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(54) Title: MAINTENANCE VEHICLE AND METHOD

(54) Bezeichnung : INSTANDHALTUNGSFAHRZEUG UND VERFAHREN

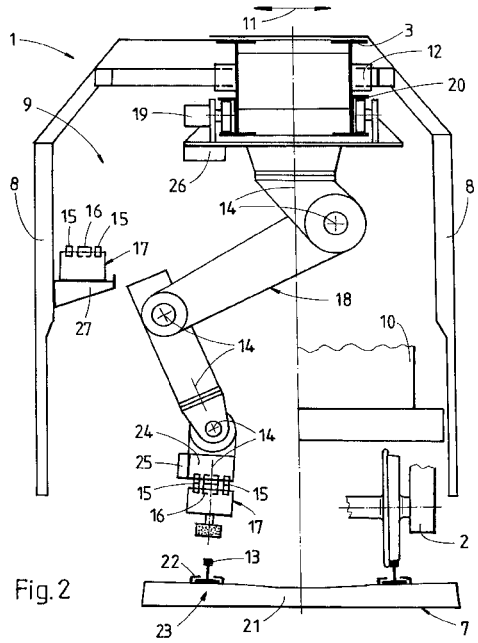

Fig. 2

(57) Abstract: The invention relates to a maintenance vehicle (1) having side walls (8) for creating a work space (9) bounded by said side walls for a work force on a track (7), which side walls are arranged on a vehicle frame (3) and can be spaced apart from each other in the vehicle transverse direction (11). For the processing of a track segment located within the work space (9), an industrial robot (18), having at least three axes of motion (14), media couplings (15) for energy supply, and a tool coupling (16) for selective connection to a track-processing tool (17), is arranged on the vehicle (1).

(57) Zusammenfassung: Ein Instandhaltungsfahrzeug (1) weist auf einem Fahrzeugrahmen (3) angeordnete, in Fahrzeugquerrichtung (11) voneinander distanzierbare Seitenwänden (8) zur Schaffung eines durch diese begrenzten Arbeitsraumes (9) für auf einem Gleis (7) befindliche Arbeitskräfte auf. Für die Bearbeitung eines innerhalb des Arbeitsraumes (9) gelegenen Gleisabschnittes ist ein wenigstens drei Bewegungsachsen (14), Medienkupplungen (15) für eine Energieversorgung sowie eine Werkzeugkupplung (16) zur wahlweisen Verbindung mit einem Gleisbearbeitungswerkzeug (17) aufweisender Industrieroboter (18) am Fahrzeug (1) angeordnet.

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MAINTENANCE VEHICLE AND METHOD

Technical Field

[01] The invention relates to a maintenance vehicle and a method of carrying out maintenance operations on a section of a track.

Background of the Invention

[02] The discussion of the background to the invention that follows is intended to facilitate an understanding of the invention. However, it should be appreciated that the discussion is not an acknowledgement or admission that any aspect of the discussion was part of the common general knowledge as at the priority date of the application.

[03] Known according to DE 20 2004 013 732 U1 is a maintenance vehicle including a work space open towards the track. The upper end region of the work space in vertical direction is formed by an upwardly recessed vehicle frame so that working personnel can work on the track without hindrance between two side walls in a secured area.

[04] On a further track work vehicle disclosed in DE 92 06 335 U1, an articulately designed jib is installed in the region of a bridge-shaped chassis wherein, with the aid of said jib, a tool arranged thereon can be positioned in a section of terrain situated next to the track.

[05] It is desirable to provide a maintenance vehicle of the type mentioned at the beginning with which an improved track treatment is possible.

Summary of the Invention

[06] According to one form of the invention there is provided a maintenance vehicle, consisting of a vehicle frame, supported at the ends on on-track undercarriages, and having side walls for creating a work space, delimited by theside walls, for working personnel situated on a track, the side walls being arranged on the vehicle frame, wherein, for treatment of a track section located

within the work space, an industrial robot is arranged on the vehicle, the robot having at least three motion axes and media couplings for energy supply as well as a tool coupling for selective connection to a track treatment tool.

[07] According to another form of the invention there is provided a method of carrying out maintenance work on a section of a track which, for creating a secured work space, is delimited by a maintenance vehicle, comprising: a) a track treatment tool suitable for a scheduled work operation is selected from a group of tools pre-stored in the work space and automatically coupled to an industrial robot both mechanically as well as with regard to a complete energy supply, b) with the aid of sensors arranged on the industrial robot, a track component to be treated is contact-less scanned for creating a reference base for a subsequent automatic work operation of the tool.

[08] Equipping the work space in this manner enables a complete relief of the working personnel from physical stress resulting from the manipulation of the track treatment tool. Furthermore, the accuracy of the work result can be increased due to a precise guidance by the robot. With the energy supply by way of the media couplings, the use of noisy combustion engines producing exhaust gases also becomes superfluous.

[09] Due to the possibility of containing various track treatment tools in the work space, it is possible to cover to a large extent all work required for complete track maintenance. The use of a worker can be restricted essentially to controlling functions. In connection with scanning the track components to be worked on, on the one hand a precise operation of the track treatment tool is ensured and, on the other hand, also a finalising documentation of the work result is possible.

[10] Additional advantages of the invention become apparent from the dependent claims and the drawing description.

Brief Description of the Drawings

[11] The invention will be described in more detail below with reference to an embodiment represented in the drawing. Fig. 1 shows a simplified side view of a maintenance vehicle, and Fig. 2 shows an enlarged cross-section of the

maintenance vehicle forming a work space.

Detailed Description

[12] A maintenance vehicle 1 shown in Fig. 1 has a vehicle frame 3, supported at the ends on on-track undercarriages 2, and a driver's cabin 4. With the aid of a motive drive 5, the vehicle 1 is mobile on a track 7 in a longitudinal direction 6 of the vehicle. The vehicle frame 3 is designed to be upwardly recessed between the two on-track undercarriages 2, whereby a work space 9 is delimited between two side walls 8 (see Fig. 2) which is open in the direction towards the track 7 but otherwise closed in itself for safety reasons. Said work space 9 is accessible from a crew cabin 10, so that workers busy in the work space 9 are not required to dwell in a danger area situated outside the maintenance vehicle 1.

[13] As visible in Fig. 2, two side walls 8 are provided which can be distanced from one another by means of a drive 12 in a transverse direction 11 of the vehicle extending perpendicularly to the longitudinal direction 6 of the vehicle. In the example shown, for providing an enlarged work space 9, only the side wall 8 on the left is displaced in the transverse direction 11 of the vehicle, so that a left-hand rail 13 of the track 7 can be worked on without hindrance. If needed, it is possible to additionally displace also the opposite, right-hand side wall 8 in the transverse direction 11 of the vehicle relative to the vehicle frame 3 for further enlargement of the work space 9.

[14] For treatment of a section of the track 7 lying within the work space 9, an industrial robot 18 is arranged on the vehicle 1, the robot having at least three motion axes 14 and media couplings 15 for energy supply as well as a tool coupling 16 for selective connection to a track treatment tool 17 (in Fig. 2 a rail grinder, for example). Said industrial robot 18 is mounted for displacement by means of a drive 19 on a robot guide 20 which extends in the longitudinal direction 6 of the vehicle and is fastened to the vehicle frame 3.

[15] For contact-less scanning of track components 23 which are accessible within the work space 9 and are composed of the rails 13, sleepers 21 and rail fastenings 22, the industrial robot 18 is equipped with sensors 25 at an end 24 at

the coupling side. A control device 26 associated with the industrial robot 18 is designed, in addition to the robot control, for storing parameters detected by the sensors 25 and characterizing the work quality of the track components 23 treated by the robot 18.

[16] The industrial robot 18 is configured for automatic coupling to the track treatment tool 17, stored for selection on a tool shelf 27 inside the work space 9, as well as for the automatic energy supply thereof by the media couplings 15 and for a subsequent work assignment taking place automatically in a selectable program mode. If needed, it is also possible to automatically control via the control device 26 a combined work effort of the industrial robot 18 with a spring balancer 28 displaceable on the vehicle frame 3 in the longitudinal direction 6 of the vehicle (see Fig. 1), particularly for installing or removing the rails 13. Thus, handling of heavy rail parts is facilitated by the industrial robot 18.

[17] For implementing maintenance operations, the vehicle 1 is stopped on a track section to be treated, and the work space 9 required for unhindered working on the track components 23 is created by displacement of the two side walls 8. For a scheduled work operation of the industrial robot 18, after inputting a corresponding code into the control device 26, the appropriate track treatment tool 17 is selected from a group of tools, pre-stored on the tool shelf 27 in the work space 9, and automatically coupled - both mechanically as well as with regard to a complete energy supply - to the industrial robot 18.

[18] The track component 23 to be treated by the track treatment tool 17 is then contact-less scanned with the aid of the sensors 15 arranged on the industrial robot 18, in order to obtain a suitable reference base for an exact work result for the following automatic working operation. This scanning by the industrial robot 18 could, of course, also be carried out immediately prior to the coupling to the track treatment tool 17.

[19] If desired, it is also possible to carry out a contact-less scan of the track component 23, preferably a rail 13 to be ground, by the sensors 25 during the work operation in order to compare the measuring data thus gained to a target condition stored in the control device 26. If the work operation is composed of several working

passes, as in rail grinding, for example, these are repeated automatically until the sensors 25 register that the target condition has been attained. Thus, the program sequence for the industrial robot 18 is automatically changed for achieving an optimal work result. Due to being mobile along the robot guide 20, the industrial robot 18 can be employed without hindrance in the entire work space 9, as desired.

[20] For a work operation of rail drilling, cited here as an example, the rail head is measured via the sensors 25 and a coupled rail drill is moved precisely to the correct position by the industrial robot 18. After drilling has taken place, it is possible to carry out a finalizing quality check with the aid of the sensors 25 and, if needed, also a documenting of the work result by storing the data in connection with a local correlation to the track 7.

[21] This work sequence is naturally also possible in an analogue way for other maintenance operations, such as, for example, rail drilling, rail cutting, shearing a weld bead, track tamping, and so on.

[22] To detach screws, an impact wrench may be used. The latter is mounted on the industrial robot 18 on a 6th motion axis. Via the sensors 25 configured for image recognition, the screw heads are located and loosened. If desired, the detached screws can be picked up and transported away by means of a magnetic gripper fastened to the industrial robot 18, for example. New screws can be placed and tightened quickly.

[23] It is also possible during travel of the maintenance vehicle 1 to measure the track geometry, the gauge or rail gaps with the aid of sensors 25 attached to the industrial robot 18, and to document the results accordingly.

[24] Where any or all of the terms "comprise", "comprises", "comprised" or "comprising" are used in this specification (including the claims) they are to be interpreted as specifying the presence of the stated features, integers, steps or components, but not precluding the presence of one or more other features, integers, steps or components.

The claims defining the invention are as follows:

1. A maintenance vehicle, consisting of a vehicle frame, supported at the ends on on-track undercarriages, and having side walls for creating a work space, delimited by the side walls, for working personnel situated on a track, the side walls being arranged on the vehicle frame, wherein, for treatment of a track section located within the work space, an industrial robot is arranged on the vehicle, the robot having at least three motion axes and media couplings for energy supply as well as a tool coupling for selective connection to a track treatment tool.

2. A vehicle according to claim 1, wherein the side walls are designed to be distanced from one another by drives in a transverse direction of the vehicle extending perpendicularly to a longitudinal direction of the vehicle.

3. A vehicle according to claim 1 or 2, wherein the industrial robot is mounted for displacement by a drive on a robot guide extending in a longitudinal direction of the vehicle.

4. A vehicle according to claim 3, wherein the robot guide is arranged on the vehicle frame which forms an upper border of the work space with regard to a vertical.

5. A vehicle according to any one of claims 1 to 4, wherein the industrial robot has sensors for contact-less scanning of track components which are accessible within the work space and composed of the rails, sleepers and rail fastenings.

6. A vehicle according to any one of claims 1 to 5, wherein a control device associated with the industrial robot is designed for storing of parameters detected by the sensors and characterizing the work quality of the track components treated by the robot.

7. A vehicle according to any one of claims 1 to 6, wherein the industrial robot

is configured for automatic coupling to the track treatment tool, stored for selection on a tool shelf inside the work space, as well as for the automatic energy supply thereof by the media couplings and for a subsequent work assignment taking place automatically in a program mode.

8. A vehicle according to claim 6, wherein the control device is designed for a combined work effort of the industrial robot with a spring balancer displaceable on the vehicle frame in the longitudinal direction of the vehicle.

9. A vehicle according to claim 8, for installing or removing rails.

10. A vehicle according to claim 5, wherein the sensors are arranged at an end at the coupling side of the industrial robot.

11. A method of carrying out maintenance work on a section of a track which, for creating a secured work space, is delimited by a maintenance vehicle, comprising:

a) a track treatment tool suitable for a scheduled work operation is selected from a group of tools pre-stored in the work space and automatically coupled to an industrial robot both mechanically as well as with regard to a complete energy supply,

b) with the aid of sensors arranged on the industrial robot, a track component to be treated is contact-less scanned for creating a reference base for a subsequent automatic work operation of the tool.

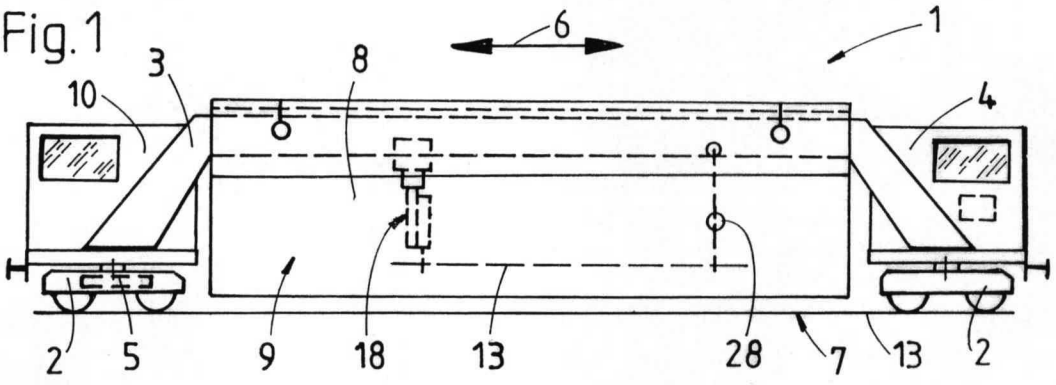
12. A method according to claim 11, wherein, during the work operation, a contact-less scanning of the track component, takes place by the sensors, and the obtained measuring data are compared to a stored target condition.

13. A method according to claim 12, wherein the track component is a rail to be ground.

14. A method according to claim 12 or 13, wherein the work operation is

composed of several working passes which are automatically repeated until the sensors register that the target condition has been attained.

Fig. 1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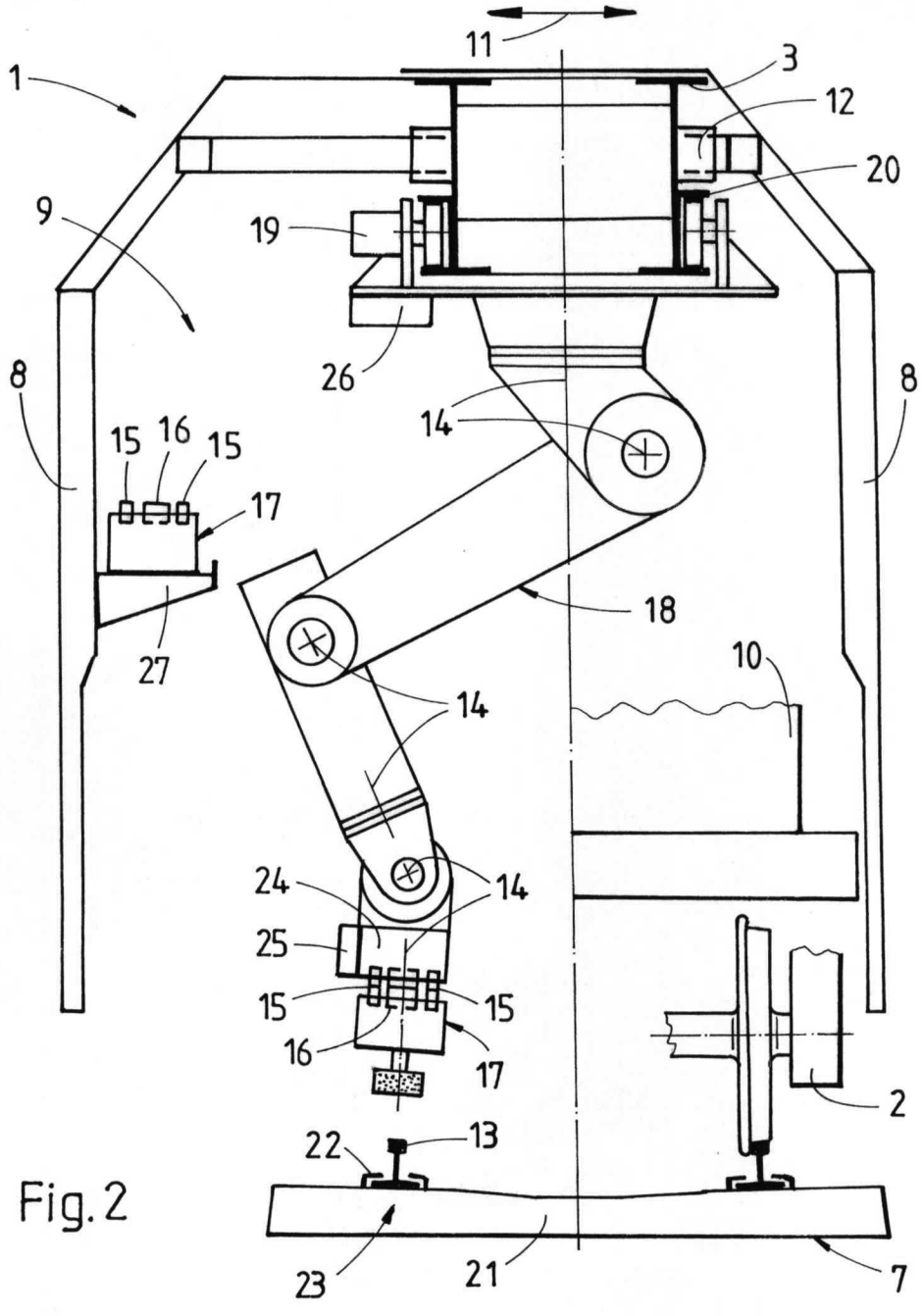
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Fig. 2