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(71) Applicant: **DYNAMIC RESOURCE SOLUTIONS PTY LTD** [AU/AU]; 34A Parkinson Lane, Kardinya, Western Australia 6163 (AU).

(72) Inventor: **HITCHCOCK, Clayton**; 34A Parkinson Lane, Kardinya, Western Australia 6163 (AU).

(74) Agent: **ROHAN WALLACE PATENT AND TRADE-MARK SERVICES**; PO Box 1006, Bentley DC, Western Australia 6983 (AU).

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(54) Title: IMPROVED RAIL MOUNTED AND GUIDED BULK MATERIAL TRANSPORTATION SYSTEM

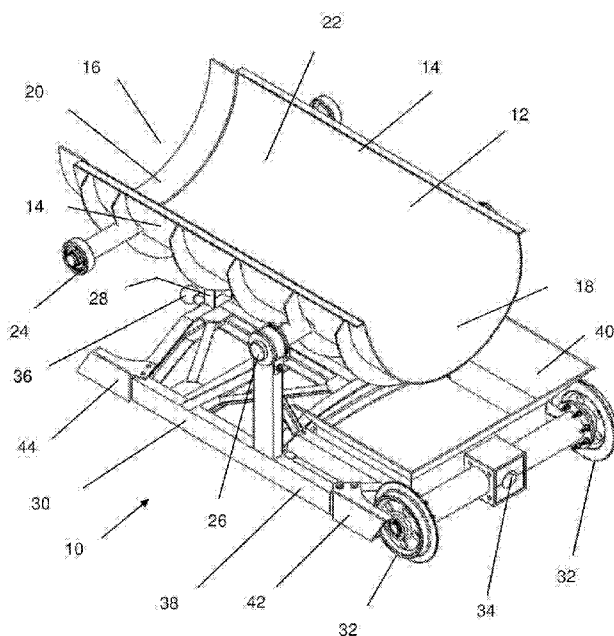


FIG. 1

(57) Abstract: A rail guided vehicle comprises a plurality of wagons. Each wagon comprises a chassis having rail engaging wheels and a bulk material carrying body tiltably mounted to the chassis so as to be inclined with respect to the direction of travel of the chassis such that bulk material carried in the body is able to be dumped between the rails when the body is tilted.



Published:

— with international search report (Art. 21(3))

— with information concerning request for restoration of the right of priority in respect of one or more priority claims (Rules 26bis.3 and 48.2(b)(vii))

IMPROVED RAIL MOUNTED AND GUIDED BULK MATERIAL TRANSPORTATION SYSTEM

Field of the Invention

[0001] The present invention relates to rail mounted and guided bulk material transportation systems.

Background

[0002] Open-cut mines and quarries need to transport bulk materials both within the boundary of the operation and externally to customers, shipping terminals and other storage depots. Traditionally, short distance transport is by way of conveyor or haulage trucks and long distance transport is by way of full-scale rail systems, haulage trucks or overland belt conveyors. These options usually involve high capital costs, high labour costs and high operating costs. An alternative lower cost solution is desirable.

[0003] This invention has been devised in order to provide a cheaper and more flexible alternative to the above-mentioned traditional transportation systems of bulk materials particularly in relation to high volumes and long distances.

[0004] In this specification the terms “comprising” or “comprises” are used inclusively and not exclusively or exhaustively.

[0005] Any references to documents that are made in this specification are not intended to be an admission that the information contained in those documents form part of the common general knowledge known to a person skilled in the field of the invention, unless explicitly stated as such.

Summary of the Invention

[0006] According to the present invention there is provided a rail guided wagon comprising a chassis having rail engaging wheels; a bulk material carrying body tiltably mounted to the chassis so as to be inclined with respect to the direction of travel of the chassis such that bulk material carried in the body is able to be dumped between the rails when the body is tilted.

[0007] In an embodiment the body comprises a cam follower configured to tilt the body upon contact with a cam. In an embodiment the cam follower is a roller. In an embodiment the body is substantially horizontal when not tilted by the cam contacting the cam follower.

[0008] In an embodiment the body extends longitudinally along the direction of travel of the chassis. In an embodiment the body comprises longitudinally extending side walls forming a trough for holding the bulk material when the body is substantially horizontal. In an embodiment the body is open ended. In an embodiment the body has an open top for receiving the bulk material in the body.

[0009] In an embodiment the body comprises a membrane extending from the body so as to overlap with an adjacent wagon body when the body is substantially horizontal. In an embodiment the membrane extends from a leading end of the body.

[0010] In an embodiment the membrane extends across an interstice between the bodies. In an embodiment the membrane is flexible so as to accommodate relative movement between adjacent wagons.

[0011] In an embodiment the chassis comprises a hopper for receiving dumped bulk material from the body and directing it between the rails.

[0012] In an embodiment the wagon comprises a first hitch and one pair of rail engaging wheels at one end of the chassis and a second hitch at another end of the chassis. In an embodiment the first hitch is for connecting to a first adjacent other wagon and the second hitch is for connecting to a second adjacent other wagon. In an embodiment the rail engaging wheels support part of the weight of the wagon and part of the weight of the first adjacent other wagon, and the second hitch transfers part of the weight of the wagon to the second adjacent other wagon.

[0013] In an embodiment the wagon comprises side respective members for receiving a locative force of drive tyres.

[0014] According to the present invention there is provided a rail guided bulk material carrying rail vehicle comprising a plurality of wagons, each wagon comprising a chassis having rail engaging wheels; a bulk material carrying body tiltably mounted to

the chassis so as to be inclined with respect to the direction of travel of the chassis such that bulk material carried in the body is able to be dumped between the rails when the body is tilted, wherein the wagons are connected end to end with abutting respective bodies so as to be able to collectively carry the bulk material in a continuous line across the wagons.

[0015] According to the present invention there is provided a rail guided bulk material carrying rail vehicle system comprising an unloader and a plurality of wagons, each wagon comprising a chassis having rail engaging wheels; a bulk material carrying body tiltably mounted to the chassis so as to be inclined with respect to the direction of travel of the chassis such that bulk material carried in the body is able to be dumped between the rails when the body is tilted, wherein the wagons are connected end to end with abutting respective bodies so as to be able to collectively carry the bulk material in a continuous line across the wagons, wherein the unloader is configured to sequentially tilt the bodies of the wagons so as to unload carried bulk material as the wagons move past the unloader.

[0016] According to the present invention there is provided a method of carrying bulk material comprising providing a rail guided bulk material carrying rail vehicle comprising a plurality of wagons, each wagon comprising a tiltable bulk material carrying body, wherein the wagons are connected end to end with abutting respective bodies so as to be able to collectively carry the bulk material in a continuous line across the wagons; tilting the bodies so as to be inclined with respect to the direction of travel of the wagons such that bulk material carried in the bodies is dumped from the bodies.

[0017] According to the present invention there is provided a method of transferring bulk material comprising providing a rail guided bulk material carrying rail vehicle comprising a plurality of wagons, each wagon comprising a tiltable bulk material carrying body, wherein the wagons are connected end to end with abutting respective bodies so as to be able to collectively carry the bulk material in a continuous line across the wagons; loading the wagons with the bulk material in a continuous line within the bodies of the wagons at a loading location; traversing the vehicle from the loading location to an unloading location; tilting the bodies so as to be inclined with respect to the direction of travel of the wagons such that bulk material carried in the bodies is dumped from the bodies at the unloading location.

Description of Drawings

[0018] Embodiments of the present invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

[0019] Figure 1 is an upper perspective of a rail guided wagon according to an embodiment of the present invention;

[0020] Figure 2 is a rear elevation of the wagon of Figure 1;

[0021] Figure 3 is a plan view of the wagon of Figure 1;

[0022] Figure 4 is a side elevation of the wagon of Figure 1;

[0023] Figure 5 is a propulsion system according to an embodiment of the present invention;

[0024] Figure 6 is a rear end view of a rail guided bulk material carrying rail vehicle system according to an embodiment of the present invention;

[0025] Figure 7 is a side elevation of the system of Figure 6; and

[0026] Figure 8 is a plan view of the system of Figure 6.

Detailed Description of Example Embodiments

[0027] Referring to Figures 1 to 4, there is a rail guided wagon 10 comprising a chassis 30 having rail engaging wheels 32 and a bulk material carrying body 12. The body 12 extends longitudinally along the direction of travel of the chassis 30. In an embodiment the body 12 comprises longitudinally extending side walls 14 forming a trough for holding the bulk material when the body 12 is substantially horizontal. In an embodiment the body 12 is arc shaped in cross section. In an embodiment the body has open ends 16 and 18. In an embodiment the body has an open top 22 for receiving the bulk material in the body 14.

[0028] The body 12 is tiltably mounted to the chassis 30 by pivotal joints 26 so that upon lifting an end of the body 12 so that it is tilted, the body 12 is inclined with respect to the direction of travel of the chassis 30 such that bulk material carried in the body 12 is able to be dumped between the rails 50, as will be described in more detail below.

[0029] In an embodiment the body 12 comprises a cam follower 24 configured to tilt the body 12 upon contact with a cam 206 as described below. In an embodiment the cam follower 24 is a roller spaced from the pivotal joints 26. In an embodiment the body 12 is substantially horizontal when not tilted by the cam 206 contacting the cam

follower 24. In an embodiment when the body 12 is substantially horizontal it rests on a support 28 extending upwardly from the chassis 30 and spaced from the joints 26.

[0030] Referring to Figures 6 to 8, a plurality of rail guided bulk material carrying wagons 10, 10', 10'', 10''', 10^{iv}, 10^v and 10^{vi} may be connected end to end to form a rail vehicle 100. In this embodiment each of the wagons 10, 10', 10'', 10''', 10^{iv}, 10^v and 10^{vi} are identical, although in another embodiment this need not be the case.

[0031] In an embodiment the wagon 10' comprises a female-type hitch 34 and one pair of rail engaging wheels 32 at a tail end of the chassis 30 and a male-type hitch 36 at a leading end of the chassis 30. In an embodiment the first hitch 34 is for connecting to a first adjacent other (trailing) wagon 10 and the second hitch 36 is for connecting to a second adjacent other (leading) wagon 10''.

[0032] In an embodiment the rail engaging wheels 32 support part of the weight of the wagon 10' and part of the weight of the first adjacent other wagon 10, and the second hitch 36 transfers part of the weight of the wagon 10' to the second adjacent other wagon 10''.

[0033] In an embodiment each body 12 comprises a membrane 20 extending from the leading end 16 of the body 12 so as to overlap with and be supported by an adjacent wagon body 12' when the body 12 is substantially horizontal. In an embodiment the membrane 20 extends across an interstice between the bodies 12 and 12', and similar membranes 20', 20'', 20''', 20^{iv}, and 20^v extend across corresponding interstices between bodies 12' and 12'', 12'' and 12''', 12''' and 12^{iv}, 12^{iv} and 12^v, and 12^v and 12^{vi}. In an embodiment each membrane 20 is flexible so as to accommodate relative movement between adjacent wagons 10 and 10' in horizontal and vertical planes. In an example the membrane 20 is formed of a resilient rubber like material, such as the material a bulk material conveyor belt is formed of. The membrane 20 enables the vehicle 100 to collectively carry the bulk material 300 in a continuous line across the wagons 10, 10' etc.

[0034] In an embodiment the chassis 30 comprises a hopper 40 for receiving dumped bulk material from the body 12 and directing it between the rails 50 and into a receptor 208.

[0035] In an embodiment the wagon 10 comprises respective side members 38 for receiving a locative force of drive tyres 64. The members 38 have wheel guards 42 and 44 for covering the wheels 32 from the sides. The guards 42 and 44 cooperate with corresponding guards 44 and 42, respectively, of the wagons on either side.

[0036] A rail guided bulk material carrying rail vehicle system comprises rails 50, an unloader 200 and a rail vehicle 100. The unloader 200 comprises the cam 206 in a framework 204. The unloader is configured to sequentially tilt the bodies 12^{vi}, 12^v, 12^{iv}, 12ⁱⁱⁱ, 12ⁱⁱ, 12ⁱ 12 of the respective wagons so as to unload carried bulk material as the wagons move past the unloader 200. Loading and unloading may be achieved while the vehicle 100 is in motion.

[0037] In one form the rails 50 are narrow gauge (approximately 1400-1500 mm).

[0038] A lead wagon 90 of vehicle 100 comprises a chassis with front and back pairs of rail engaging wheels 92 and 92 respectively and a female-type hitch for connection to a male type hitch of wagon 10^{vi}. The lead wagon 90 supports part of the weight of wagon 12^{vi}. The wagon 90 comprises side members 96, which are similar to and perform the same roll of members 38 of wagon 10.

[0039] The rail vehicle 100 may be a continuous, automated train driven either externally by an external locomotion system, or by a robotic small-scale locomotive. In an embodiment a lead wagon 90 operates as the locomotive and comprises a locomotive engine 98 for hauling the rest of the vehicle 100. The locomotion engine 98 may be remote controlled. In an alternative the external locomotion system comprises a plurality of drive stations 60 positioned at appropriate distances along the track.

[0040] Referring to Figure 5, each station 60 comprises a pair of drive modules 62 facing each other on each side of the rails 50 at a distance of substantially the width of the wagons 10. Each module 62 comprises a tyre 64 mounted inside a frame 68 and a motor 66. Typically the tyres 64 are pneumatic tyres. Typically the motor 66 will be an electric motor. The motor 66 is fixed to the frame 68 and arranged to rotate the respective tyre 64. In this embodiment the tyre 64 is coupled to the stator of the motor 66. The tyres 64 are positioned to contact and fictionally engage respective side members 38. The motors 66 of each station 60 rotate in unison, but in opposite directions, so as to propel the wagons 10, 10ⁱ etc of the vehicle 100.

[0041] Generally the stations 60 are spaced about, and preferably just less than, the length of the vehicle 100 apart. Thus as the vehicle 100 travels along the rails 50 initially the front of the vehicle 100 will enter the station 60. The tyres 64 will engage the front part of the vehicle 100 and they will pull it. Then as the vehicle 100 travels past the station 60 the tyres 64 will engage the back part of the vehicle 100 and they will push it. Accordingly the hitches 34 and 36 are suitable for both pull and push engagement.

[0042] Stations 60 may also be used for breaking. The power, torque, speed and spacing of the drive modules 62 are determined by the flow rate of the bulk material and the topography of the terrain. External drive and breaking is achieved by a friction contact between the pneumatic rubber drive tyres 64 and the side rails 38 of the wagon chassis 30. An integrated control system manages the loading, travel and discharge of the system.

[0043] The rail guided bulk material carrying rail vehicle system also comprises a loader (not shown) that comprises a feed chute that directs bulk material into the wagon bodies 12^{vi}, 12^v, 12^{iv}, 12ⁱⁱⁱ, 12ⁱⁱ, 12ⁱ 12 as they pass beneath it (in that order). Loading can continue in an uninterrupted flow without the need for the vehicle 100 to stop and start for indexing of each wagon.

[0044] Under the locomotion of the stations 60, or locomotive form of lead wagon 90, the vehicle can travel to an unloading station 200.

[0045] The unloading station 200 comprises a receptor 208 under the rails 50 and a frame 204. The receptor 208 will typically be in the form of a hopper. The frame supports the cam 206. The cam 206 is in the form of a lifting rail that is inclined, thereby tilting the body 12 as roller 24 rolls up the incline as the vehicle 100 moves through the station 200 (right to left of page). Rail 206 then declines thus lowering the body 12 back to a generally horizontal rest position as the roller 24 rolls down the decline.

[0046] It can be seen that the incline is less steep than the decline. This allows the body 12 of each wagon 10 to be raised at a rate suitable for the appropriate dumping of the bulk material from the rear of each wagon 10 etc., through the hopper 40 into

the receptor 208. However once the body 12 is emptied it can be lowered as a faster rate.

[0047] Figure 8 shows the bulk material 300 has been dumped from wagons 10^{vi}, 10^v, 10^{iv}, 10ⁱⁱⁱ, has begun dumping from wagon 10ⁱⁱ and is yet to be dumped from wagons 10ⁱ and 10. Unloading is achieved by end-tipping the wagon bodies. Fouling of the rails is prevented by sizing the bodies narrower than the rail gauge. The rails 50 can either be elevated to discharge into an above-ground hopper, or the hopper 208 can be installed below ground.

[0048] The wagon chassis 30 and body 12 are generally fabricated from standard steel sections and plate. The robust construction enables the transport of large lump, high abrasion, high impact, high density, run-of-mine bulk material. Bearings and housings and the like may be commercially available components.

[0049] The capacity of the system is flexible and depends on the cross sectional dimensions of the bodies, the number of wagons 10 in the vehicle 100 and the speed at which it travels.

[0050] Modifications may be made to the present invention within the context of that described and shown in the drawings. Such modifications are intended to form part of the invention described in this specification.

CLAIMS

1. A rail guided wagon comprising a chassis having rail engaging wheels; a bulk material carrying body tiltably mounted to the chassis so as to be inclined with respect to the direction of travel of the chassis such that bulk material carried in the body is able to be dumped between the rails when the body is tilted.
2. A wagon according to claim 1, wherein the body comprises a cam follower configured to tilt the body upon contact with a cam.
3. A wagon according to claim 2, wherein the cam follower is a roller.
4. A wagon according to claim 1, wherein the body comprises a membrane extending from the body so as to overlap with an adjacent wagon body when the body is substantially horizontal.
5. A wagon according to claim 1, wherein the membrane extends from a leading end of the body.
6. A wagon according to claim 1, wherein the membrane extends across an interstice between the bodies.
7. A wagon according to claim 1, wherein the membrane is flexible so as to accommodate relative movement between adjacent wagons.
8. A wagon according to claim 1, wherein the chassis comprises a hopper for receiving dumped bulk material from the body and directing it between the rails.
9. A wagon according to claim 8, wherein the wagon comprises a first hitch and one pair of rail engaging wheels at one end of the chassis and a second hitch at another end of the chassis.
10. A wagon according to claim 9, wherein the first hitch is for connecting to a first adjacent other wagon and the second hitch is for connecting to a second adjacent other wagon.

11. A wagon according to claim 10, wherein the rail engaging wheels support part of the weight of the wagon and part of the weight of the first adjacent other wagon, and the second hitch transfers part of the weight of the wagon to the second adjacent other wagon.

12. A wagon according to claim 1, wherein the wagon comprises side respective members for receiving a locative force of drive tyres.

13. A rail guided bulk material carrying rail vehicle comprising a plurality of wagons, each wagon comprising a chassis having rail engaging wheels; a bulk material carrying body tiltably mounted to the chassis so as to be inclined with respect to the direction of travel of the chassis such that bulk material carried in the body is able to be dumped between the rails when the body is tilted, wherein the wagons are connected end to end with abutting respective bodies so as to be able to collectively carry the bulk material in a continuous line across the wagons.

14. A rail guided bulk material carrying rail vehicle system comprising an unloader and a plurality of wagons, each wagon comprising a chassis having rail engaging wheels; a bulk material carrying body tiltably mounted to the chassis so as to be inclined with respect to the direction of travel of the chassis such that bulk material carried in the body is able to be dumped between the rails when the body is tilted, wherein the wagons are connected end to end with abutting respective bodies so as to be able to collectively carry the bulk material in a continuous line across the wagons, wherein the unloader is configured to sequentially tilt the bodies of the wagons so as to unload carried bulk material as the wagons move past the unloader.

15. A method of carrying bulk material comprising providing a rail guided bulk material carrying rail vehicle comprising a plurality of wagons, each wagon comprising a tiltable bulk material carrying body, wherein the wagons are connected end to end with abutting respective bodies so as to be able to collectively carry the bulk material in a continuous line across the wagons; tilting the bodies so as to be inclined with respect to the direction of travel of the wagons such that bulk material carried in the bodies is dumped from the bodies.

16. A method of transferring bulk material comprising providing a rail guided bulk material carrying rail vehicle comprising a plurality of wagons, each wagon comprising a tiltable bulk material carrying body, wherein the wagons are connected

end to end with abutting respective bodies so as to be able to collectively carry the bulk material in a continuous line across the wagons; loading the wagons with the bulk material in a continuous line within the bodies of the wagons at a loading location; traversing the vehicle from the loading location to an unloading location; tilting the bodies so as to be inclined with respect to the direction of travel of the wagons such that bulk material carried in the bodies is dumped from the bodies at the unloading location.

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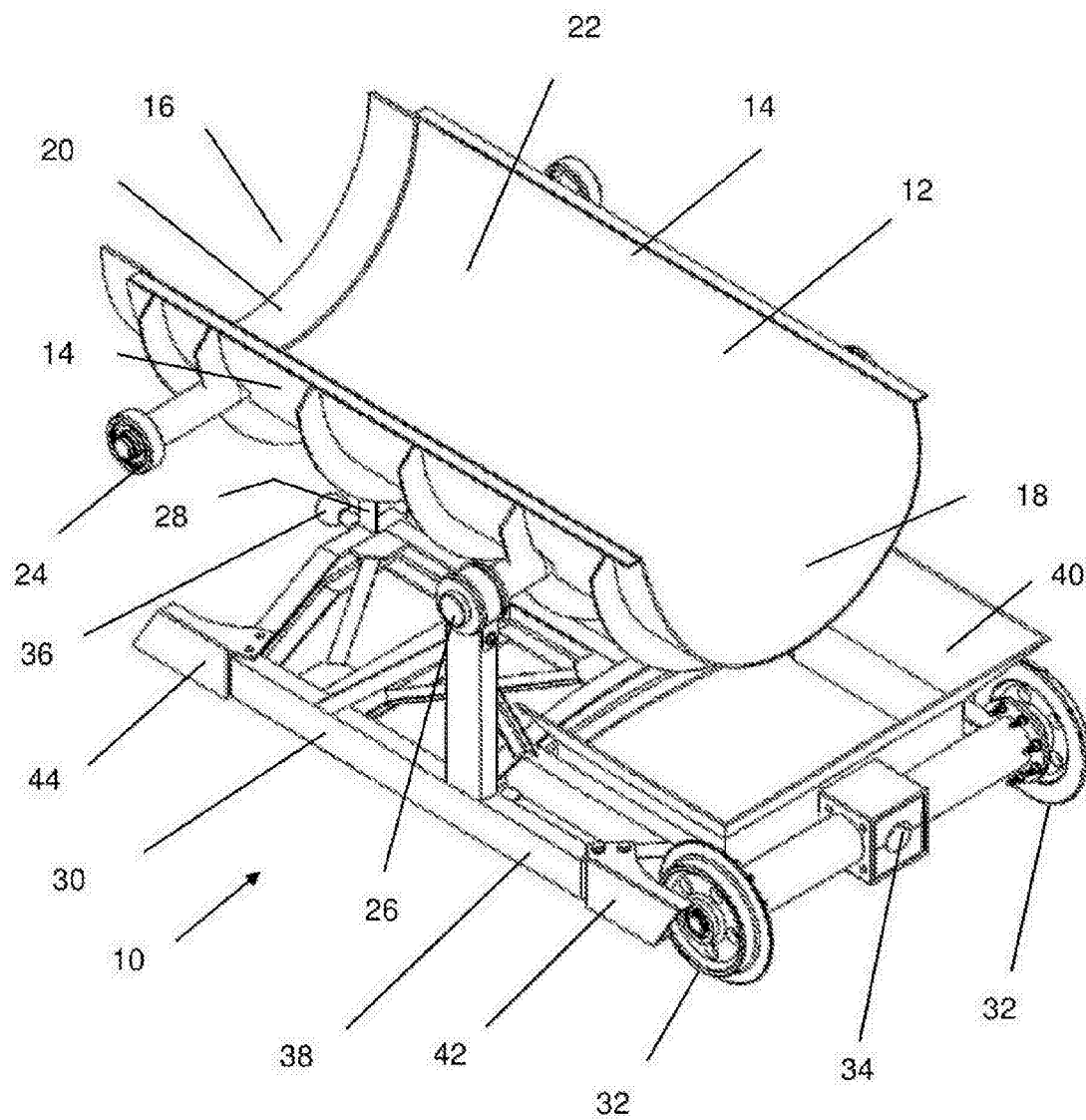


FIG. 1

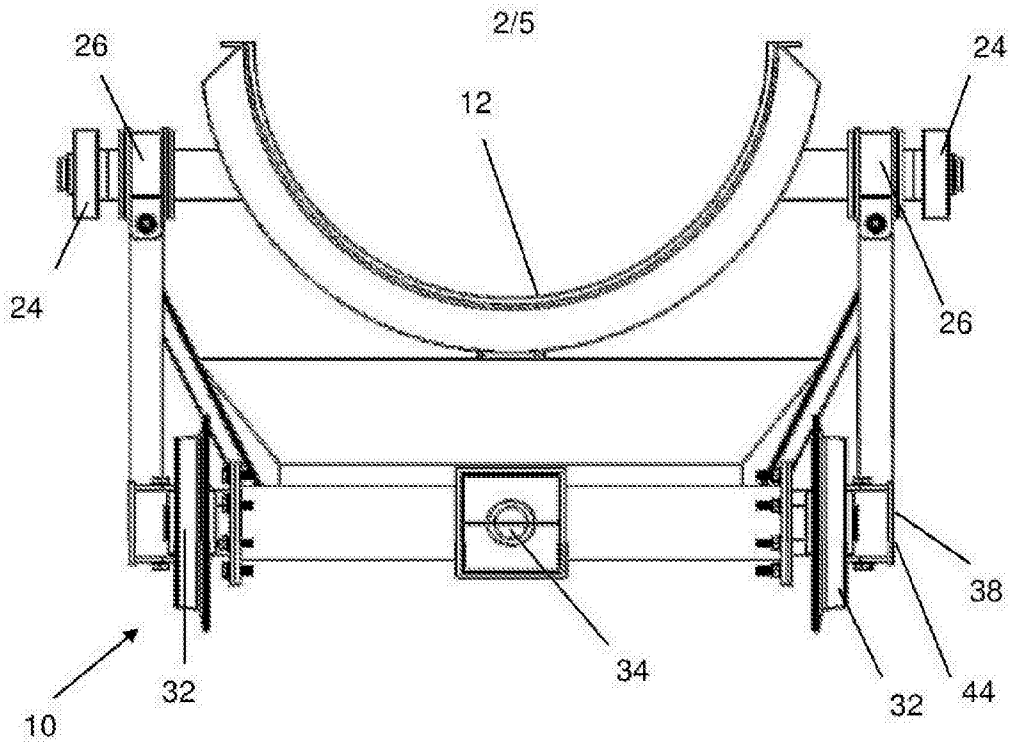


FIG. 2

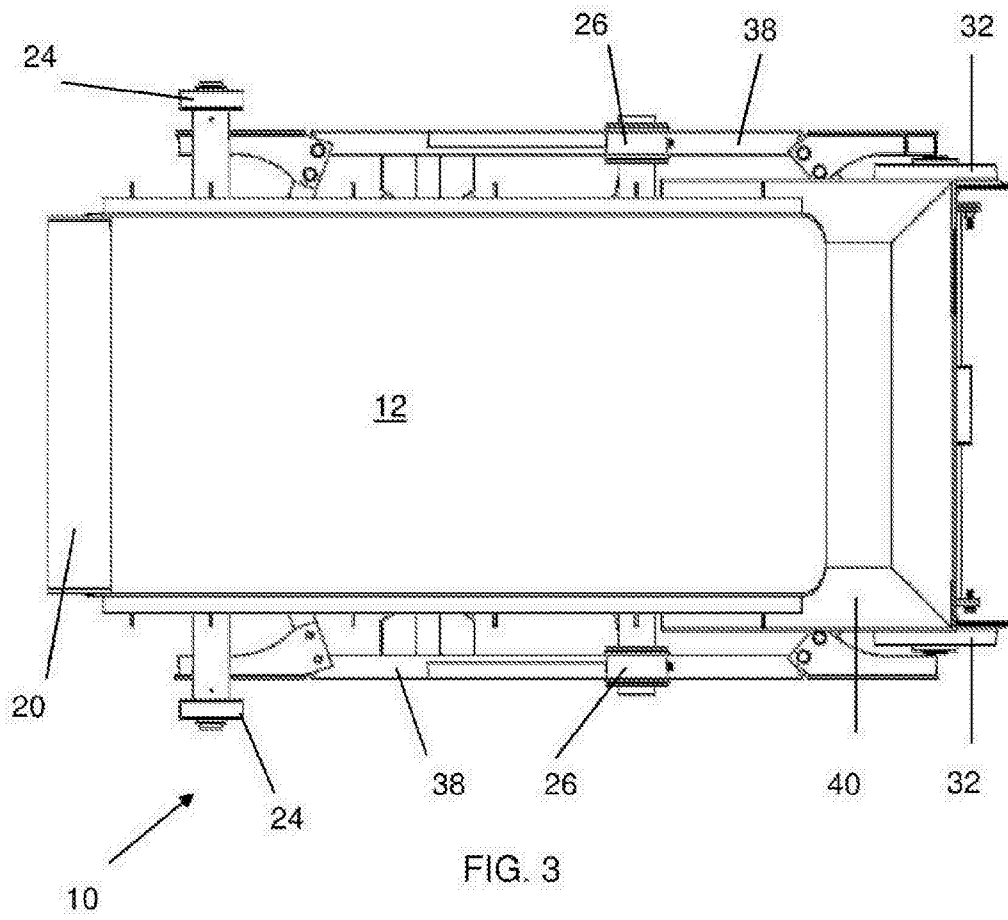


FIG. 3

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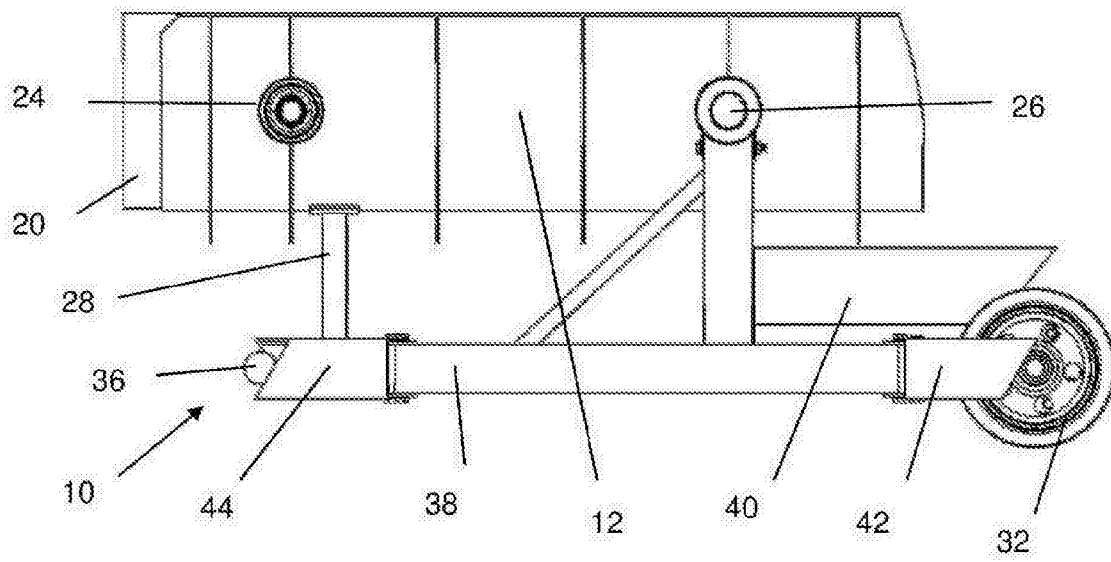


FIG. 4

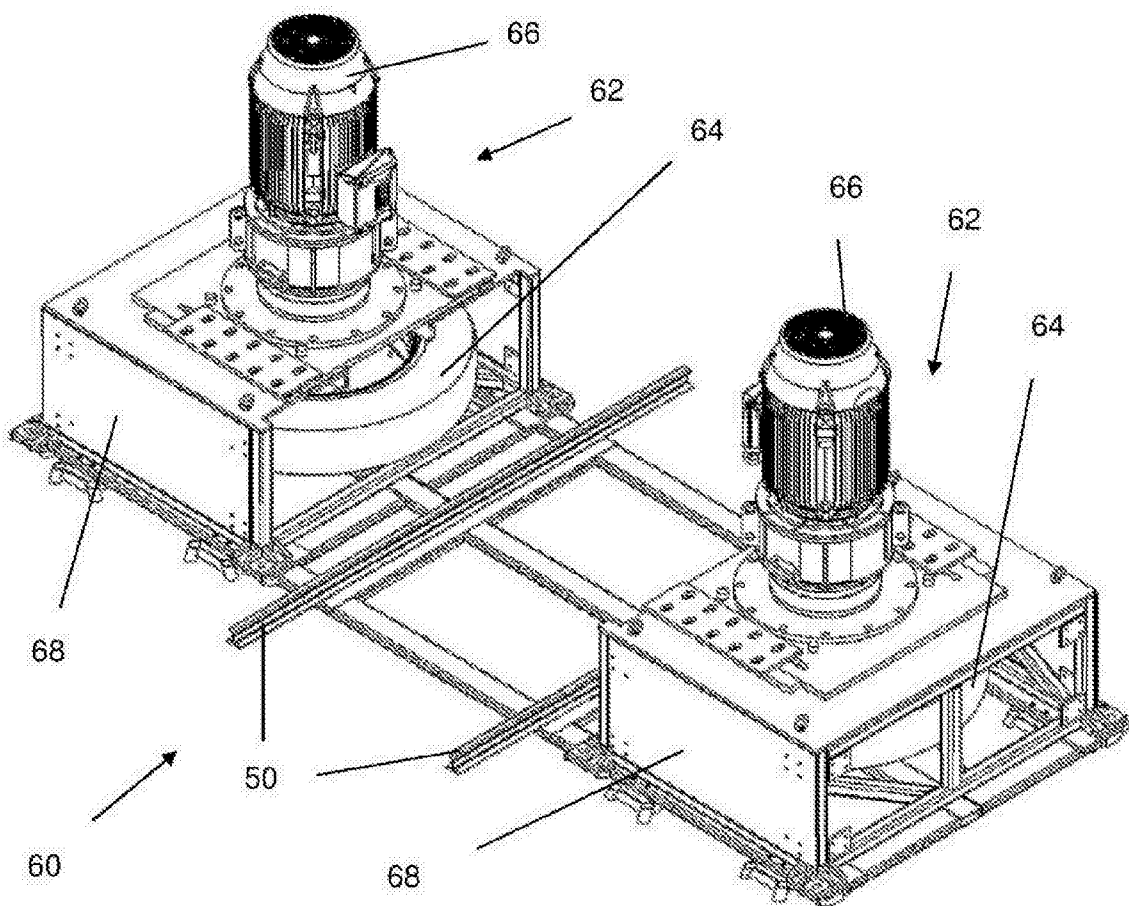
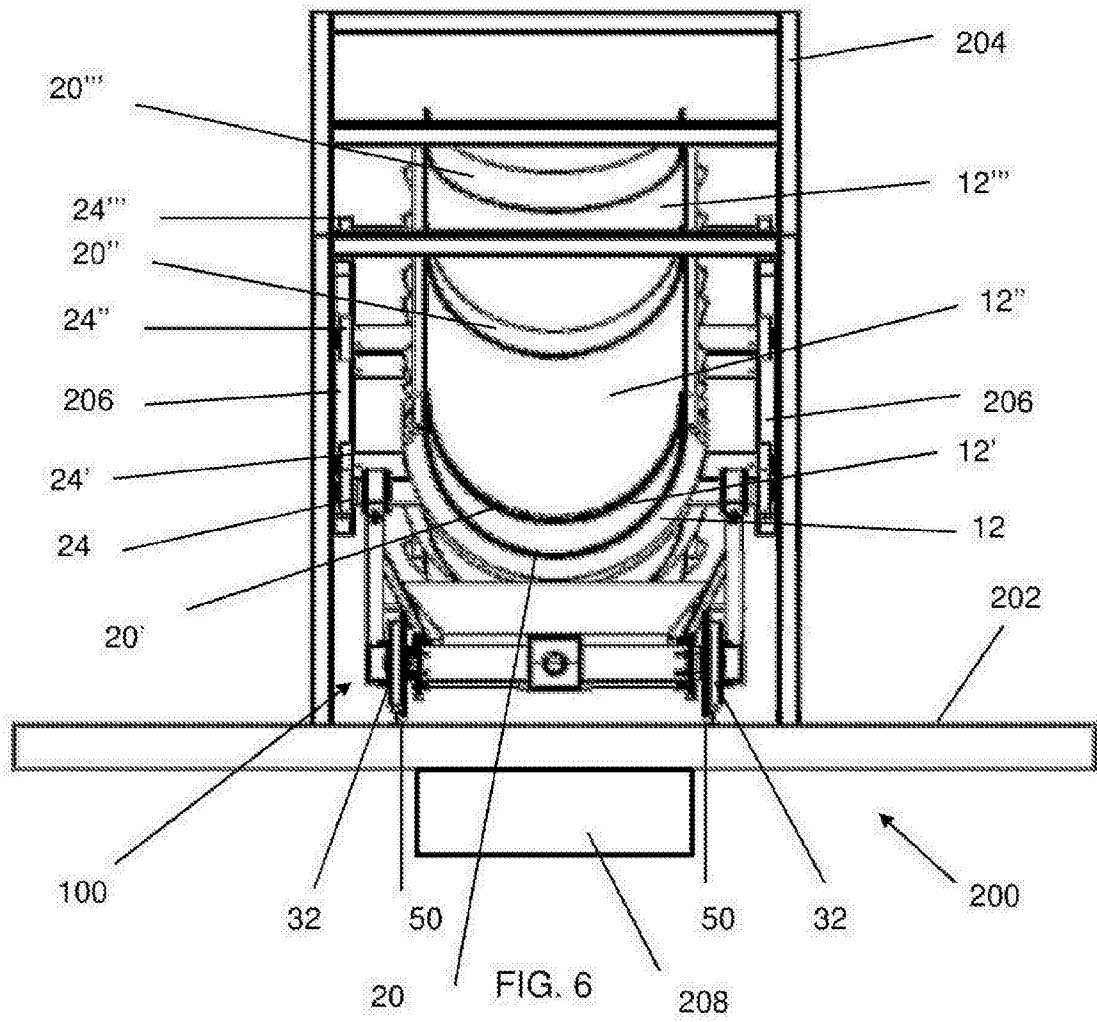
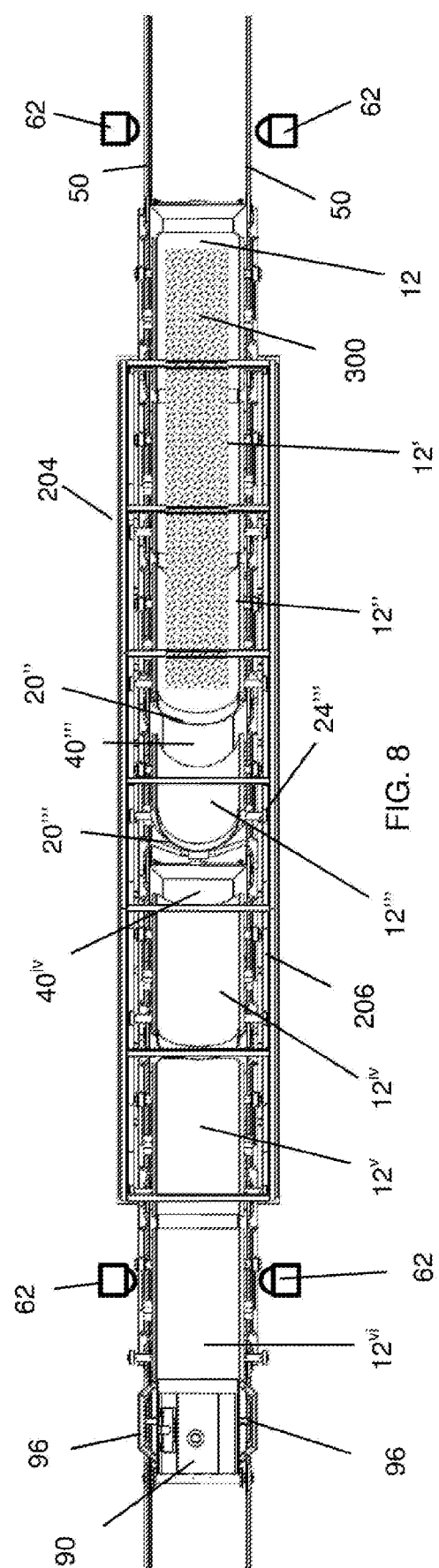
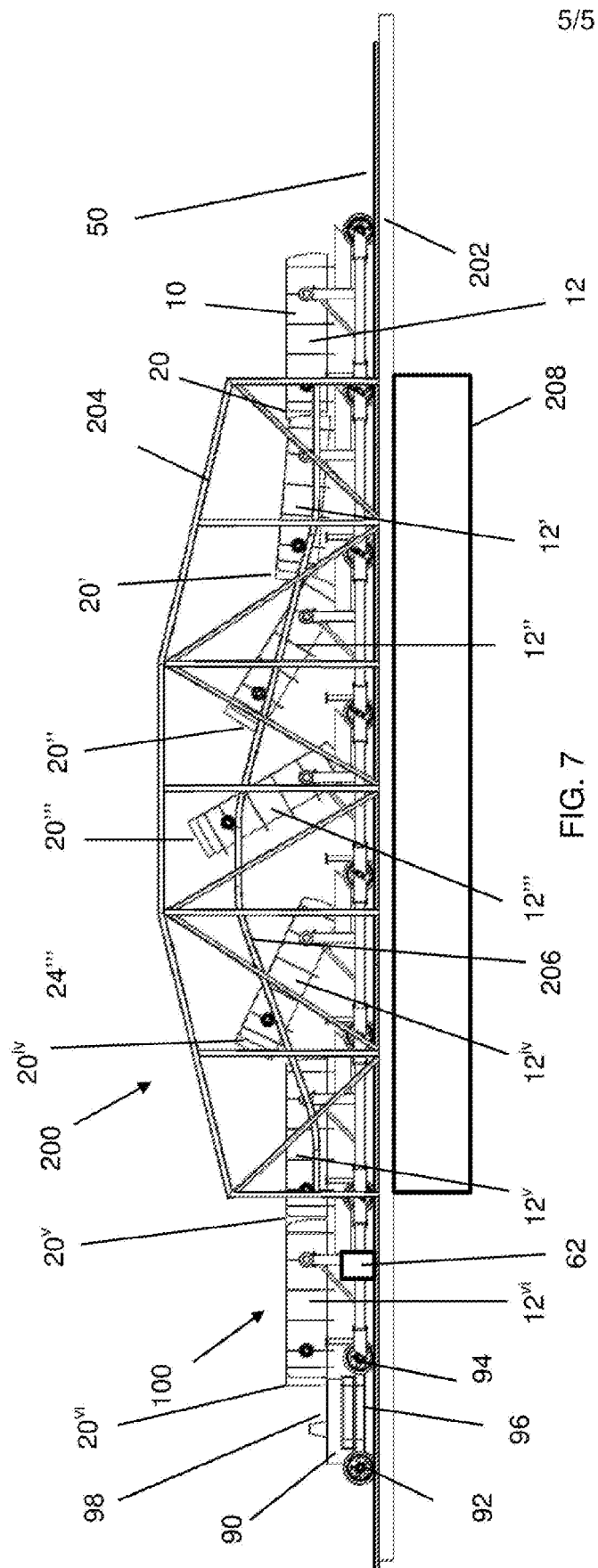


FIG. 5

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU2014/000749

A. CLASSIFICATION OF SUBJECT MATTER

B61D 9/14 (2006.01) B60P 1/28 (2006.01) B61D 11/02 (2006.01) B61D 47/00 (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)

Databases: WPI, EPODOC

IPC Marks: B61D9/00/-, B60P1/12/-, B60P1/28/-, B61D15/00/-, B61D7/06/-, B61D3/04/-, B61D47/00/-, B61K1/00/-, B65G67/40/-.

Keywords: Tip, unload, dump, discharge, deliver, release, distribute, end, rear, distal, longitudinal, parallel, wagon, trolley, cart, train, truck, cam, roller, bearing, follower, activate, tilt, lift, pivot, raise, incline, angle, elevate, rise.

Google Patents and ESPACENET using similar keywords. Applicant and inventor names also searched on ESPACENET.

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

* "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 26 August 2014		Date of mailing of the international search report 26 August 2014	
Name and mailing address of the ISA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA Email address: pct@ipaustalia.gov.au		Authorised officer Clive Gaskin AUSTRALIAN PATENT OFFICE (ISO 9001 Quality Certified Service) Telephone No. 0262256108	

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:
the subject matter listed in Rule 39 on which, under Article 17(2)(a)(i), an international search is not required to be carried out, including
2. ☐ Claims Nos.:
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:
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:

See Supplemental Box for Details

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/AU2014/000749
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CA 2029374 A1 (VENTERSDORP KONTRAKTEURS EDMS) 09 May 1991	1 - 12
Y	Page 9 lines 6 - 15, Page 19 lines 27 - 33, Figures 1, 3, 4 and 8. Page 17 line 35 – Page 18 line 15, Figures 1, 4 and 8.	13 - 16
Y	US 2003/0226470 A1 (DIBBLE ET AL) 11 December 2003 Abstract, Figures 1 and 2.	13 - 16
A	US 4688489 A (MÅNSTRÖM) 25 August 1987 Abstract, Figures 1 and 2a	14, 16

Form PCT/ISA/210 (fifth sheet) (July 2009)

INTERNATIONAL SEARCH REPORT	International application No. PCT/AU2014/000749
Supplemental Box	
Continuation of: Box III This International Application does not comply with the requirements of unity of invention because it does not relate to one invention or to a group of inventions so linked as to form a single general inventive concept. This Authority has found that there are different inventions based on the following features that separate the claims into distinct groups: • Claims 1 – 12 are directed to a rail guided wagon comprising a bulk material carrying body tiltably mounted to the chassis to be inclined with respect to the direction of travel, such that the load can be dumped between the rails when tilted. • Claims 13 and 15 are directed to a plurality of wagons wherein the wagons are connected end to end with abutting respective bodies so as to be able to collectively carry the material in a continuous line across the wagons, this feature is specific to this group of claims. • Claims 14 and 16 are directed to a material carrying rail vehicle system comprising an unloader, wherein the unloader is configured to sequentially tilt the bodies of the wagons so as to unload the material as the wagons move past the unloader. PCT Rule 13.2, first sentence, states that unity of invention is only fulfilled when there is a technical relationship among the claimed inventions involving one or more of the same or corresponding special technical features. PCT Rule 13.2, second sentence, defines a special technical feature as a feature which makes a contribution over the prior art. When there is no special technical feature common to all the claimed inventions there is no unity of invention. In the above groups of claims, the identified features may have the potential to make a contribution over the prior art but are not common to all the claimed inventions and therefore cannot provide the required technical relationship. Therefore there is no special technical feature common to all the claimed inventions and the requirements for unity of invention are consequently not satisfied <i>a priori</i>.	
Form PCT/ISA/210 (Supplemental Box) (July 2009)	

INTERNATIONAL SEARCH REPORT Information on patent family members		International application No. PCT/AU2014/000749	
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
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		SE 8401508 A	20 Sep 1985
		WO 8504138 A1	26 Sep 1985
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)			