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(54) Method and system for detecting a grab

(57) The invention relates to a grab (6) to which a first communication unit (15) is attached. The first communication unit (15), which preferably comprises a unique identification code, is designed for wireless communication with a second communication unit (16) disposed elsewhere, for instance at a bearing construction (2) of a crane (1) to which the grab (6) is attached. Preferably, the second communication unit (16) is disposed at a location along a path of the grab (6).

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Description

[0001] Grabs that can be coupled to cranes are industrially used for transferring bulk goods such as coals, ores, cereals and the like. Transfer of bulk goods takes place at, for instance, transfer companies in harbor areas, but also at large industrial users of bulk goods such as steel works and power companies.

[0002] Such grabs are deployed in fairly rough surroundings which are characterized in, inter alia, rough use of the grabs, much dust and/or dirt near the grabs, coarse bulk goods and a continuous risk of damage to the grab as a result of a combination of, inter alia, on the one side, narrow margins in the available time for transferring the goods, and, on the other side, the great forces which occur when transferring the bulk goods.

[0003] Despite the high quality requirements with regard to manufacture and choice of materials and components of which qualified grabs are composed, wear proves impossible to avoid in practice, so that maintenance and repair are required. For an efficient deployment of a grab or a fleet of grabs, it is of importance, in addition to repair data, to obtain information regarding the operational use of the maintenance prone-grab, in order, for instance, to proceed timely to the execution of preventive maintenance or other grab-related activities.

[0004] The object of the invention is to obtain information, such as management information, regarding the use of a grab that can be coupled to a crane. To that end, the invention provides a method for detecting a grab that can be coupled to a crane, with detection taking place wirelessly.

[0005] Through detection of the grab, data about the use of the grab with respect to, for instance, the approximate position of the grab, can be advantageously obtained. Wireless detection enables a particularly flexible method as in practice, detection by means of electric wiring only provides limited possibilities for (re)moving the required infrastructure for carrying out the detection and would, in addition, be extremely vulnerable, if not unfeasible.

[0006] Preferably, the wireless detection takes place with the aid of radio waves as equipment for generating and receiving radio signals is widely available. Use of radio equipment also allows, in an advantageous manner, the detection to be automated, which can be beneficial to the reliability of the obtained data. Naturally, it is also possible to carry out wireless detection in a different manner, with the aid of, for instance, optic means and/or infrared equipment.

[0007] Through the use of radio waves with, substantially, frequencies of hundreds of MHz, an optimum can be advantageously realized, geared to the practical situation in which grabs of cranes are deployed. The fact is that with relatively low frequencies, the adverse affect occurs that relatively much energy is required for transmitting remotely detectable radio signals, which is of importance in particular if a transmitter cannot be directly connected to a local energy network. With relatively high frequencies, the robustness of the radio waves is reduced, inter alia by the occurrence of inconvenient reflections caused by the large amount of steel present, for instance of the grab itself, but also of the bearing construction of the crane. By choosing frequencies of hundreds of MHz, the energy consumption is relatively favorable, while still a robustly detectable radio signal can be generated.

[0008] According to the invention, in an advantageous manner, use can be made of a first communication unit which is attached to the grab, and a second communication unit which is designed for wireless communication with the first communication unit. Due to communication between the communication units, the grab can thus be detected from the second unit. For detection of the grab at a pre-desired location, the second unit can be disposed adjacent said location.

[0009] In a first advantageous embodiment according to the invention, the first communication unit transmits, during use, a repetitive signal, while the second communication unit detects the signal if the grab is present within a predetermined area, also called detection zone, adjacent the second communication unit. As a result, only one transmitter, that is, the first communication unit, and minimally one transceiver, that is, the second communication unit are required. Owing to the simplicity of the concept, a relatively inexpensive embodiment is obtained.

[0010] In a second advantageous embodiment according to the invention, the second communication unit transmits a repetitive signal, while, in reaction to the signal, the first communication unit transmits a second signal if the grab is present within a predetermined area adjacent the second communication unit, the detection zone, whereby the second communication unit detects the second signal. Here, both the first and the second unit are equipped with a transmitter and a transceiver. However, the energy consumption of the first communication unit is considerably smaller than in the first embodiment, as during use, the first unit according to the second embodiment only transmits signals when the grab is present adjacent the second unit.

[0011] Preferably, the first communication unit is designed having a unique identification code so that upon detection, also, the identity of the grab can be established. Thus, confusion of data can be prevented. Hence, the identification code of the grab according to the invention can now be electronically detected so that the risk of errors can be considerably reduced n relation to a system with which the crane operator must enter a code manually. In practice, entering codes manually leads to considerable confusion due to incorrect identification, errors or inattention of the crane operator. As a result, other measured data which are coupled to the identification of the grab become practically useless. Thus, by equipping the first communication unit with a unique identification code, incorrect identification is prevented so that other

data coupled thereto are made available as relevant information.

[0012] By, further, entering data in a database regarding the detection of the grab, the data can be adequately sorted and stored, so that at a later moment, the data may, if desired, be made available, for instance for determining whether preventive maintenance of the grab is to be recommended.

[0013] Advantageously, also other data regarding the grab are entered into the database, for instance dates on which repair operations to the grab have been carried out, or data regarding items connected, optionally permanently, to the grab, such as grab wires. Integration of data regarding the grab enables improvement of logistic decision-making as the decisions can be based on more detailed information. In this manner, for instance also day-to-day costs of a grab in combination with its use can be visualized in a transparent manner. By also entering in the database, for instance, the weight transferred by the grab and obtained by measuring equipment in a crane, the maintenance costs and the performance of the grab can be visualized.

[0014] Due to selection with the aid of an interface of specific data entered into the database, in an efficient manner, for the purpose of easy reference, only the data needed at a specific moment can be made available, data regarding, for instance, a specific grab, so as to compose a grab profile. Also, statistical data regarding a fleet of grabs may be visualized, such as costs of repair. Naturally, it is also possible to select other specific data, for instance for assessing the status of grabs, or the use thereof by different operators.

[0015] Selecting data of different grabs from the database, for instance different types of grabs, or grabs of various manufacturers, enables advantageous comparison of profiles of the different grabs with regard to, for instance, performance or costs per transferred ton of bulk goods.

[0016] The invention also relates to a grab.

[0017] In addition, the invention relates to a crane.

[0018] Also, the invention relates to a detection system.

[0019] The invention further relates to a computer system.

[0020] Here, the invention relates to a computer program product.

[0021] Further advantageous embodiments of the invention are represented in the subclaims.

[0022] The invention will be further elucidated with reference to an exemplary embodiment represented in the drawing. In the drawing:

Fig. 1 shows a schematic side view of a crane with a grab according to the invention coupled thereto; and

Fig. 2 shows a schematic partial view of the grab of Fig. 1.

[0023] The Figures are only schematic representations of a preferred embodiment of the invention. In the Figures, identical or corresponding parts are indicated with the same reference numerals.

[0024] Fig. 1 shows a crane 1 according to the invention. The crane 1, in this Figure designed as a bridge crane, has a bearing construction 2 on which a rail construction 3 rests. The rail construction bears a movable lifting mechanism 4 carrying and operating a grab 6 by means of coupling means. The coupling means comprise a cable system 5. On the bearing construction 2, also a control cabin 18 rests.

[0025] The crane 1 is moveable along a quay 7 in a harbour area by means of, for instance, wheels guided through rails in the quay 7. In the water 8 beside the quay 7, a ship 9 is docked with bulk goods 10 such as sand, coals or ore in the hold 11. The crane 1 transports the bulk goods 10 from the hold 11 to a storage space such as a silo or bunker 12 in the bearing construction 2 of the crane, or to a depot 13 on the quay 7 located further away from the water 8. Naturally, the bulk goods can also be transferred to other spaces such as freight cars, loading spaces of trucks, conveyor belts and/or cargo spaces of other ships.

[0026] The grab 6 shown is designed as a scissors grab. Naturally, other types of grabs are possible too, such as a bar grab. With the aid of the lifting mechanism 4, the person in the control cabin 18 operating the crane 1, also called operator, can hoist the grab 6, lower it and open and close it. The grab 6 can be uncoupled so that a different grab, for instance of a different type or from a different manufacturer, can be coupled to the crane 1. During transfer of the bulk goods 10, the grab 6 travels a more or less predetermined path 14. In Fig. 1, the path 14 is represented upon transfer between the ship 9 and the depot 13 on the quay 7. Naturally, with transfer between the bunker 12 and the ship 9 or the depot 13 the path 14 alters.

[0027] A first communication unit 15 is attached to the grab 6, as will be explained hereinafter in more detail. The bearing construction 2 of the crane 1 is provided with a second and third communication unit 16, 17 disposed at locations along the path 14 of the grab 6, preferably to legs 2a of the supporting construction 2a. The second and third communication unit 16, 17 are each designed for wireless communication with the first communication unit 15 on the grab 6. When the grab 6 passes the second or third communication unit 16, 17, and is, hence, temporarily present in the detection zone of the communication units 16, 17, respectively, the second or third unit 16, 17 detects the first unit 15 and consequently, the grab. As a result, cycles of the grab 6 can be determined in a highly advantageously manner. Determination of the cycles provides the user of the grab 6 with particularly usable information not available before. The cycle information can be used highly favourably for, for instance, optimizing the use and/or for comparing the grab 6, as will be elucidated hereinbelow in more detail. Due to the use

of the second and third unit, a redundancy is built-in, so that breakdown of one the units 16, 17 disposed in the bearing construction needs not lead to breakdown of the entire detection system comprising at least the first communication unit 15 and another communication unit 16, 17, while the first communication unit 15 is provided with attachment means for attachment to the grab 6. Moreover, through the use of the second and third unit 16, 17, also, the current direction of movement of the grab 6 along the path 14 can be determined. Detection along different paths of grabs can also take place. The second and third communication units 16, 17 are connected to a computer system, so that data with regard to the detection of the grab 6 can be stored. Naturally, it is possible to place a multiple number of communication units, for instance three or four units, each designed for wireless communication with the first unit.

[0028] Preferably, the first communication unit is designed having a unique identification code, so that upon detection, also, the identity of the grab can be determined. Confusion of data can thus be prevented.

[0029] The communication unit 16 that is attached to the grab 6 comprises a transmitter for transmitting radio waves, also called radio signals, with frequencies of approximately 400 MHz, for instance 433 MHz. The radio signals are transmitted in a repetitive manner, at intervals of, for instance, tenths of seconds. The second and third communication unit 16, 17 comprise a transceiver for detecting the repetitive radio signals within a predetermined area adjacent the second and third unit 16, 17 so that detection of the grab 6 can take place.

[0030] In a different embodiment, after detection of repetitive radio signals generated by a second communication unit, a first communication unit reacts by transmitting a different radio signal that can be detected by the second communication unit. Through the use of different frequencies for the different signals, interference can be prevented. The repetitive frequency can for instance be approximately 400 MHz, and the other radio signal for instance approximately 900 MHz.

[0031] Fig. 2 shows a schematic partial view of the grab 6. The first communication unit 16 is attached to the grab 6 adjacent a main pivot A of the grab 6, so that the orientation of the unit 15 is more or less independent of the position of the grab 6. This is beneficial to the robustness of the wireless communication with the other communication units.

[0032] The first communication unit 15, preferably designed as a RFID tag, more preferably as a heavy duty RFID, is attached to the first communication unit 15 with the aid of attachment means. The attachment means can comprise epoxy and/or resin for embedding the unit 15 so that interference of the incoming and outgoing signals is minimal. The unit 15 may also be suspended in a resilient manner. The attachment means can further comprise a housing. Accommodation of the unit 15 in a housing 19 which is detachably attached to the grab 6 enables a relatively easy replacement of the communication unit 15, while also, a relatively robust unit is obtained. Moreover, the unit 15 can simply be attached to already existing grabs. Preferably, the housing 19 comprises a steel ring defining a cavity 21 in which the first communication unit is disposed. The rear side 22 of the housing 19 can be of closed design, optionally in metal, while the front 20 of the housing 19 is clear of metals and is preferably filled up with epoxy and/or resin for closing off and/or embedding the unit 15.

[0033] A computer program product, also called software, is loaded on the computer system for entering in a database data regarding detection of the grab. Also other data can be loaded in the database. Here are involved, for instance, profile data of the grab such as identification number, serial number, order number, manufacturer, production date, grab type, theoretical capacity, practical capacity, individual weight, filling per cycle, number of cycles a day/week/year, total number of cycles, cycles per session, transported weight per cycle, total transported weight since last repair and/or during life-span grab, estimated life-span, type and date of damage, type and date of maintenance and/or repair, total operating time of the grab and availability of the grab.

[0034] Additionall y, data that can be entered regarding a specific session, such as an identification of the operator, session identification, date, time, number of cycles in the session, transferred weight, type of transferred bulk goods, material density of the bulk goods *et cetera* can be involved.

[0035] Also, data regarding costs can be entered into the database such as purchase costs, total maintenance costs, sub-costs per repair and the like.

[0036] Collection of data in the above-mentioned manner enables easy comparison of the performances and current costs of different grabs from a fleet of grabs in an advantageous manner.

[0037] The computer system is also provided with applications for the representation, by means of an interface, of selected data with regard to, for instance, the profile of a specific grab, for comparing grabs, for showing statistic data of a grab or fleet of grabs, for showing costs, for representing the status of a grab or a fleet of grabs with, optionally, a status history, or for showing data with respect to use by different operators. As a result, in an effective manner, data are made available that visualize productivity and costs, for instance per transferred ton of bulk goods, so that logistic planning with respect to, for instance, preventive maintenance can be carried out better.

[0038] The invention is not limited to the above-described exemplary embodiments. Many variants are possible.

[0039] For instance, it is also possible to realize a fourth, portable communication unit which is connected to a computer system in which data from grabs are stored. Through detection of a grab, in situ, all sorts of information from the history of the grab can be retrieved.

[0040] Naturally, instead of bridge cranes, other types

of cranes can be used as well, for instance pivot cranes, that is, cranes with which the entire crane is constructed for pivotal movement about a central axis. Such a pivot crane is used, for instance, on independently floating pontoons or on quay platforms. Floating cranes are deployed for direct transfer of bulk goods between cargo spaces of different ships. The path the grab of a pivot crane travels is often, in top plan view, substantially a segment of a circle extending, most often, not directly along or through the bearing construction of the crane. In order to determine the cycles of the grab, the second communication unit is disposed such that the detection zone is present between the end points of the path of the grab. Preferably, to that end, the sender and/or transceiver configuration of the second unit has a limited opening angle, or detection angle. As is the case with bridge cranes, naturally with pivot cranes too, a multiple number of communication units can be placed

[0041] Such variants will be clear to the skilled person and are understood to fall within the range of the invention as set forth in the following claims.

Claims

1. A method for detecting a grab that can be coupled to a crane, wherein detection takes place wirelessly.

2. A method according to claim 1, wherein the wireless detection takes place with the aid of radio waves.

3. A method according to claim 2, wherein the radio waves have frequencies of, substantially, hundreds of MHz.

4. A method according to any one of the preceding claims, wherein a repetitive signal is used with a frequency of approximately 400 MHz.

5. A method according to any one of the preceding claims, wherein a signal is used with a frequency of approximately 900 MHz in reaction to the repetitive signal.

6. A method according to any one of the preceding claims, wherein use is made of a first communication unit attached to the grab and a second communication unit designed for wireless communication with the first communication unit.

7. A method according to claim 6, wherein the first communication unit transmits, during use, a repetitive signal while the second communication unit detects the signal if the grab is present within a predetermined area adjacent the second communication unit.

8. A method according to claim 6, wherein the second communication unit transmits, during use, a repetitive signal, the first communication unit transmitting, in reaction to the signal, a second signal if the grab is present within a predetermined area adjacent the second communication unit, while the second communication unit detects the second signal.

9. A method according to any one of the preceding claims, wherein detection of the grab takes place when passing a predetermined position in the path of the grab.

10. A method according to any one of the preceding claims, comprising entering data in a database regarding detection of the grab.

11. A method according to any one of the preceding claims, comprising also entering in the database other data regarding the grab.

12. A method according to any one of the preceding claims, comprising selecting, with the aid of an interface, specific data entered in the database.

13. A method according to any one of the preceding claims, comprising selecting data from the database regarding a specific grab.

14. A method according to any one of the preceding claims, comprising selecting data from the database for comparing different grabs.

15. A method according to any one of the preceding claims, comprising selecting data from the database regarding maintenance of grabs.

16. A grab for coupling to cranes, to which grab a first communication unit is attached designed for detecting the grab and for wireless communication with a second communication unit.

17. A grab according to claim 16, wherein the first communication unit comprises a unique identification code.

18. A grab according to claim 16 or 17, wherein the first communication unit is accommodated in a housing which is detachably attached to the grab.

19. A grab according to any one of claims 16 - 18, wherein the first communication unit is embedded in a metal ring by means of epoxy and/or resin.

20. A grab according to any one of claims 16 - 19, wherein the first communication unit is provided at the outside of the grab adjacent a main pivot of the grab.

21. A crane, comprising a bearing construction and cou-

pling means for coupling to a grab to which a first communication unit is attached for detection of the grab, while for wireless communication with the first communication unit, the crane is further provided with a second communication unit.

22. A crane according to claim 21, wherein the second communication unit is disposed at a location along a path of the grab.

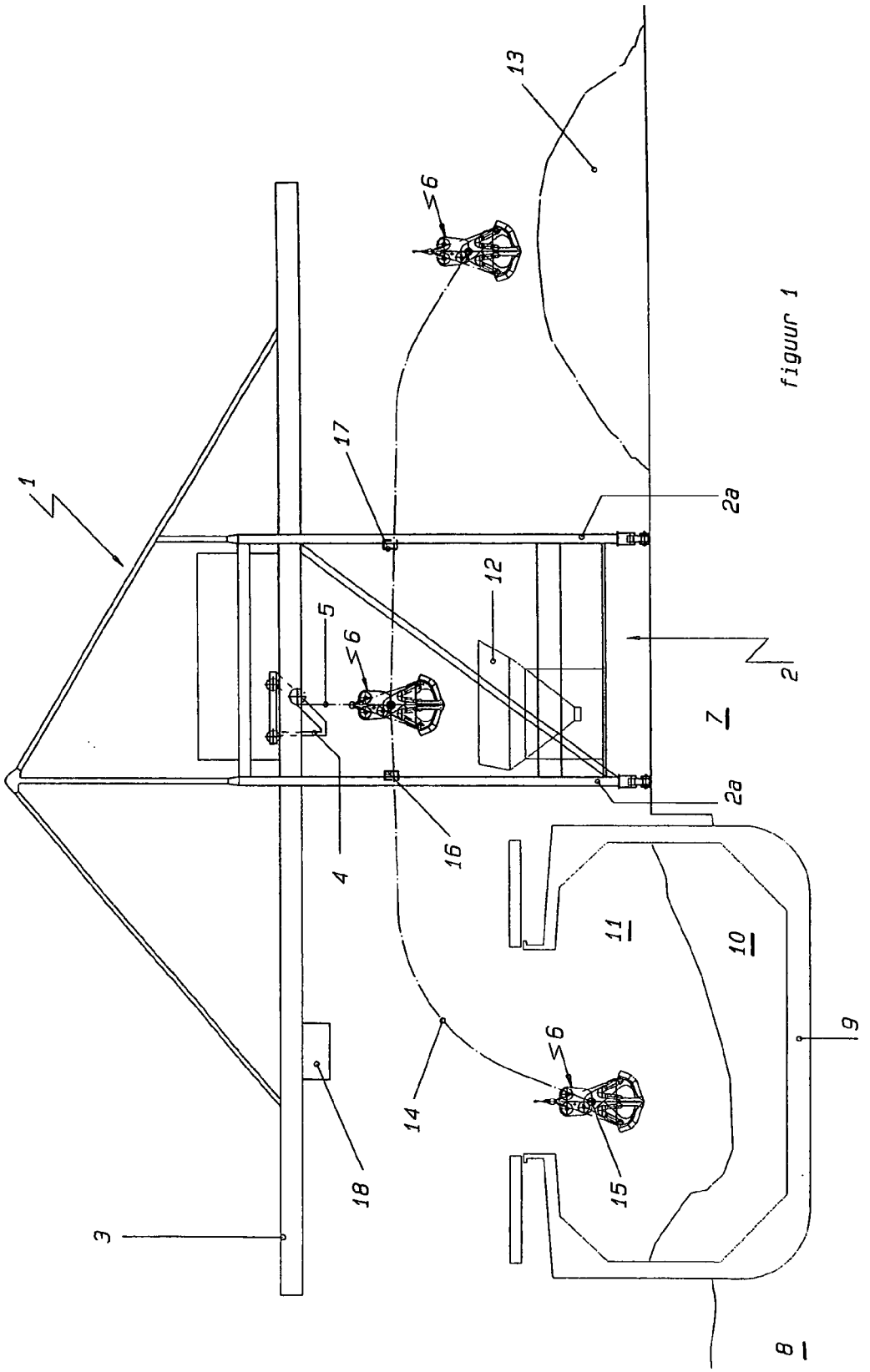
23. A crane according to claim 21 or 22, which is further provided with a third communication unit designed for wireless communication with the first communication unit, while the third communication unit is also disposed at a location along a path of the grab.

24. A crane according to any one of claims 21 - 23, wherein the second communication unit is connected to a computer system.

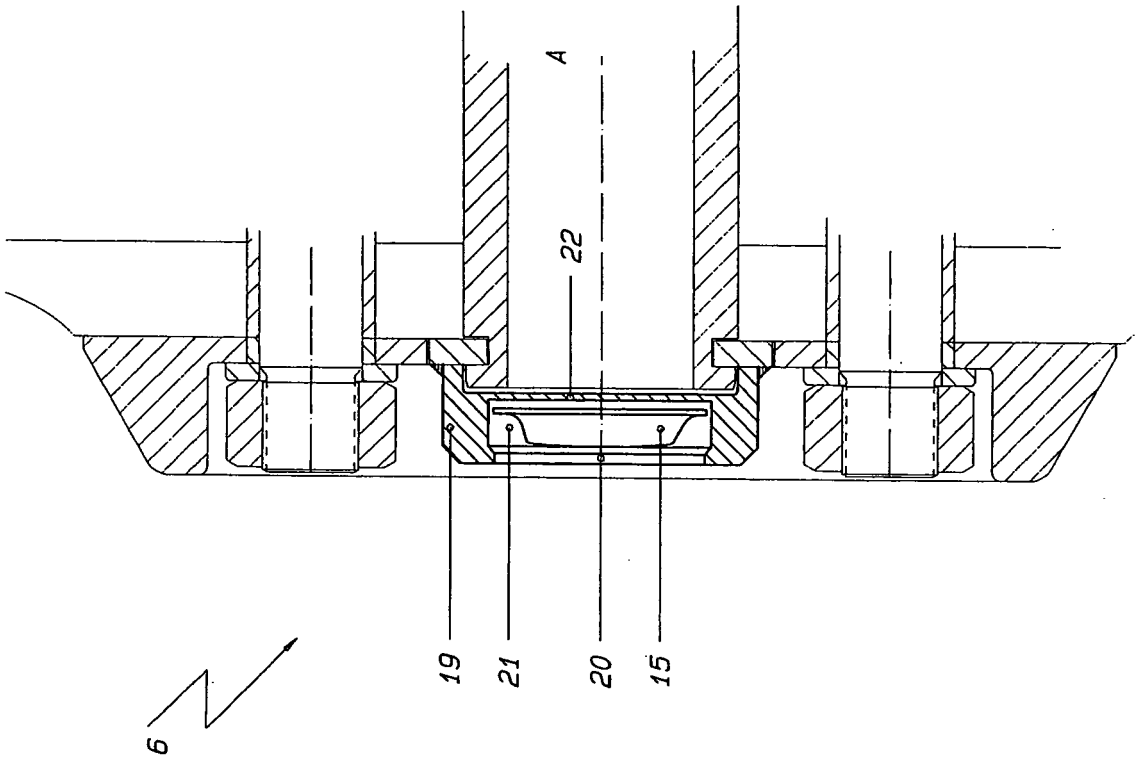
25. A detection system for wirelessly detecting a grab for cranes, comprising a first communication unit which is provided with attachment means for attachment to the grab, and a second communication unit designed for wireless communication with the first communication unit.

26. A computer system which is connected to a second communication unit designed for wireless communication with a first communication unit attached to a grab for cranes, for wirelessly detecting the grab.

27. A computer program product designed for having a computer system execute a method according to any one of claims 1 - 15.



figuur 1



Figuur 2

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 05 07 7920

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	25 April 2006	Sheppard, B

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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L : document cited for other reasons

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 05 07 7920

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
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