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(54) Title: SINGLE CELL ROBOT WITH CONTROL UNIT

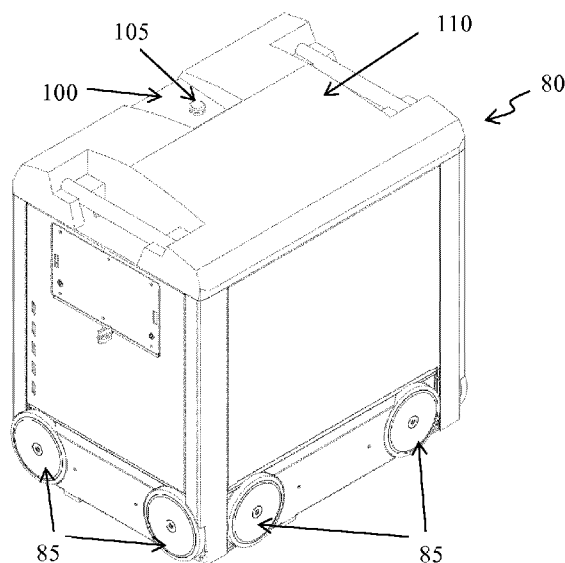


Figure 3

(57) Abstract: A remotely operated vehicle (80) for picking up storage bins (60) from an underlying storage system (10), comprising an internal lifting device for lifting storage bins (60) from the underlying storage system (10), rolling means (85) allowing movement of the vehicle (80) along first and second directions (x, y) on the underlying storage system (10), driving means (90) situated at or at least partly within the rolling means (85) for providing driving force to the vehicle (80) while occupying minimum space, and a control unit (95) configured to control the movements of the vehicle (80), where the control unit (95) is connected to said driving means (90) and provided with wireless communication to and from the vehicle (80) by means of a wireless communication link (75). The control unit (95) is connected to a control panel (100) with input means for manual overriding a remote controlled operation of the vehicle (80).

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Declarations under Rule 4.17:

- *as to the identity of the inventor (Rule 4.17(i))*
- *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*
- *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*
- *of inventorship (Rule 4.17(iv))*

Published:

- *with international search report (Art. 21(3))*

SINGLE CELL ROBOT WITH CONTROL UNIT

Introduction

The present invention relates to a remotely operated vehicle, or robot, for picking up storage bins from a storage system. The vehicle occupies a single cell holding storage bins, and comprises control means for manually overriding a remote controlled operation.

Background

A remotely operated vehicle for picking up storage bins from a storage system is known. A detailed description of a relevant prior art storage system is presented in WO 98/49075, and details of a prior art vehicle being suitable for such a storage system is disclosed in detail in Norwegian patent no. 317366 B1.

Such prior art storage systems comprise a three dimensional storage grid holding storage bins that are stacked on top of each other up to a certain height. The storage grid is normally constructed as aluminium columns interconnected by top rails, onto which a plurality of remotely operated vehicles, or robots, are arranged to move laterally. Each vehicle is equipped with a lift for picking up, carrying, and placing bins that are stored in the storage grid. A vehicle further comprises a rechargeable battery in order to supply electrical power to a motor incorporated in the vehicle. The vehicle typically comprises a control unit adapted for communication with a control system via a wireless link which is provided with power from the internal rechargeable battery that is recharged at a charging station when needed.

An example of a prior art storage system is illustrated in figure 1. The storage system 10 includes a plurality of remotely operated vehicles 80 configured to move in X and Y directions on dedicated supporting rails 20, and to receive a storage bin 60 from a storage column 30 within a bin storing grid 50. The prior art storage system 10 may also include a dedicated bin lift device 70, the latter being arranged to receive a storage bin 60 from a vehicle 80 at the top level of the storage system 10 and to convey the storage bin 60 down in a vertical direction to a delivery port or station 40.

Said known system comprises vehicles 80, each covering a cross section of the underlying storage system 10 corresponding to two storage columns 30.

In order to allow an increase in the number of remotely operated vehicles operating simultaneously on the top rails of the three dimensional storage grid, the applicant has also developed single cell vehicles, where each vehicle occupying only a single cell. Each vehicle will operate very close to each other, e.g. as close as 4mm. This

does however introduce a problem related to congestion if one or more vehicles fail to operate which may result in blocking of other vehicles. If congestion or jamming occurs it will be hard to operate and move the automated vehicles. Control signals to and from vehicles may be blocked.

- 5 It is thus an object of the present invention to provide a single cell vehicle with control means for manually overriding a remote operation thereby enabling manual operation of the vehicle.

Summary of the invention

- 10 The present invention relates to a remotely operated vehicle, or robot, for picking up storage bins from a storage system.

- More specifically, the invention is defined by a remotely operated vehicle for picking up storage bins from an underlying storage system, comprising an internal lifting device for lifting storage bins from the underlying storage system, rolling
15 means allowing movement of the vehicle along first and second directions (x, y) on the underlying storage system, driving means situated at or at least partly within the rolling means for providing driving force to the vehicle while occupying minimum space, and a control unit configured to control the movements of the vehicle, where the control unit is connected to said driving means and provided with wireless
20 communication to and from the vehicle by means of a wireless communication link.

The remotely operated vehicle is characterized in that the control unit is connected to a control panel with input means for manual overriding a remote controlled operation of the vehicle.

Other features of the invention are defined in the dependent claims.

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Brief description of the drawings

Figure 1 is a perspective view of a prior art storage system comprising a grid and a plurality of remotely operated vehicles;

- 30 Figure 2 shows a section of the storage system seen from above where several vehicles are arranged directly above five neighbouring storage columns;

Figure 3 shows a remotely operated vehicle according to one embodiment of the invention, and

Figure 4 shows the control unit and its connection to different control means.

Detailed description of the invention

The present invention addresses a problem related to remotely operated single cell vehicles for picking up storage bins from a storage system. Using single cell vehicles in a storage system described in the background section above allow more vehicles to operate simultaneously. They may then operate very close to each other, e.g. as close as 4mm. This may however introduce a problem if one or more vehicles fails or is stuck. Congestion may then occur resulting in several blocked vehicles. If congestion and jamming occurs it will be hard to operate and move the automated vehicles. Control signals to and from vehicles may further be blocked.

It is thus an object of the present invention to provide a single cell vehicle with control means enabling manually overriding of a remote controlled operation of the vehicle.

Figure 1 is a perspective view of a prior art storage system 10 comprising a storing grid 50 and a plurality of remotely operated vehicles 80. The upper part of the storage grid is provided with dedicated supporting rails 20 for the vehicles to run on. The vehicles 80 are configured to move in X and Y directions on the rails 20, and to receive a storage bin 60 from a storage column 30 within a bin storing grid 50. The storage system 10 may also include a dedicated bin lift device 70, the latter being arranged to receive a storage bin 60 from a vehicle 80 at the top level of the storage system 10 and to convey the storage bin 60 down in a vertical direction to a delivery station or port 40.

Figure 2 shows a section of the storage system 10 seen from above, and where several vehicles 80 are arranged directly above five neighbouring storage columns 30. This figure illustrates the problem occurring if the remotely operated vehicle 80 located in the middle is stuck. It will then block the passage for the other vehicles 80 making a storage operation more time consuming and possibly preventing it totally.

Figure 3 shows a remotely operated vehicle 80 according to one embodiment of the invention. The vehicle 80 is adapted for picking up storage bins 60 from an underlying storage system 10.

The body of the vehicle 80 comprises a cavity for receiving a storage bin 60. The cavity is arranged centrally within and is surrounded by the body of the vehicle 80. The body of the vehicle 80 further comprises A lifting device for lifting and lowering a storage bin 60 is further provided in the body of the vehicle 80.

The vehicle 80 further comprises rolling means 85 allowing movement of the vehicle 80 along first and second directions (x, y) on the underlying storage system 10. The rolling means are connected to driving means 90 situated at or at least

partly within the rolling means 85 for providing driving force to the vehicle 80. This configuration will occupy minimum space within the vehicle 80, thereby freeing space for other installations in the vehicle.

5 The vehicle 80 further comprises a control unit 95 configured to control the movements of the vehicle 80. The control unit 95 is connected to the driving means 90 and provided with wireless communication to and from the vehicle 80 by means of a wireless communication link 75.

10 In addition to controlling the vehicle 80 by means of wireless input signals, the control unit 95 is also connected to a control panel 100 with input means for manually overriding a remote controlled operation of the vehicle 80. This manual overriding feature is important if congestion with several vehicles 80 occurs.

In one embodiment, the control unit 95 is installed in the top section 110 of the vehicle 80, e.g. above the cavity holding a storage bin 60.

15 The control panel 100 may be installed in the top section 110 of the vehicle 80 and with input means that are accessible from the outside of the vehicle 80. This configuration is favourable for vehicles 80 occupying only a single cell. Even though all sides of a vehicle are blocked due to other neighbouring vehicles 80, the outer part of the top section will always be accessible. The control panel 100 may in one embodiment comprise input buttons for controlling movements of the vehicle
20 80.

In one embodiment, the control panel 100 comprises an emergency stop button 105 stopping all operations of the vehicle 80. This may be necessary if the wireless connection is lost. The emergency stop button 105 and the control panel 100 will be accessible for operation from the outside of the vehicle. This opens for different
25 scenarios for pressing the stop button 105 and operating the control panel 100.

One or more vehicles may for instance be equipped with a robot arm enabled to access the control panel of an adjacent vehicle 80. There may also be an installation, located above the upper part of the storage grid, having means for moving to a specific vehicle 80 and accessing the control panel 100 and the stop
30 button 105. An operator may also operate the control panel 100 directly.

By placing a control panel 100 with a stop button 105 on the top part 110 of the vehicle 80, a vehicle may be operated despite of a broken wireless control link.

CLAIMS

1. A remotely operated vehicle (80) for picking up storage bins (60) from an underlying storage system (10), comprising an internal lifting device for lifting storage bins (60) from the underlying storage system (10), rolling means (85) allowing movement of the vehicle (80) along first and second directions (x, y) on the underlying storage system (10), driving means (90) situated at or at least partly within the rolling means (85) for providing driving force to the vehicle (80) while occupying minimum space, and a control unit (95) configured to control the movements of the vehicle (80), where the control unit (95) is connected to said driving means (90) and provided with wireless communication to and from the vehicle (80) by means of a wireless communication link (75),
characterized in that
the control unit (95) is connected to a control panel (100) installed in the top section (110) of the vehicle (80), the control panel (100) having input means, including an emergency stop button (105) for manual overriding a remote controlled operation of the vehicle (80).
2. The remotely operated vehicle (80) according to claim 1, where the control unit (95) is installed in the top section (110) of the vehicle (80).
3. The remotely operated vehicle (80) according to claim 1 or 2, where the control panel (100) comprises input buttons for controlling movements of the vehicle (80).
4. The remotely operated vehicle (80) according to one of the previous claims, further comprising a robot arm installed on its top part (110), where the robot arm is adapted for accessing a control panel of an adjacent vehicle (80).

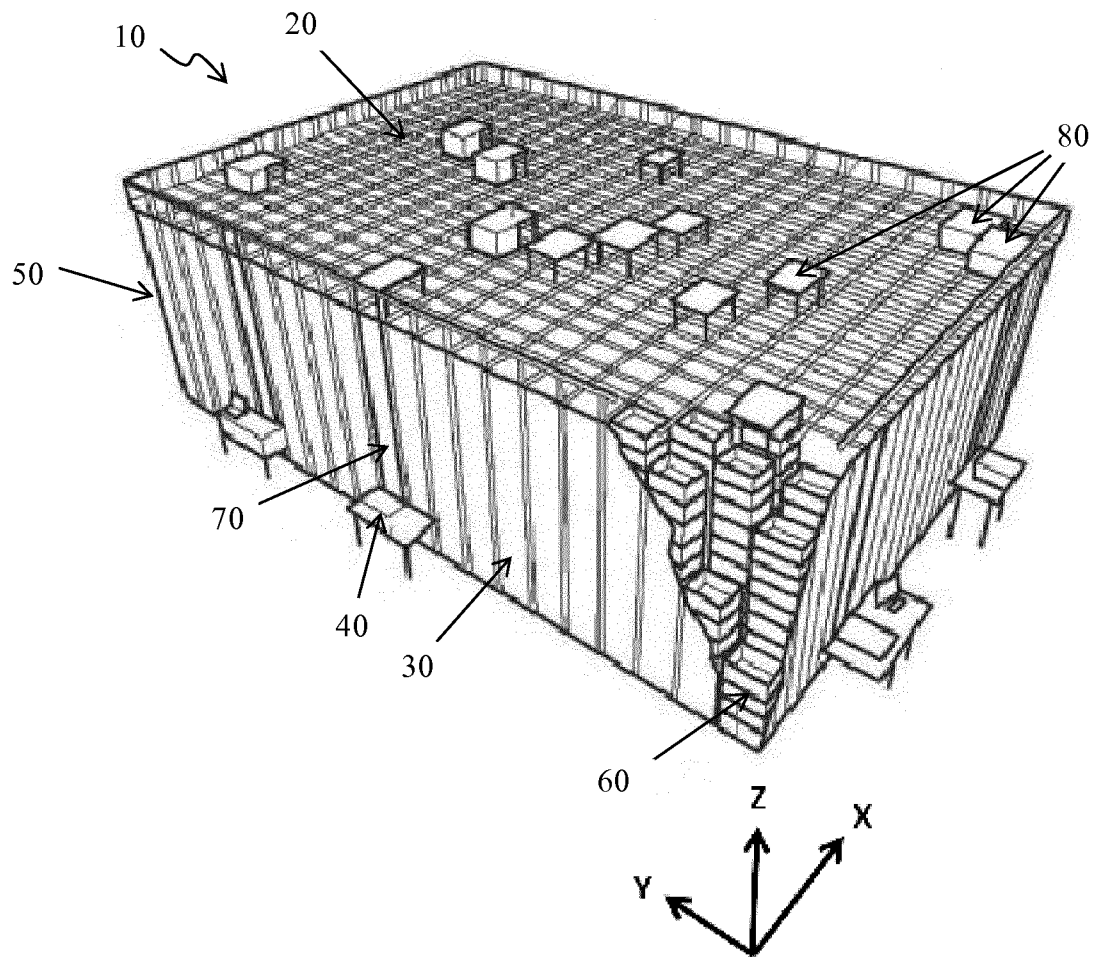


Figure 1

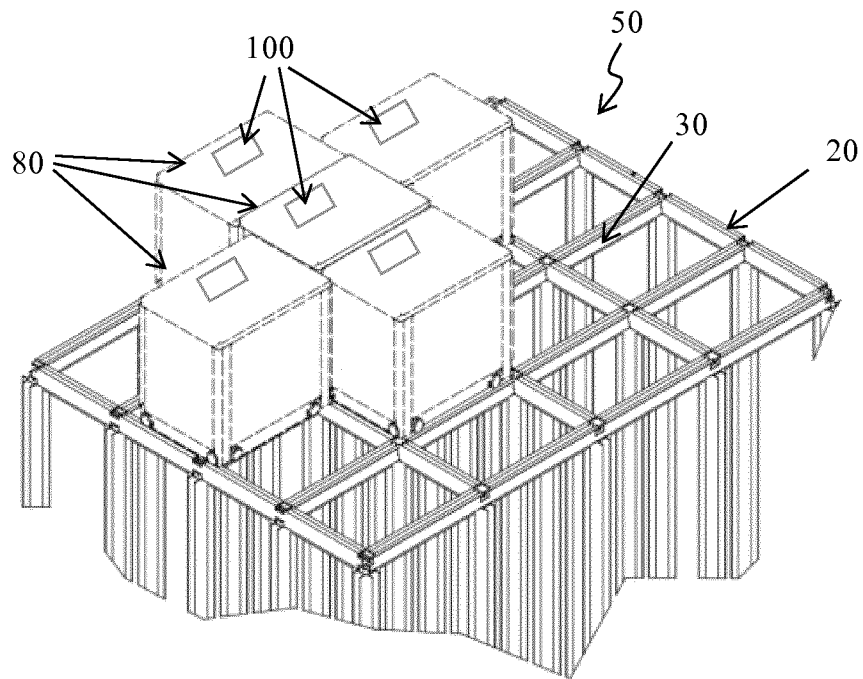


Figure 2

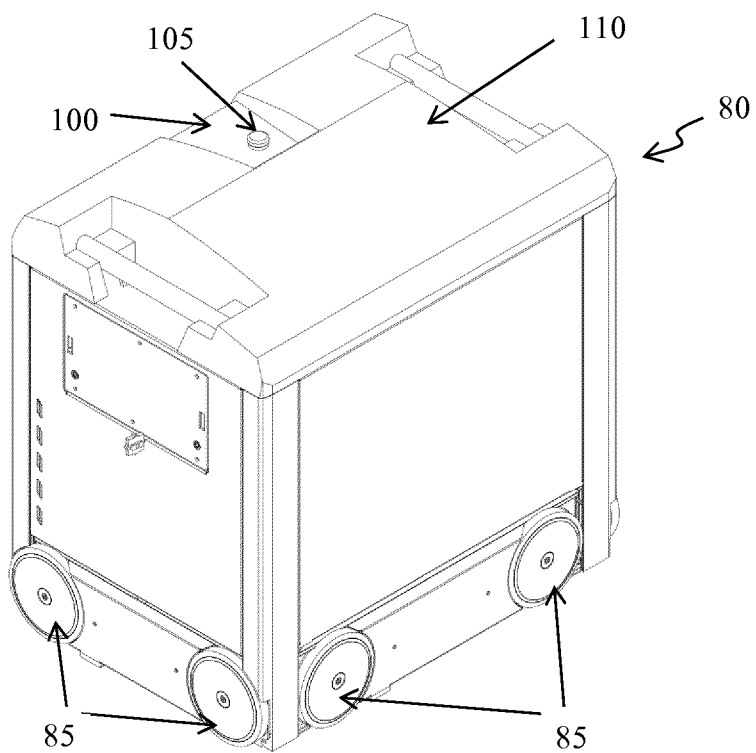


Figure 3

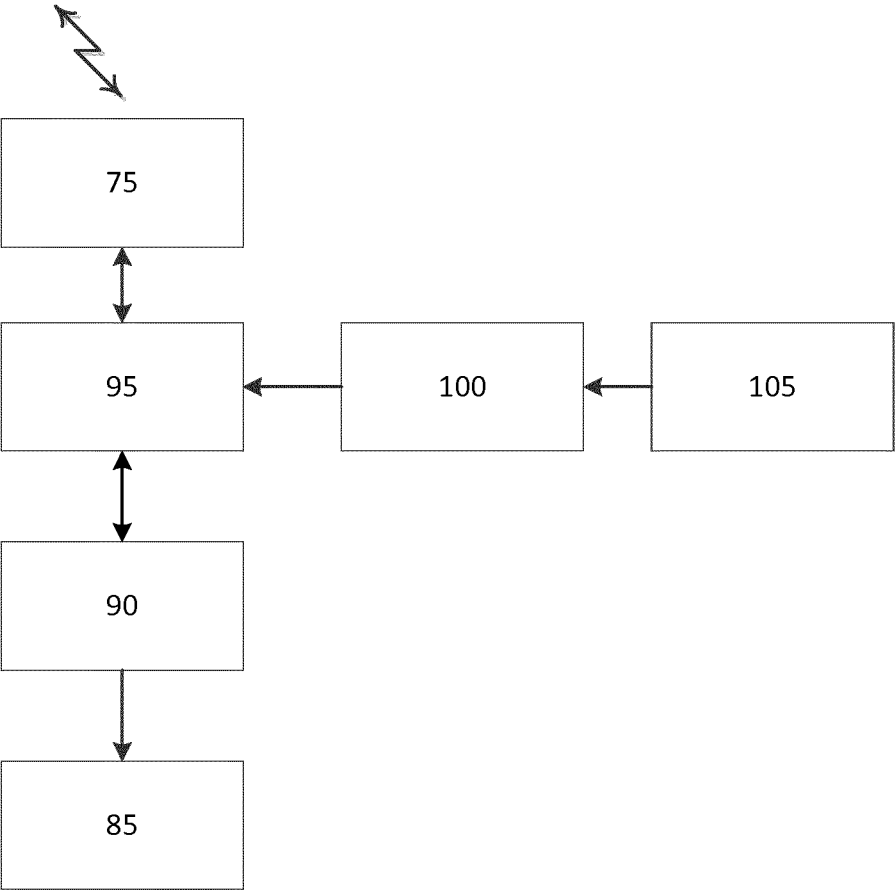


Figure 4

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2017/070016

A. CLASSIFICATION OF SUBJECT MATTER
INV. B65G1/04
ADD.

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)
B65G

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)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	KR 2016 0087922 A (JAKOB HATTELAND LOGISTICS AS [NO]) 22 July 2016 (2016-07-22) paragraph [0020] - paragraph [0029] figures 1-9	1-3
Y	----- US 2002/007235 A1 (HWANG GYU-DONG [KR] ET AL) 17 January 2002 (2002-01-17) paragraph [0001] - paragraph [0004] -----	1-3
A	CN 203 937 526 U (ANHUI CHEARI ZHIRUI TECHNOLOGY CO LTD) 12 November 2014 (2014-11-12) abstract; figures 1,2 -----	4



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

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"P" document published prior to the international filing date but later than the priority date claimed

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"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

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"&" document member of the same patent family

Date of the actual completion of the international search

1 November 2017

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
KR 20160087922 A	22-07-2016	KR 20160087922 A	22-07-2016
		KR 20160106777 A	12-09-2016

US 2002007235 A1	17-01-2002	KR 20020007031 A	26-01-2002
		US 2002007235 A1	17-01-2002

CN 203937526 U	12-11-2014	NONE	
