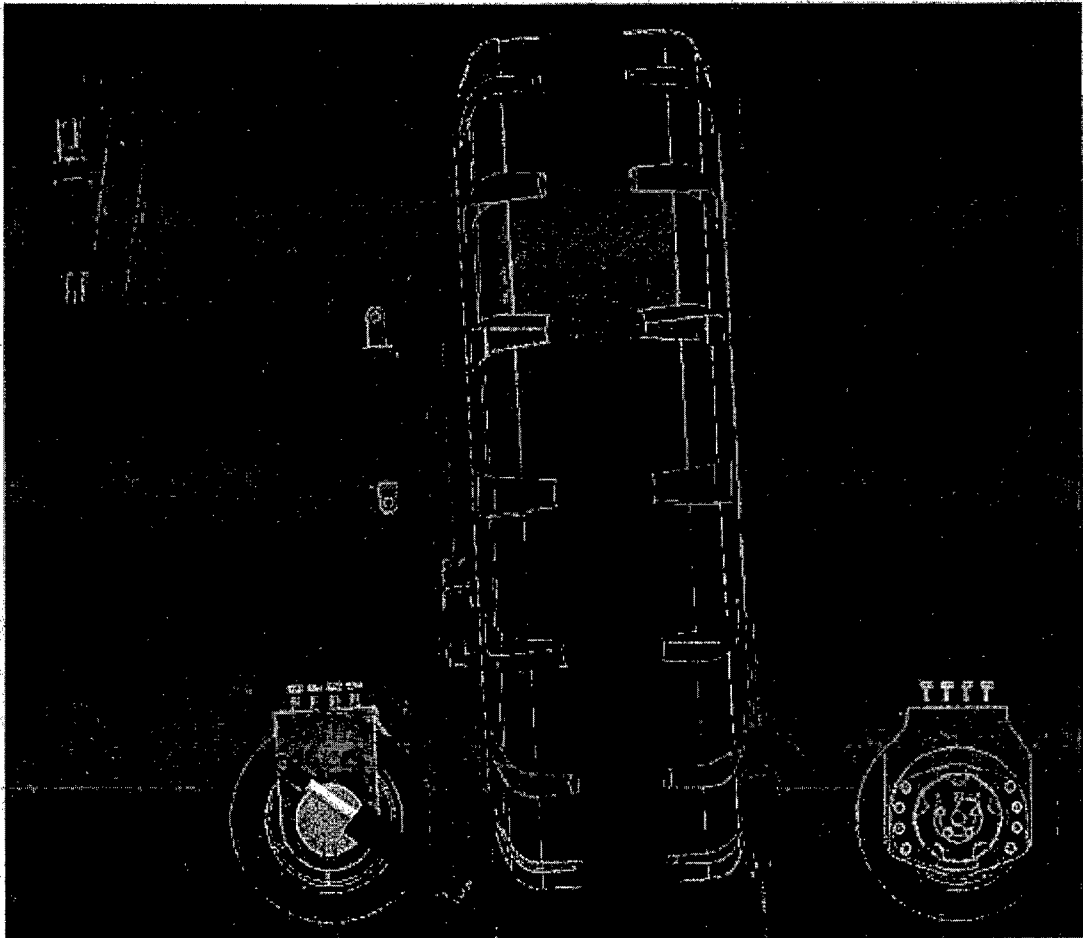
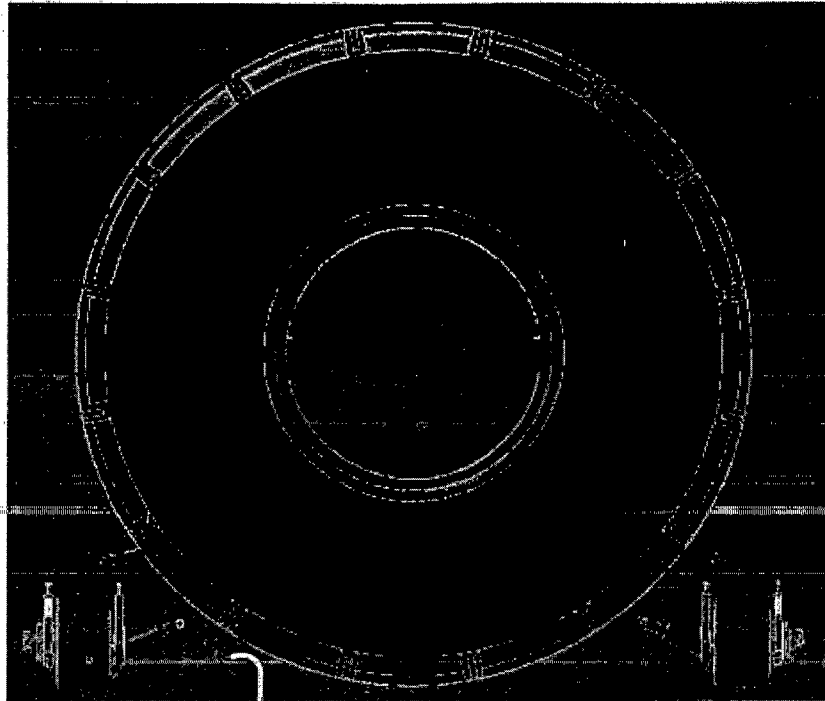


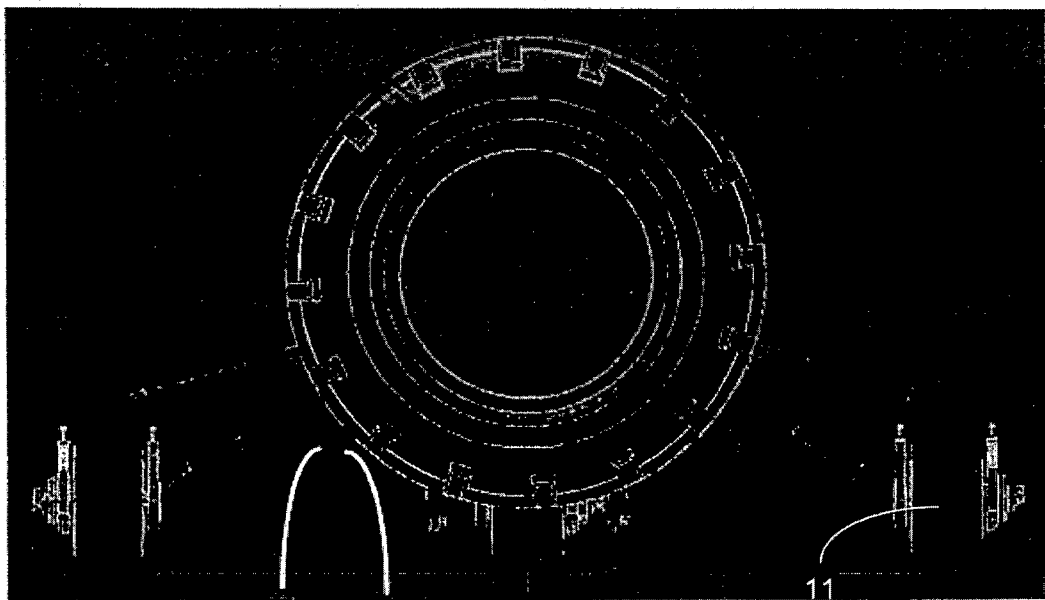
Figure 7

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2

Figure 8



2

13

11

Figure 9

- 8/28 -

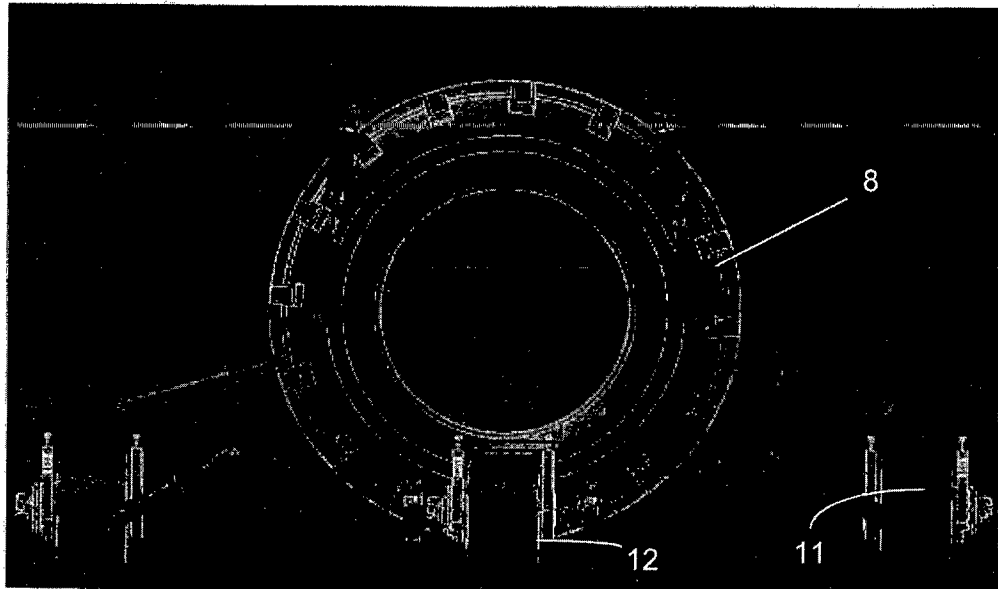


Figure 10

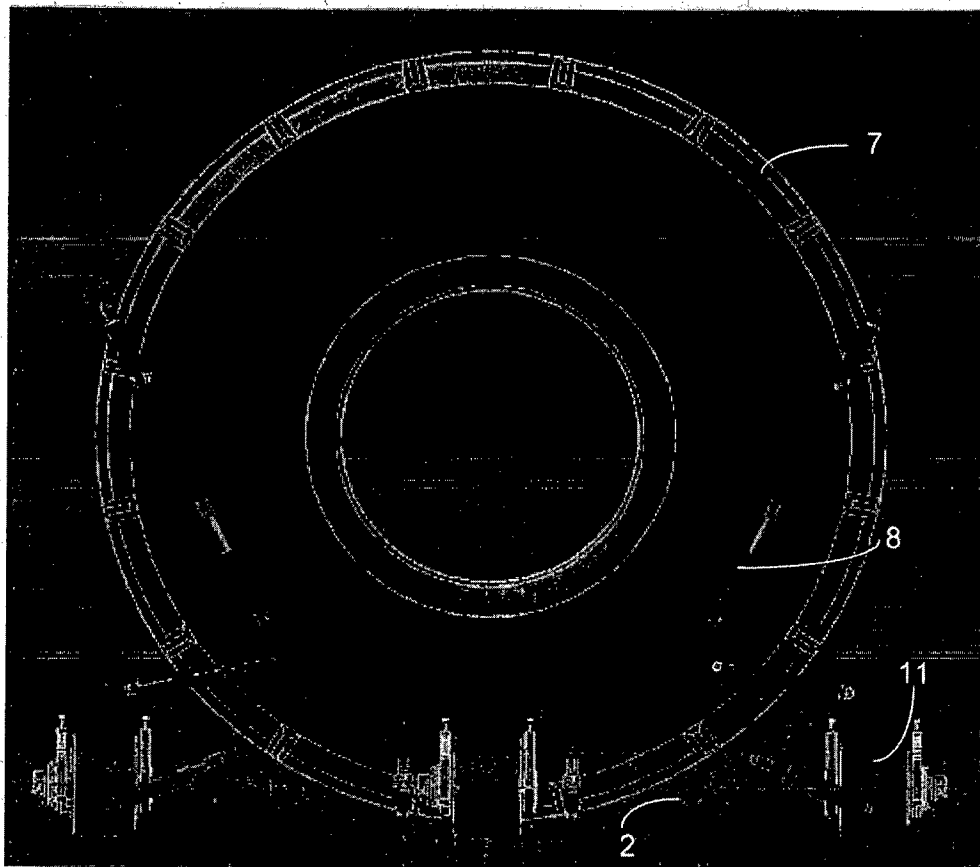


Figure 11

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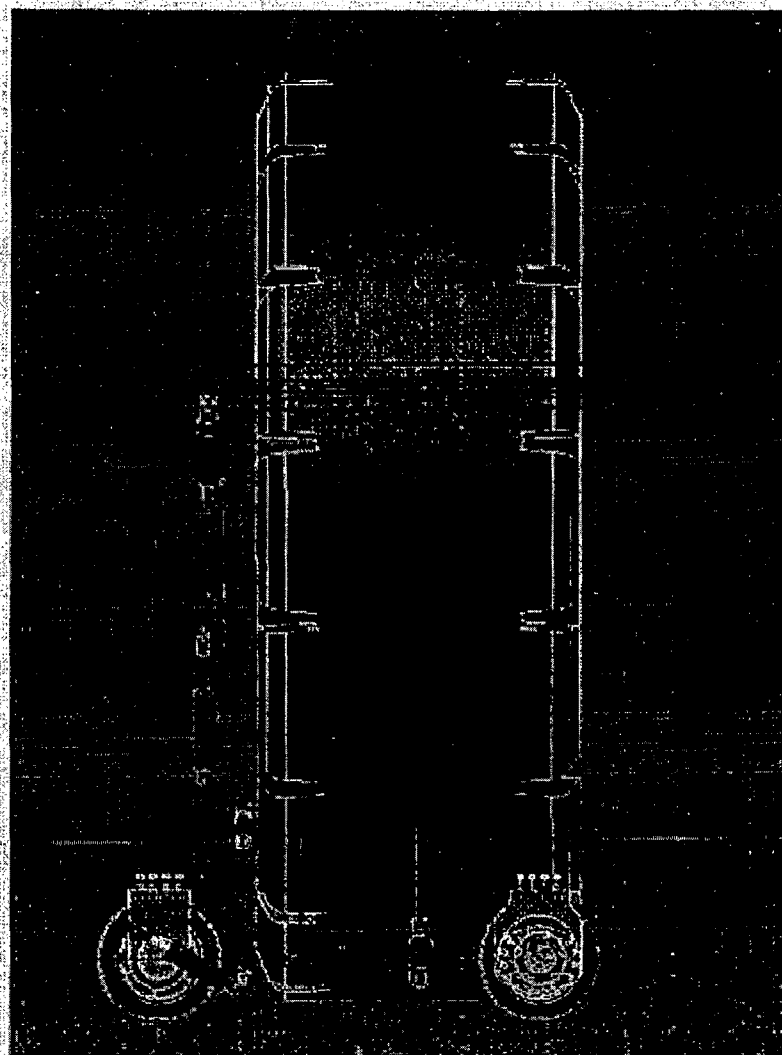


Figure 12

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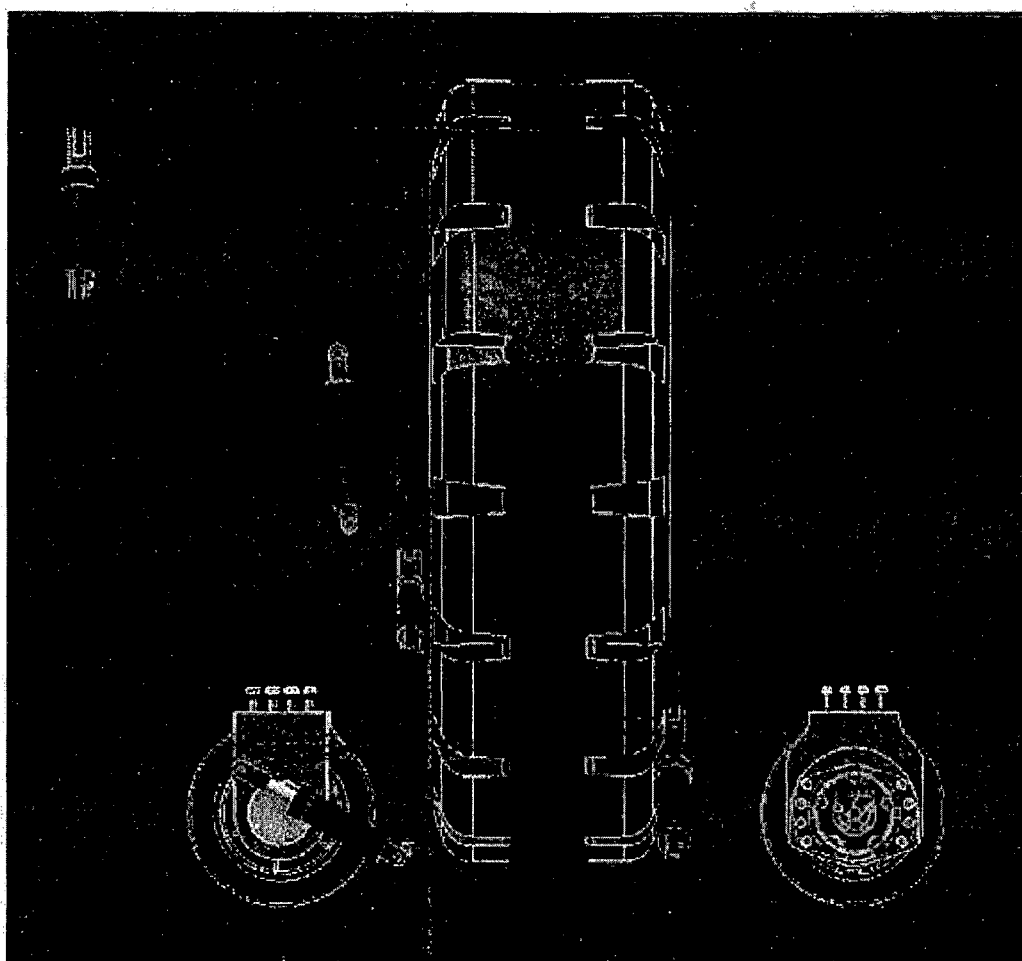


Figure 13

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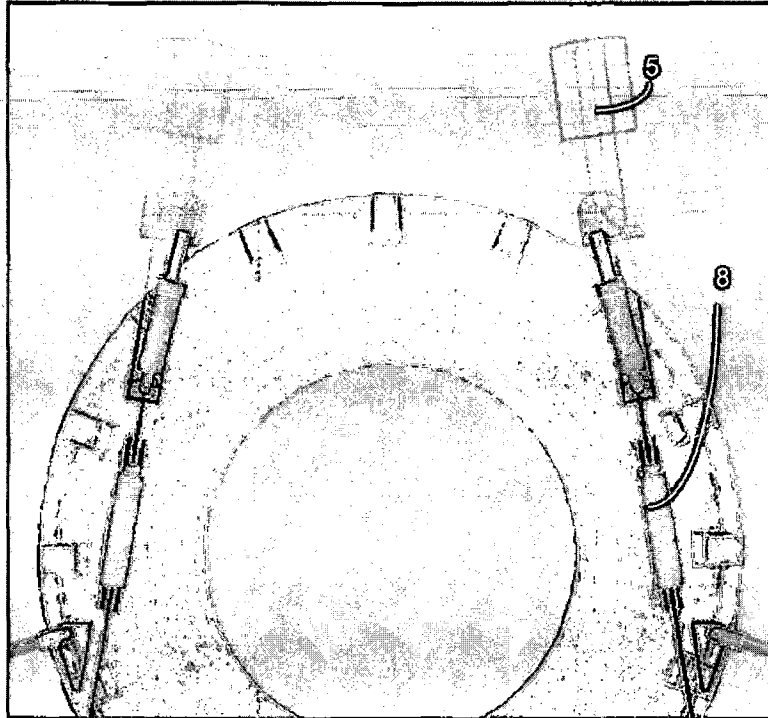


Figure 14

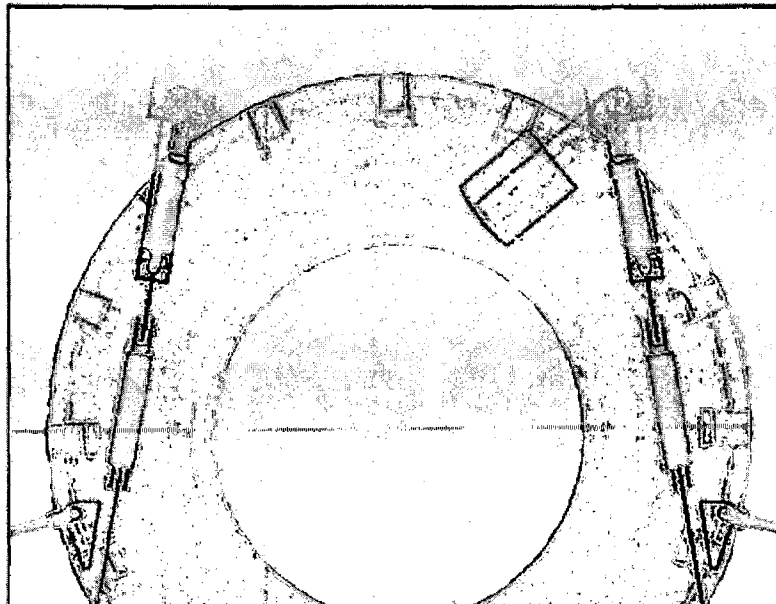


Figure 15

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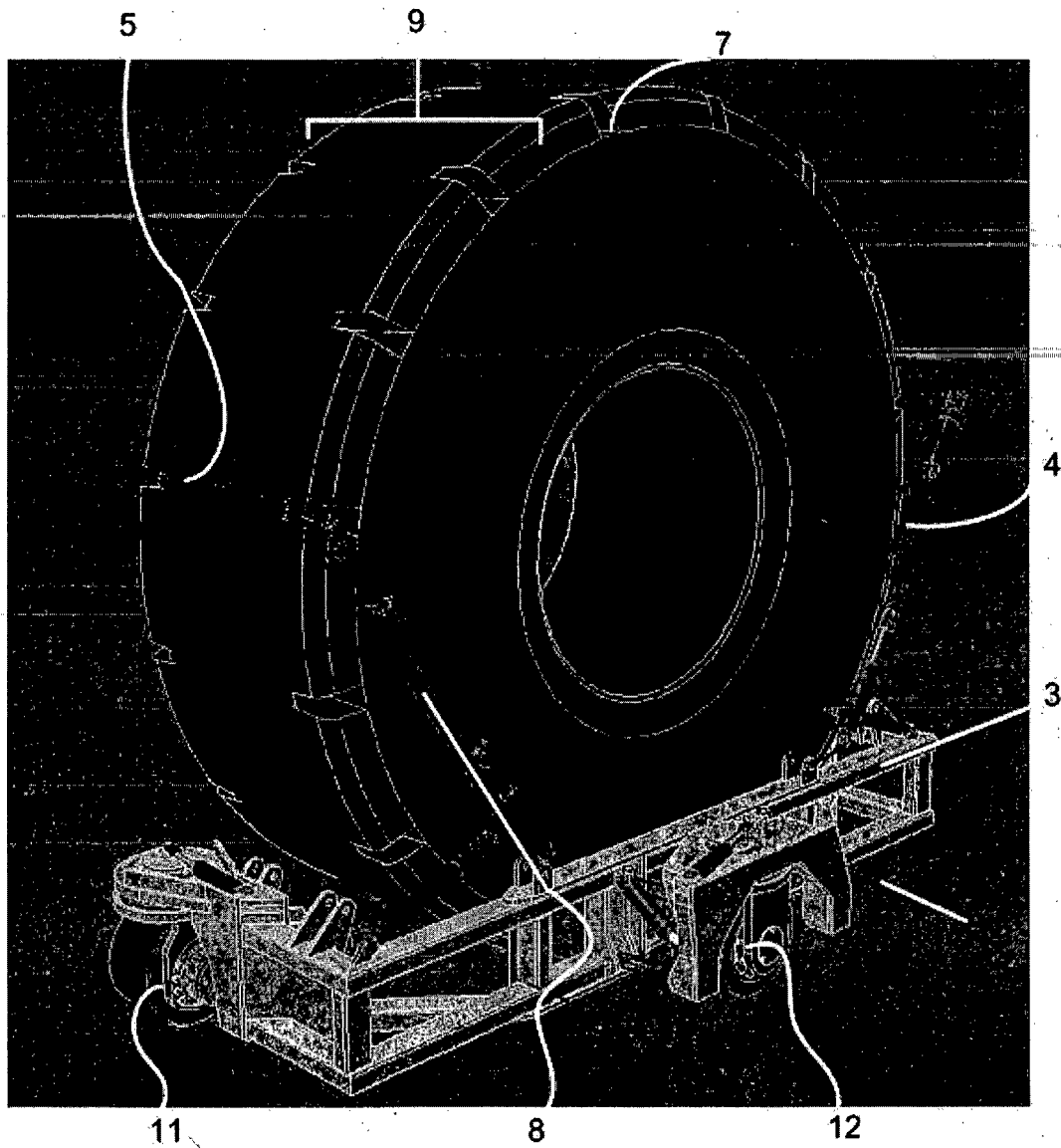


Figure 16

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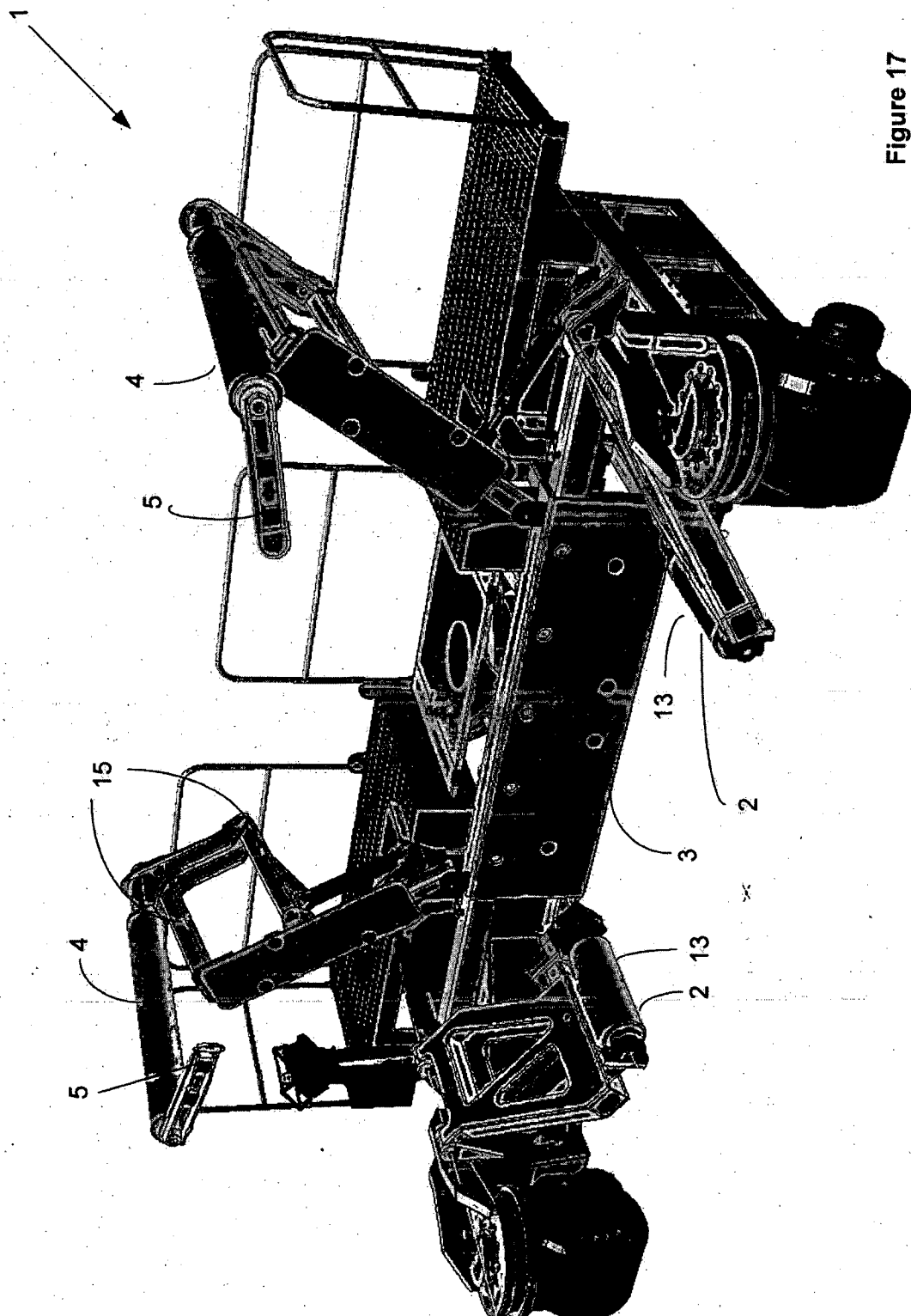


Figure 17

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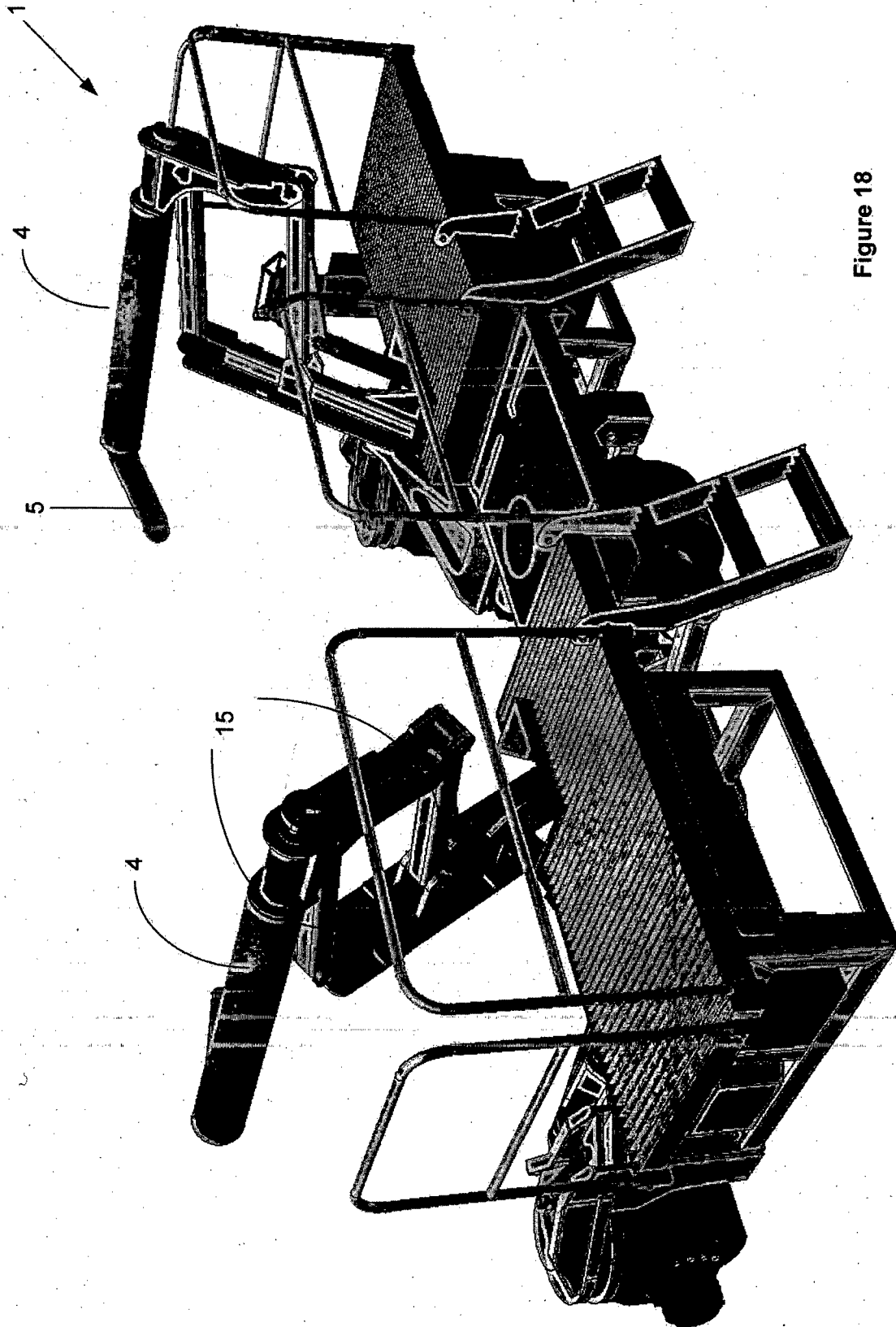


Figure 18

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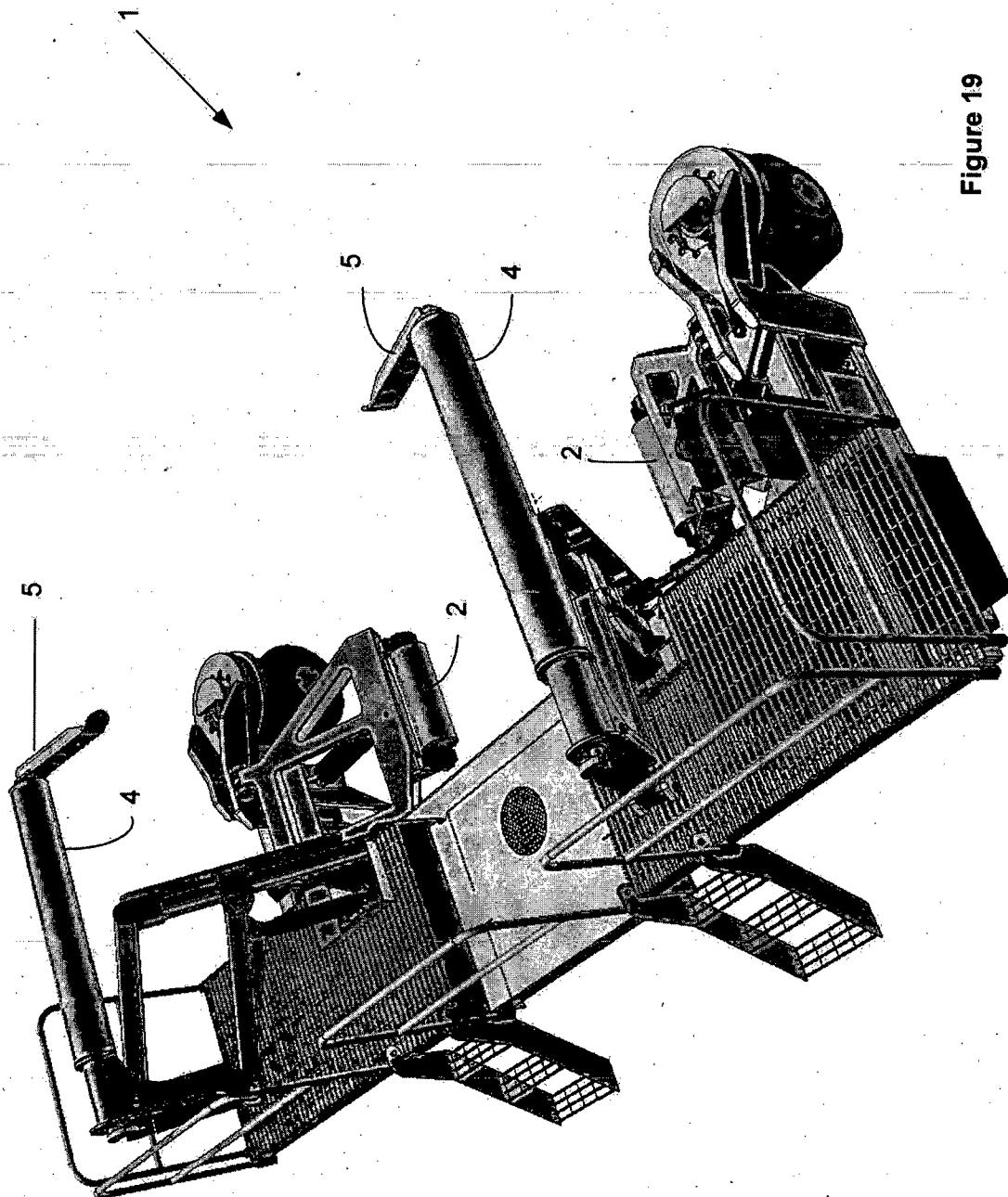


Figure 19

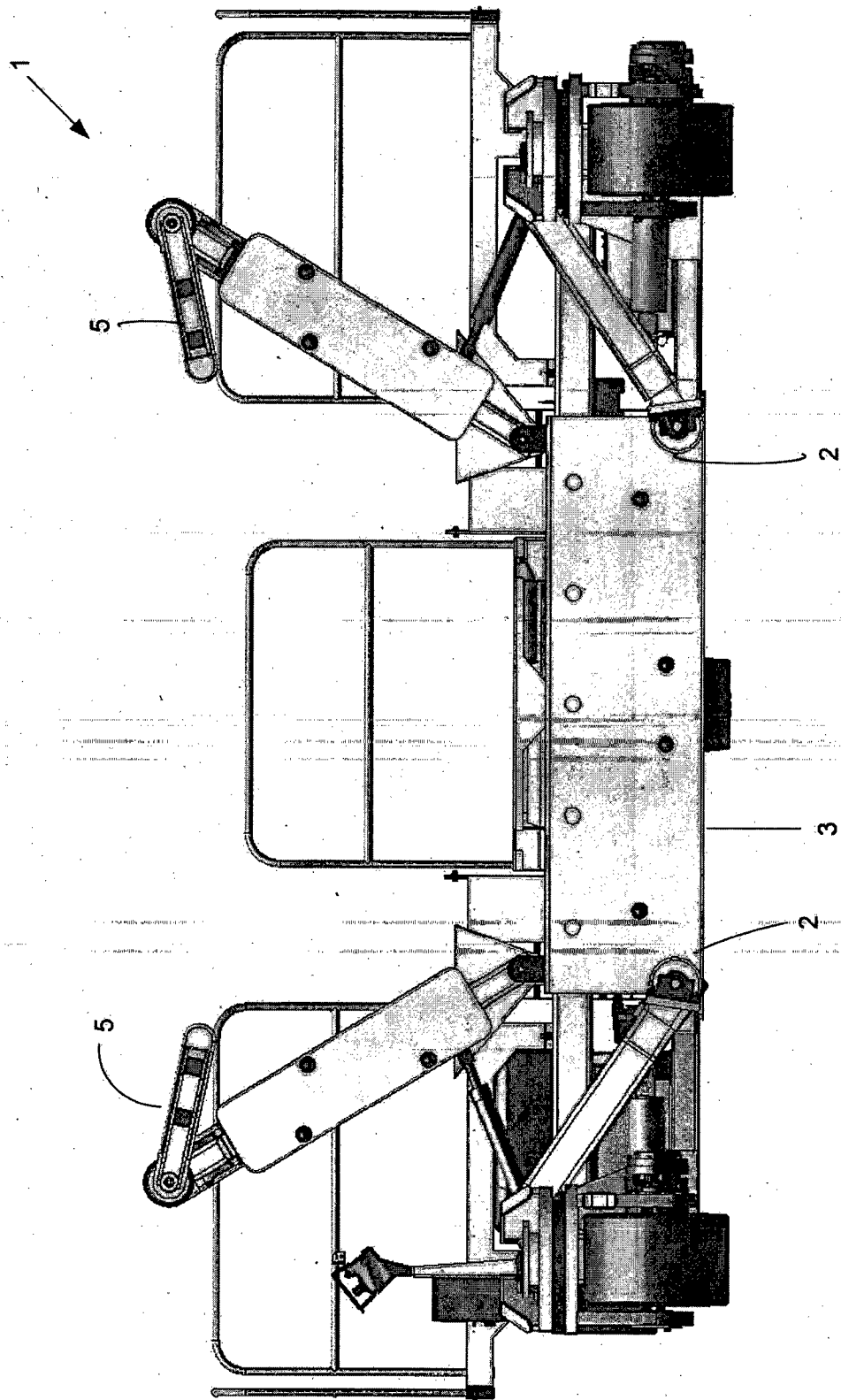


Figure 20

- 17/28 -

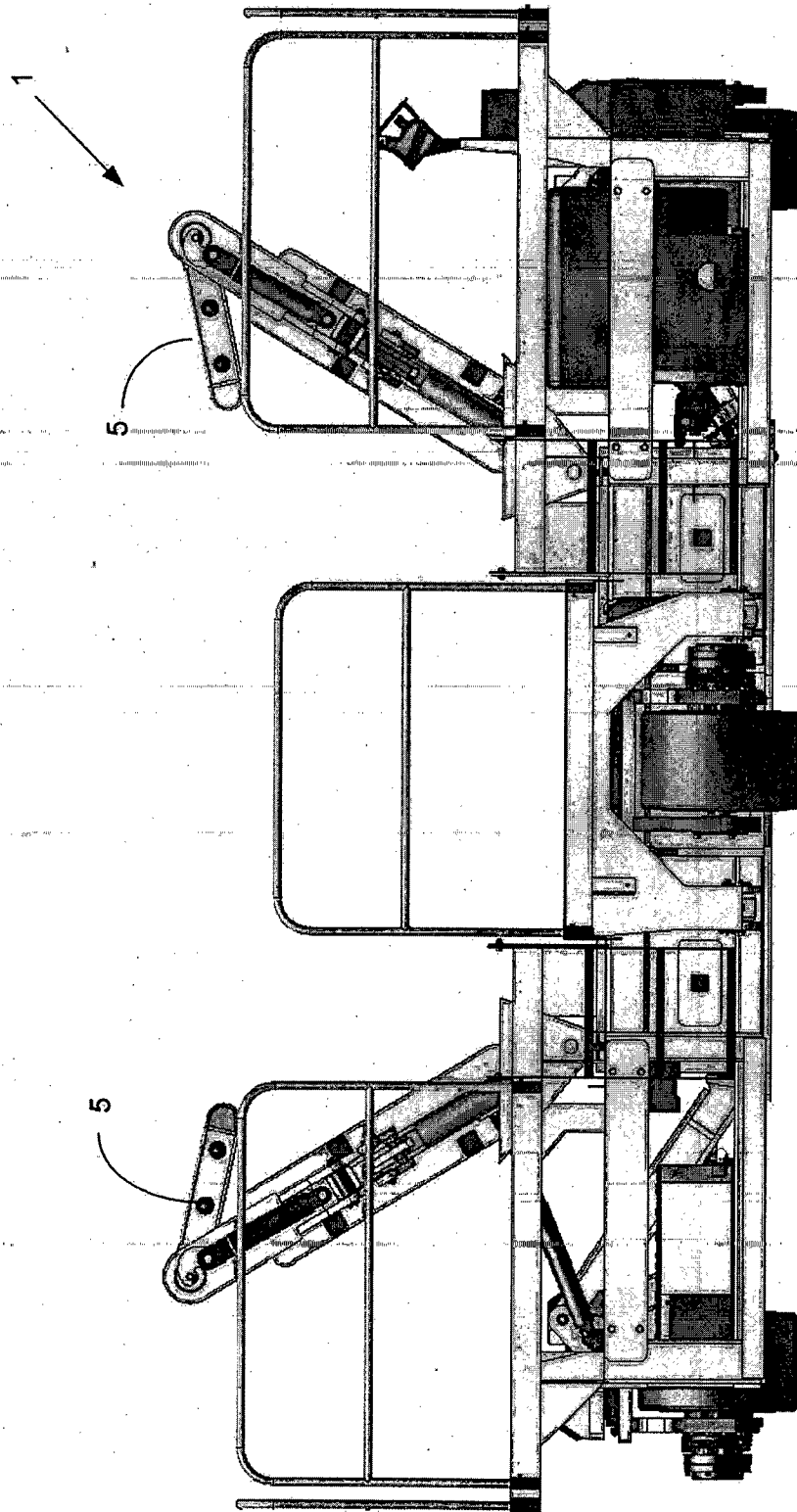


Figure 21

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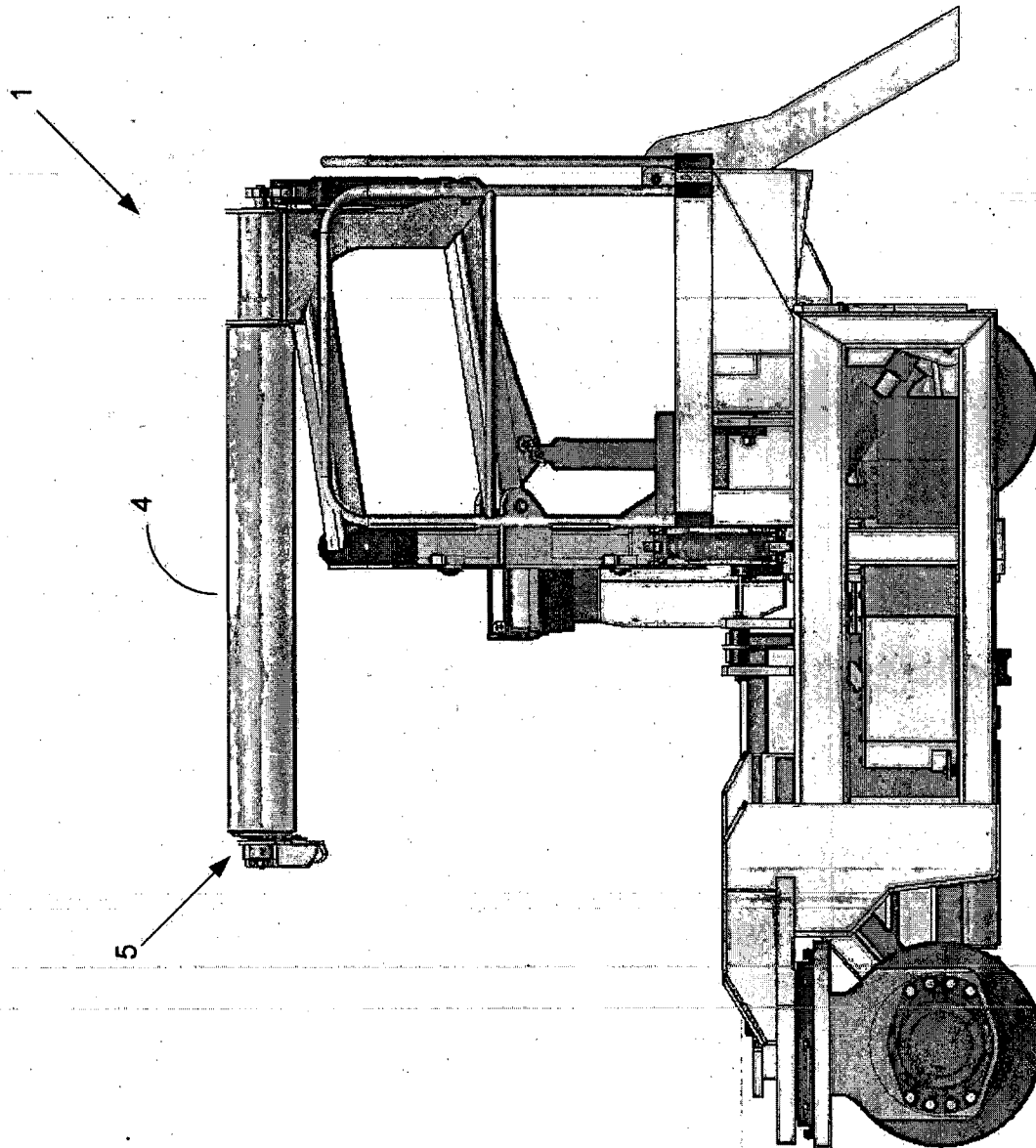


Figure 22

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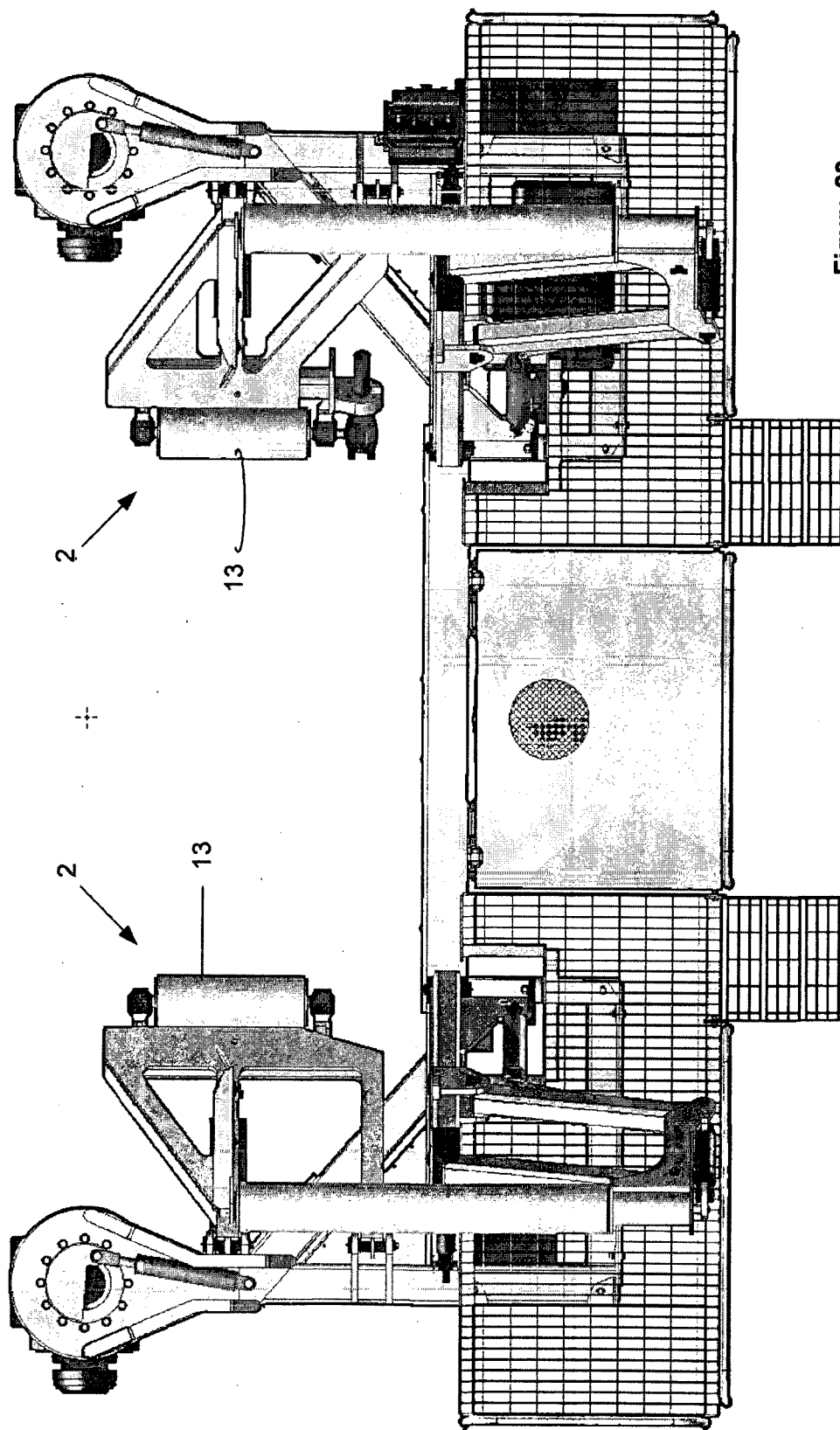


Figure 23

- 20/28 -

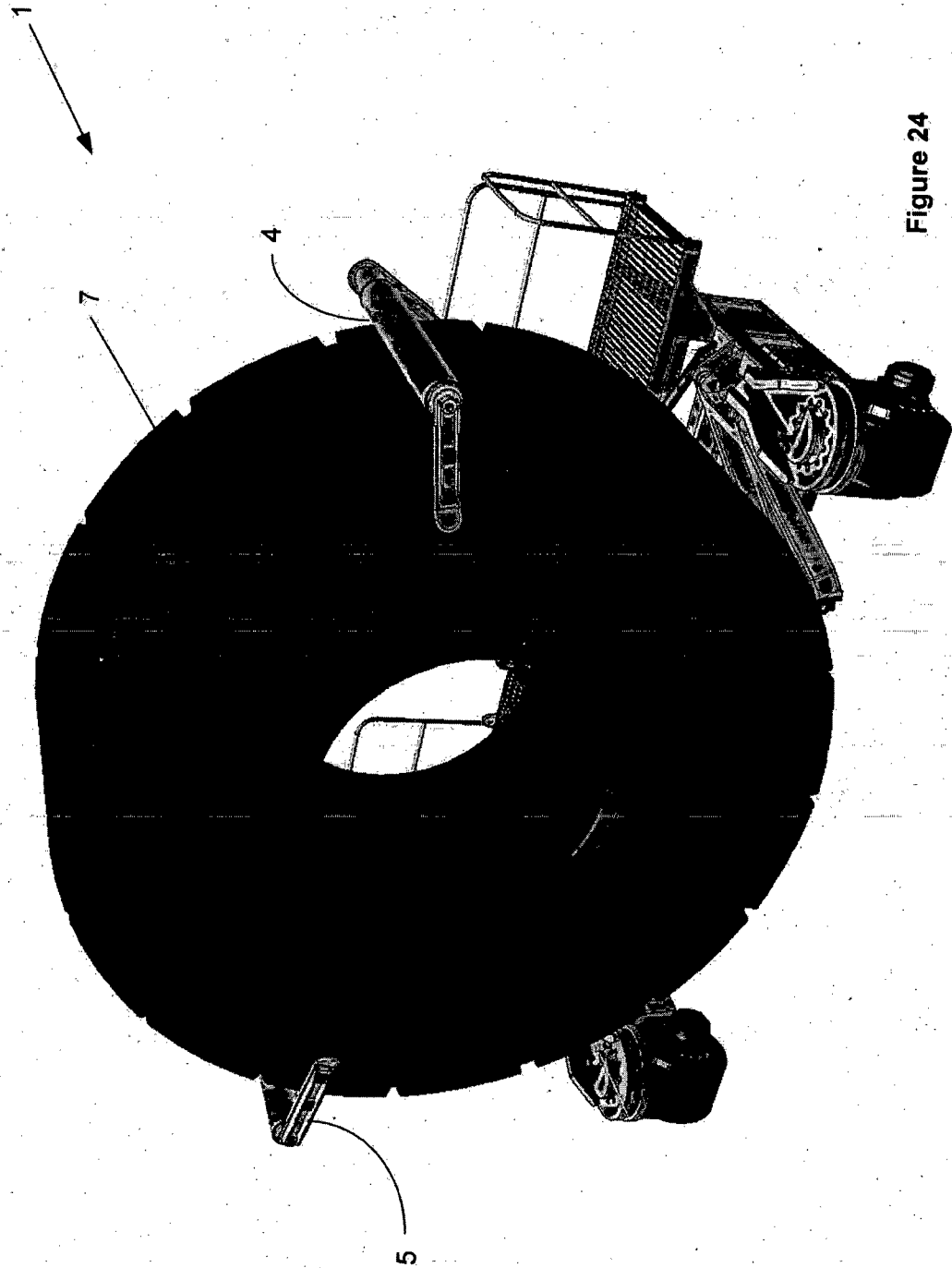


Figure 24

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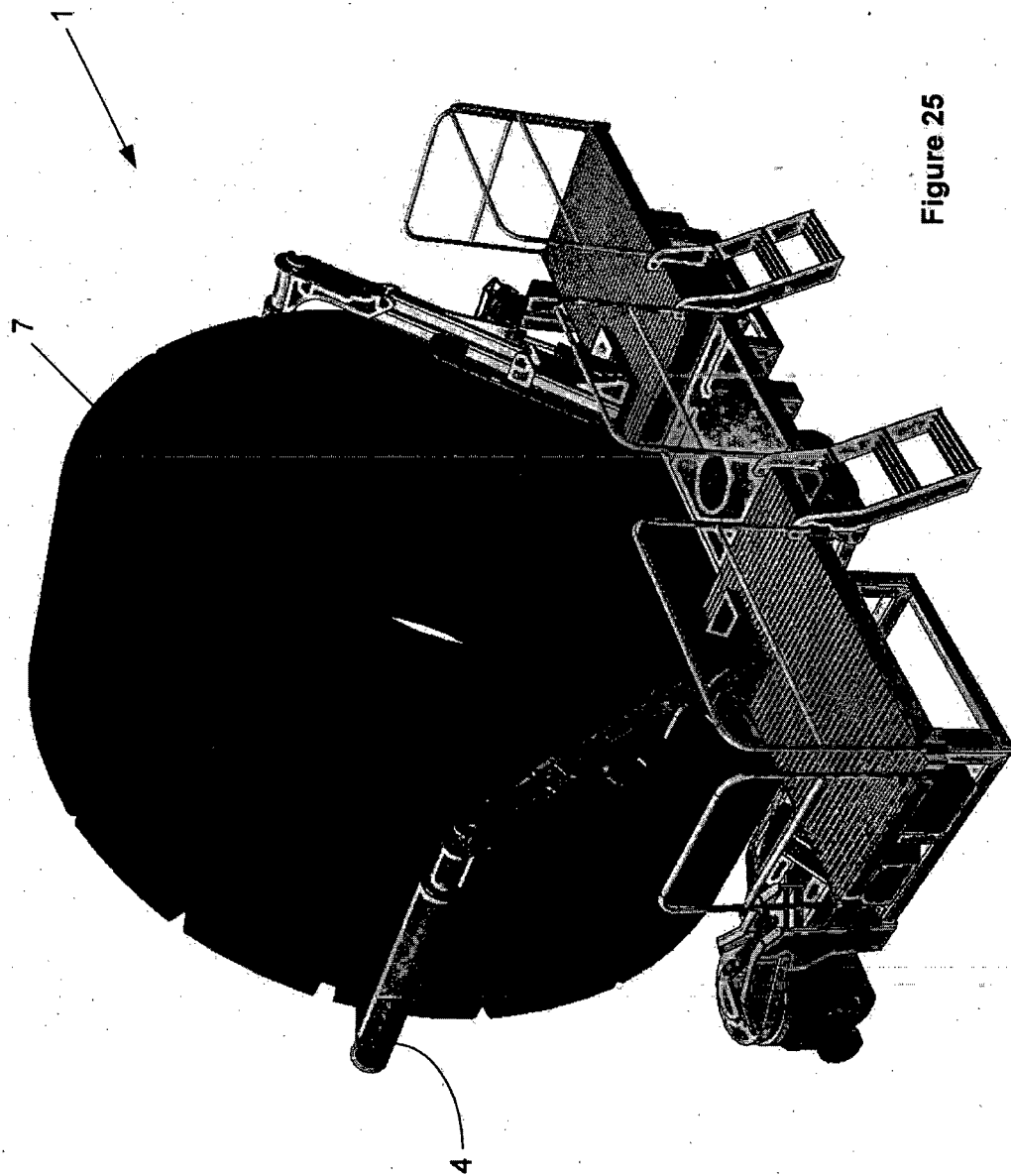


Figure 25

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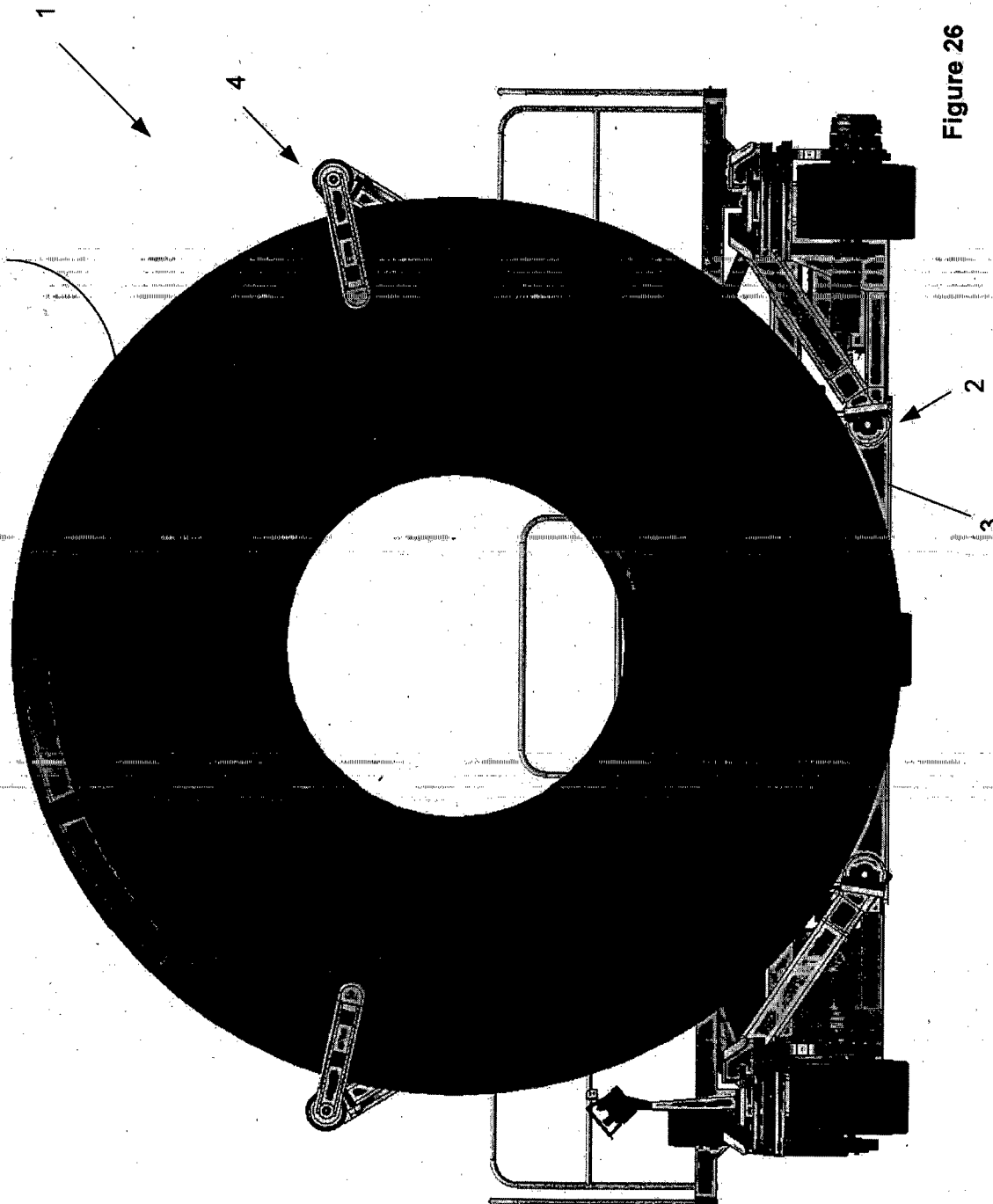


Figure 26

-23/28 -

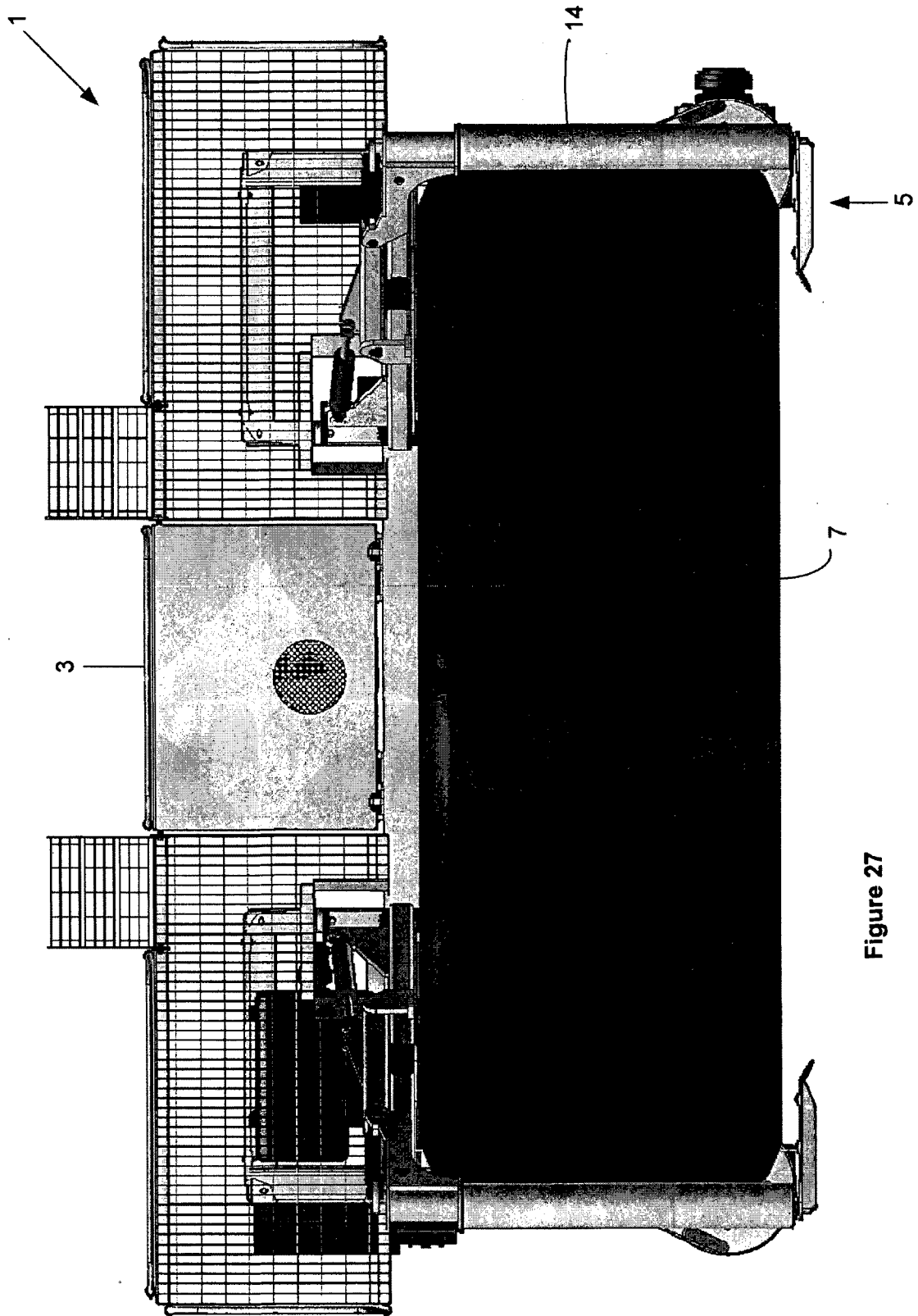


Figure 27

- 24/28 -

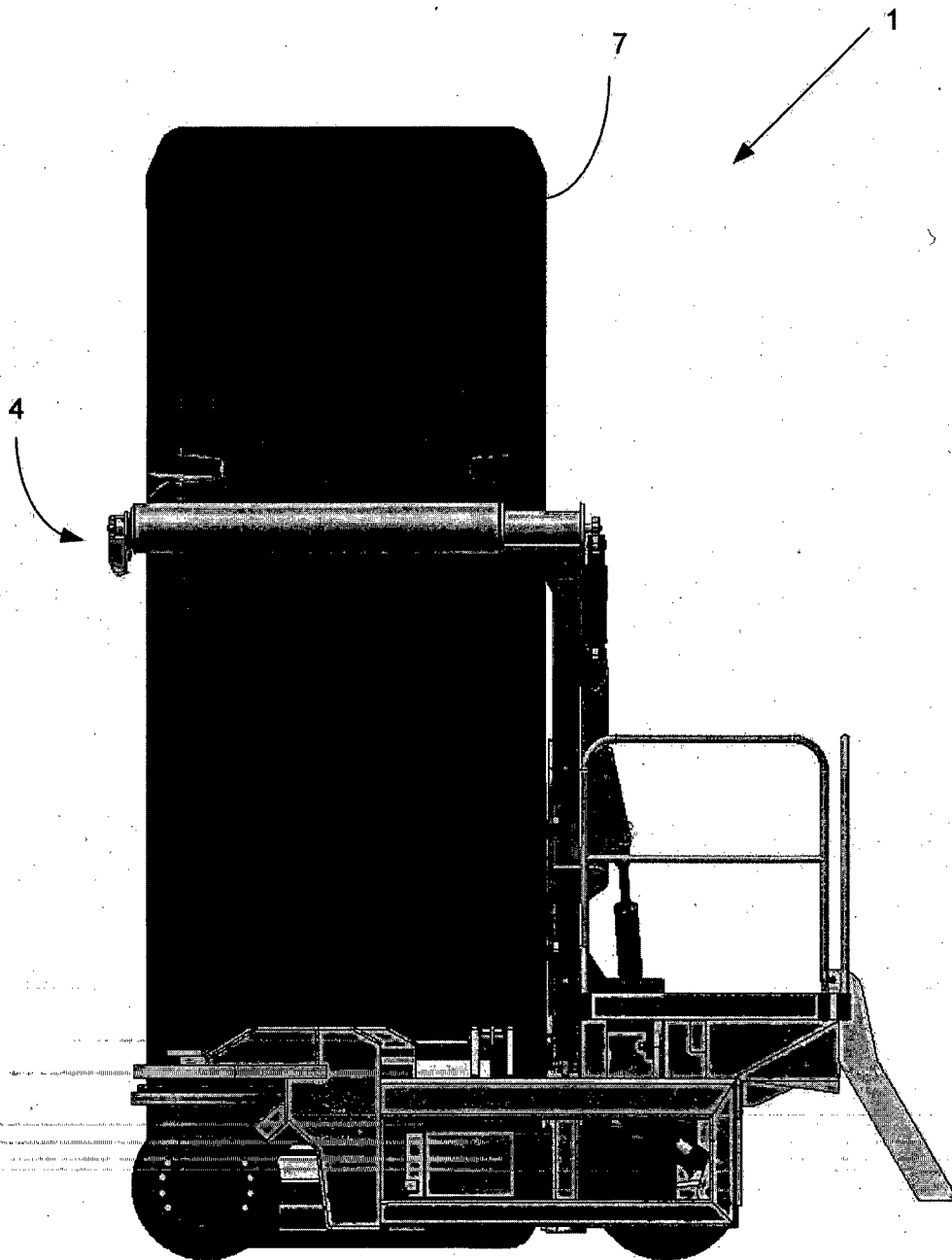


Figure 28

- 25/28 -

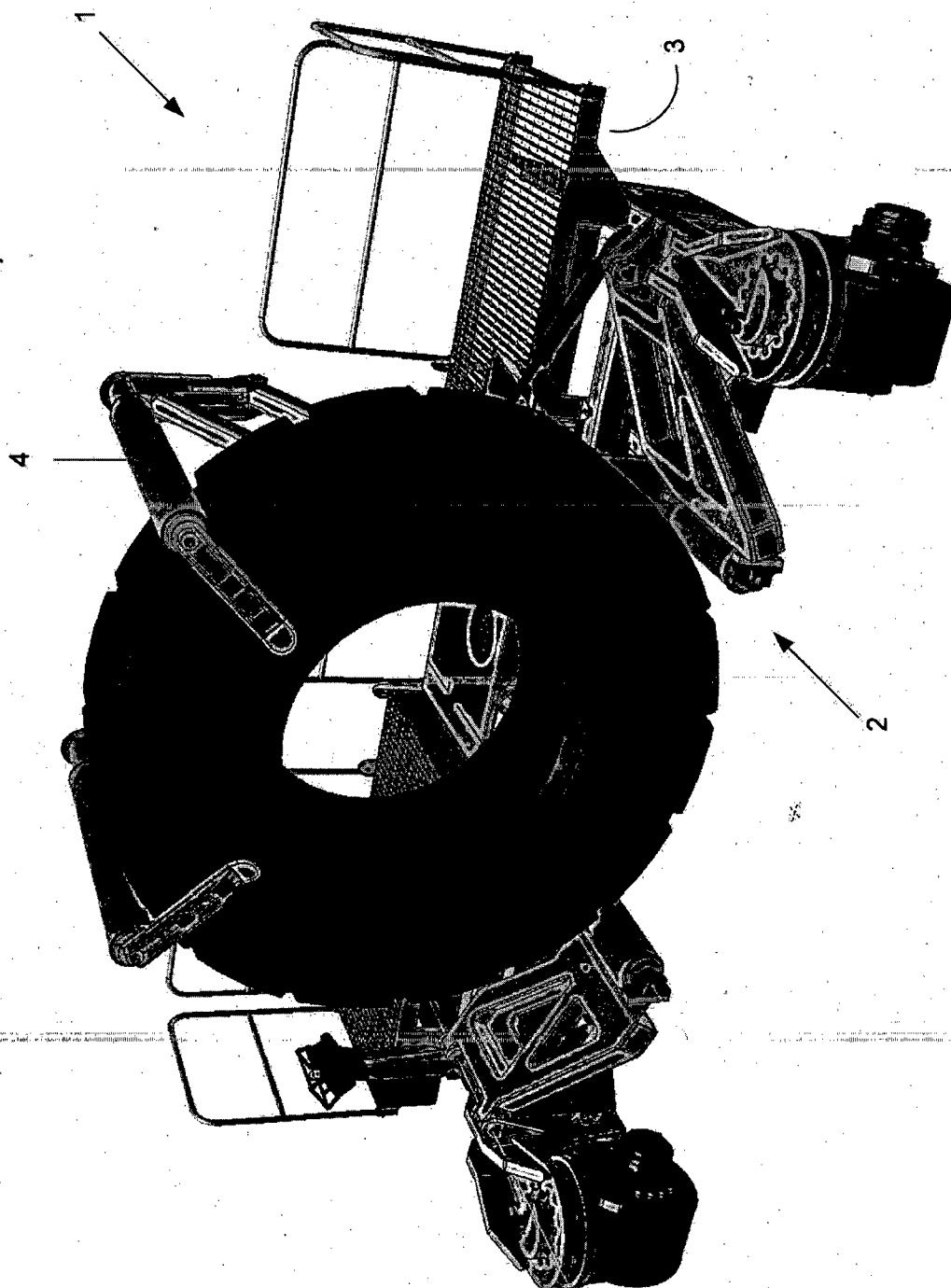


Figure 29

- 26/28 -

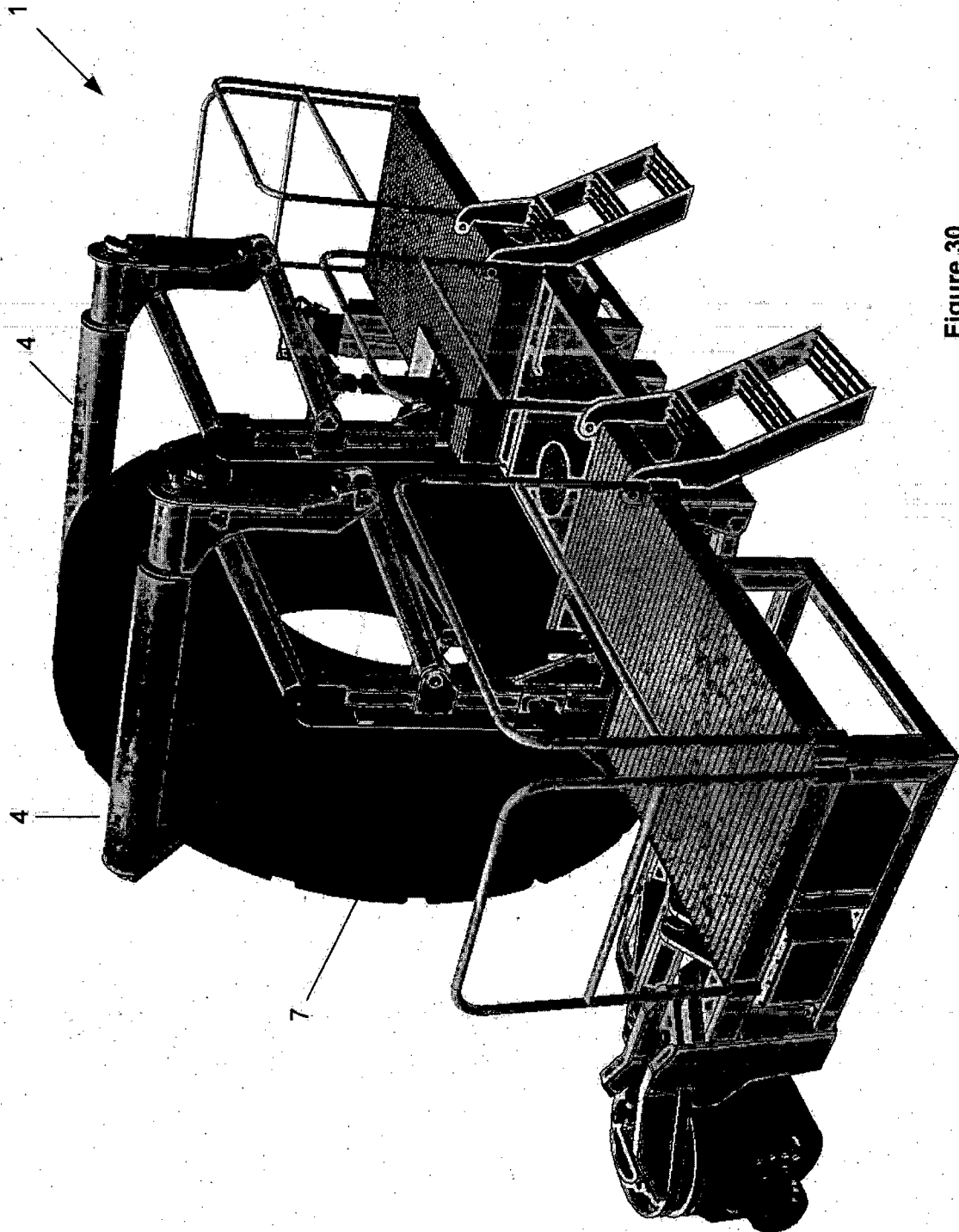


Figure 30

- 27/28 -

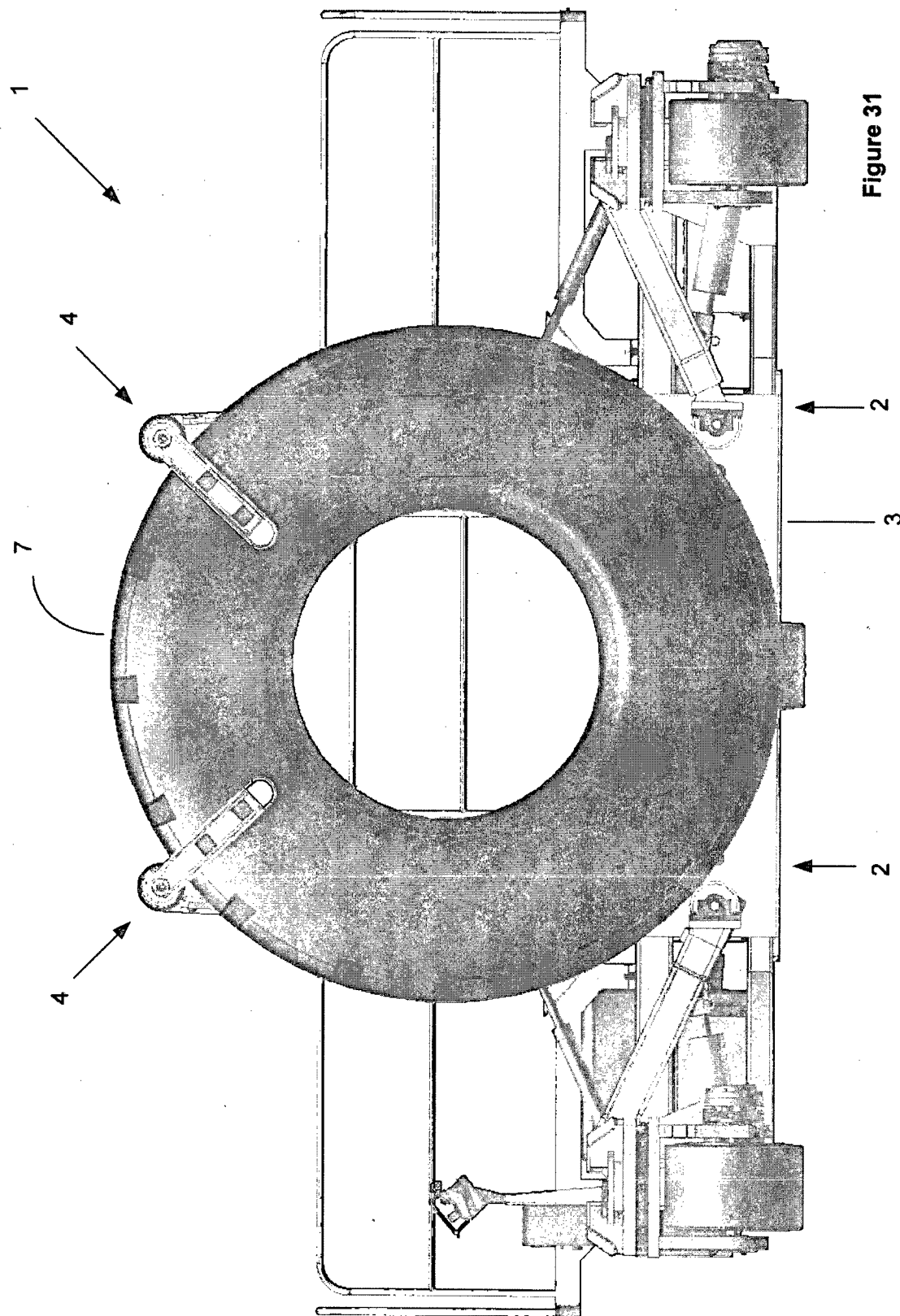


Figure 31

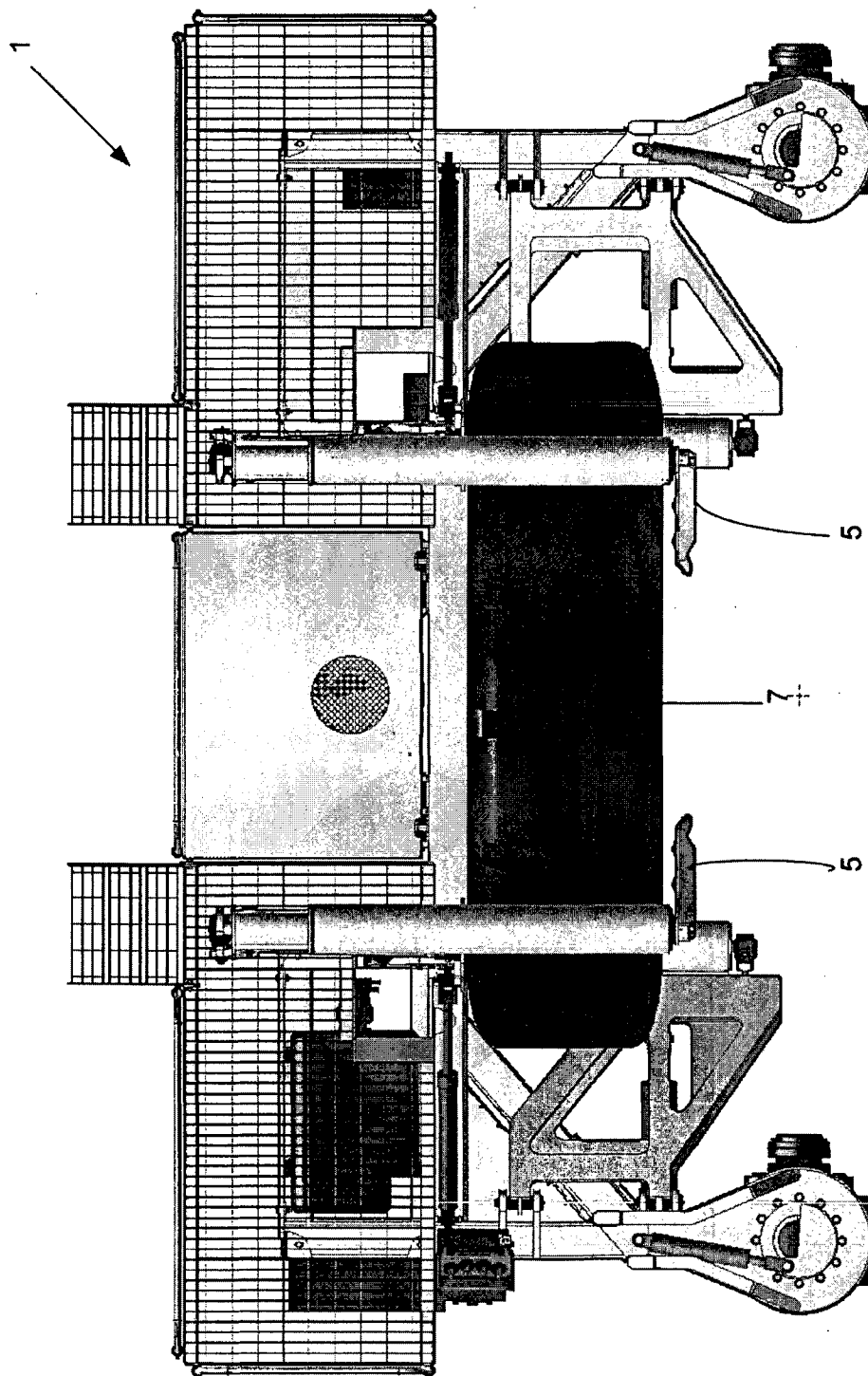


Figure 32

INTERNATIONAL SEARCH REPORT

International application No.

PCT/AU2012/000547

A. CLASSIFICATION OF SUBJECT MATTER

B62B 3/04 (OCT 2005)	B62B 3/12 (OCT 2005)	B60B 29/00 (OCT 2005)	B60B 30/02 (OCT 2005)
B60B 30/10 (OCT 2005)	B66F 7/22 (OCT 2005)	B66F 7/26 (OCT 2005)	B66F 9/065 (OCT 2005)
B65G 7/04 (OCT 2005)	B65G 7/08 (OCT 2005)		

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)
 EPODOC, WPI & IPC B60B29/00, B60B30/00, B60B30/02/low, B60B30/10, B62B3/LOW, B66F7/22, B66F7/26, B66F9/065, B65G7/LOW, with keywords (retain, secure, hold, restrict, constrain, dolly, wagon, cart, bogey, carry, under+, cradle, support, trundle, tyre, wheel, and similar terms)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
	Documents are listed in the continuation of Box C	

☒ Further documents are listed in the continuation of Box C
 ☒ See patent family annex

* Special categories of cited documents:	
"A" 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
 25 June 2012

 Date of mailing of the international search report
 27 June 2012

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/AU2012/000547

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

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

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☒ Claims Nos.: 13
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
Claim 13 does not comply with Rule 6.2(a) because it relies on references to the description and/or drawings.
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a)

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

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

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

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT		International application No.
C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		PCT/AU2012/000547
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2852151 A (SMITH) 16 September 1958 Figures 1 and 2; column 1, lines 42 to 57; column 2 line 69 to column 3, line 30; claims 1 to 5.	1-2, 10-12
Y	Figures	11-12
X	US 2583216 A (HOFFMAN) 22 January 1952 Figures 1 to 3.	1-2, 10
Y	Figures	11-12
Y	US 1523486 A (MANLEY) 20 January 1925 Figures 1 to 4; page 1, line 85 to page 2, line 53.	1-12
Y	US 4401405 A (EALET) 30 August 1983 Abstract, figures.	1-12
A	US 4460306 A (HAWKINS) 17 July 1984 Figure 4	9
A	US 2007/0290179 A1 (HEDLEY et al.) 20 December 2007 Whole document	

INTERNATIONAL SEARCH REPORT

International application No.

Information on patent family members

PCT/AU2012/000547

This Annex lists known 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/s Cited in Search Report		Patent Family Member/s	
Publication Number	Publication Date	Publication Number	Publication Date
US 2852151 A	16 Sep 1958	US 2852151 A	16 Sep 1958
US 2583216 A	22 Jan 1952	US 2583216 A	22 Jan 1952
US 1523486 A	20 Jan 1925	US 1523486 A	20 Jan 1925
US 4401405 A	30 Aug 1983	DE 3047844 A1	27 Aug 1981
		FR 2471869 A1	26 Jun 1981
		FR 2471869 B1	12 Oct 1984
		GB 2066206 A	08 Jul 1981
		GB 2066206 B	08 Feb 1984
		NL 8006892 A	16 Jul 1981
		US 4401405 A	30 Aug 1983
US 4460306 A	17 Jul 1984	US 4460306 A	17 Jul 1984
US 2007/0290179 A1	20 Dec 2007	AU 2007202219 A1	06 Dec 2007
		CA 2589336 A1	18 Nov 2007
		US 2007290179 A1	20 Dec 2007
		US 7677582 B2	16 Mar 2010

End of Annex

Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001.

Form PCT/ISA/210 (Family Annex)(July 2009)