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(54) Ballast removal method and apparatus

(57) Rotors 8 are driven by motors in housings 20 to direct ballast on an apron 6. The motors and rotors can be raised from the apron 6 to allow for repair or replacement of any of these components.

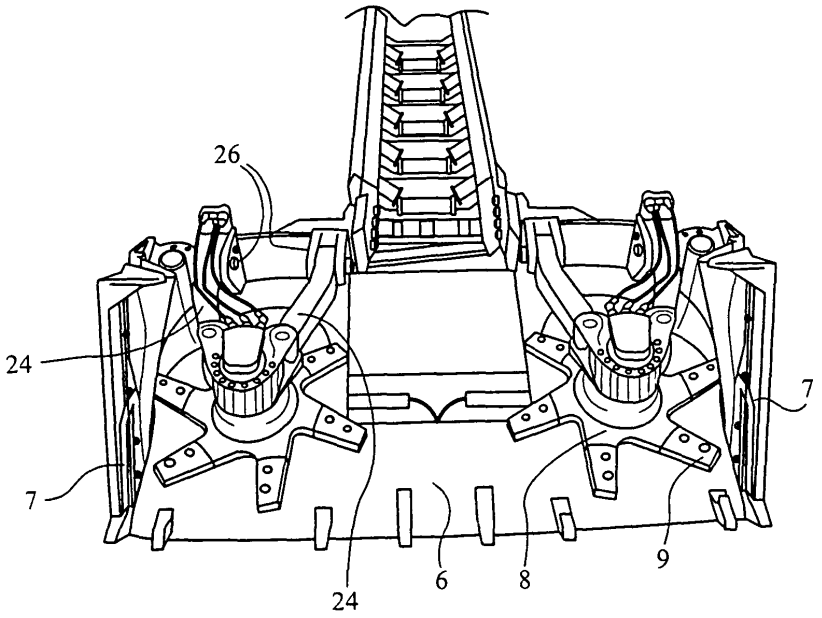

Fig. 4

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Description

[0001] This invention relates to a method and an apparatus for removing ballast from a road bed, and to an apparatus and method for maintaining such apparatus and, more particularly, to an improved method and apparatus for removing ballast from a rail road bed.

[0002] PCT publication WO 02052105 is a prior application of the present applicant. The prior specification includes three figures in which:-

Figure 1 is a schematic side view of an apparatus for removing ballast from a road way;

Figure 2 is a schematic front view of the apparatus of Figure 1 in operation adjacent a wagon for collecting ballast; and

Figure 3 is a schematic overhead view of the apparatus of Figure 1 in operation.

[0003] Turning now to the Figures there is shown in Figures 1-3 an apparatus for removing ballast from a road way, particularly from a rail road bed. The apparatus is incorporated into a vehicle 1 which is intended to be driven and controlled by a single operator thereby overcoming the labour intensive problems associated with the prior art methods and apparatus used.

[0004] As shown in Figure 1, an apparatus for removing ballast comprises a vehicle 1 provided with suitable transport means 2. In the illustrated embodiment, the vehicle comprises a main frame 3 to which the transport means 2 for advancing the vehicle along a road bed are connected in a conventional manner. Advantageously, transport means 2 includes caterpillar tracks 4 mounted on either side of the vehicle and this provides adhesion to the ground for the apparatus to penetrate the ballast and these allow the vehicle to be driven directly over rough or uneven ground in order to gain access to the road way to be worked on.

[0005] The apparatus further comprises means for excavating and lifting ballast from the rail bed. The excavation means 5 is mounted on the front of the main frame 3 of the vehicle (as determined by the direction of operation of the vehicle) and comprises a loading apron 6 which may be formed of a wear resistant material. The loading apron comprises a generally C-shaped member which is mounted to the main frame at the closed end thereof.

[0006] Means (not shown) are provided on the main frame 3 for raising and lowering the loading apron 6 towards and away from the rail bed and also for altering the transverse relationship with the main frame. This allows the position of the loading apron to be adjusted in order to ensure that the loading apron maintains the optimum position during operation.

[0007] Feeding means are provided within the loading apron 6 to encourage ballast excavated and lifted by the loading apron to pass through it back towards the main frame 3 of the vehicle. The feeding means in the illustrated embodiment comprise a pair of rotors 8 which are mounted side by side within the loading apron and a set of spill plates 7. The rotors are each provided with a plurality of blades 9 which may be formed of a wear resistant material. The blades are of a sufficient length as to advance ballast towards the centre of the loading apron. Means comprising motors located beneath the apron are provided for rotating the rotors 8 in opposite directions to facilitate advancement of the ballast.

[0008] Conveyor means are provided within the main frame 3 of the vehicle for conveying ballast from the loading apron 6 to the rear of the vehicle. The conveyor means may be in the form of a conveyor belt 10. In the illustrated embodiment, the height of the conveyor belt increases as it passes through the vehicle 1. Means (not shown) may be provided on the main frame to adjust the height of the conveyor belt 10 if required. It is envisaged that the conveyor belt will be driven by hydraulic means provided on the main frame. Additionally, tensioning means may be provided in order to adjust the tensioning of the conveyor belt to achieve optimum operation of the apparatus.

[0009] At the other end of the conveyor belt 10, remote from the loading apron 6, a selectively positionable feeding means is mounted to the rear of the vehicle. The feeding means takes the form of a boom member 11 mounted onto the main frame 3 by suitable fixings which allow the position of the boom 11 to be adjusted as required.

[0010] The boom member is provided with a further conveyor belt 12 which extends along the entire length of the boom. As with the primary conveyor belt 10, this secondary conveyor belt may be provided with tensioning means to adjust the operational characteristics of the belt.

[0011] A control cab 13 is mounted on the main frame 3 of the vehicle and in the illustrated embodiment is shown as being located behind the loading apron 6 and above the primary conveyor belt 10. It is envisaged that the cab will be fully glazed in order to provide maximum visibility for the operator during use. Furthermore, the position of the cab allows the operator to oversee the operation of the apparatus in order that he can make any adjustments necessary during the excavation process.

[0012] Control means (not shown) are provided within the cab, as will be described further below, for operating the vehicle. Such control means may, for example, comprise amongst other things, means for operating and controlling the speed of the primary and secondary conveyor belts 10, 12, control means for raising and lowering the loading apron 6, control means for advancing, retracting and tilting the loading apron and control means for adjusting the position of the boom 11. Additionally, standard vehicle control means will also be provided within the cab which will allow the vehicle to be driven along standard roads to any particular location where it may be required.

[0013] A wagon 14 is illustrated in the figures for collecting ballast excavated from the rail bed by the apparatus described above. The wagon is shown as being provided on an adjacent rail to the rail bed being cleared, although the wagon could of course be replaced with a skip or truck which can be moved along the rail bed together with the excavation apparatus in order to facilitate continuous operation of the apparatus.

[0014] This enables the apparatus to remove ballast in a single pass along the rail bed rather than a series of backwards and forwards operations to remove ballast and then return to a collection device to load recovered ballast onto a suitable means to allow for removal from the work site.

[0015] Additional control means (not shown) for the various components of the apparatus may also be mounted on the main frame 3 of the vehicle. This may include for example, power packs, fuel tank, electric and hydraulic equipment, service jacks and other associated means.

[0016] The operation of the apparatus will now be described with reference to the Figures. Firstly, the rails of the railroad bed from which the ballast is to be excavated are removed and stored at a suitable location such as adjacent to the rail bed. The removal apparatus as described above is then moved into position on the rail bed. The vehicle 1 upon which the apparatus is located may be driven to the required location or may alternatively be transported to the required location via the existing rail network prior to removal of the rails.

[0017] Wagons 14 or other suitable collection means is then provided adjacent to the collection apparatus and it is intended that the collection apparatus should be advanced together with the apparatus. It is therefore preferable that a wagon or wagon train be positioned on adjacent tracks to the rail bed to be removed to allow the apparatus to deposit collected ballast into the successive wagons.

[0018] Prior to use of the apparatus, the position of the boom 11 is adjusted so that the free end of the boom and the conveyor belt 12 provided thereon is located above the wagon 14 or truck into which the excavated ballast is to be loaded.

[0019] As shown in Figures 2 and 3, the position of the loading apron 6 of the apparatus can be adjusted, grading down into the ballast in order to bring the front of the loading apron into engagement beneath ballast to be removed. The loading apron 6 and primary and secondary conveyor belts 10, 12 are activated by the operator of the apparatus. As the vehicle 1 is advanced forwards along the rail bed, ballast is lifted into the loading apron.

[0020] Contra rotation of the two rotors 8 directs excavated ballast between the blades 9 and moves the ballast through the loading apron 6 onto the end of the primary conveyor belt 10 which is located within the loading apron.

[0021] The excavated ballast is then carried along the primary conveyor belt until it reaches the end of the belt at the rear of the main frame 3. It then falls from the end of the primary conveyor belt and drops onto the secondary conveyor belt 12 provided on the boom member 11 at the rear of the main frame. The ballast is carried along the secondary conveyor belt and falls from the free end of the conveyor belt into the wagon 14 or other collection means provided adjacent to the rail bed.

[0022] As the position of the boom member 11 and therefore the end of the secondary conveyor belt 12 can be controlled by the operator from within the cab, any inconsistencies in the distance between the vehicle and the adjacent collection means can be compensated for by suitable movement of the boom member.

[0023] Indicator means (not shown) may be provided within the cab 13 of the vehicle to allow the operator to monitor the position of the boom and to allow him to make suitable adjustments without interrupting the operation of the apparatus. This enables the apparatus to be operated more efficiently and facilitates the one-pass operation of the apparatus as previously described.

[0024] In the embodiment shown in Figure 2, a wagon train is provided adjacent to the rail bed from which ballast is to be removed. In this embodiment, the apparatus can be driven along the rail bed excavating ballast as it advances. The ballast falling from the secondary conveyor belt fills each successive wagon as the apparatus advances along the bed. Once all of the wagons are filled they can be simply transported along the rail track to a suitable location for unloading.

[0025] The rotors 8 are driven by motors located beneath the apron 6. Thus the motors are operating in a harsh environment where ballast not loaded onto the apron 6 will scrape against the motors. Consequently extensive reinforcement has to be provided to protect the motors. In addition, the angle of attack of the apron has to be high enough to allow for the location of the motors to be clear of the ground when the apron is being lowered into engagement with the ground. This can result in the apron being more prone to digging in to the ground and this force has to be resisted by considerable forces being applied to the equipment.

[0026] In addition, as the rotors are connected to the motors through the apron, it is difficult to undertake maintenance operations on the rotors or motors. Furthermore, dirt can tend to enter the space between the rotors and the apron to contact the drive shaft, even if seals are provided.

[0027] It is an object of the present invention to attempt to overcome at least one of the above or other disadvantages.

[0028] The present invention is defined in the claims.

[0029] The present invention includes any combination of the herein referred to features or limitations.

[0030] The present invention can be carried into practice in various ways but one embodiment will now be described by way of example and with reference to the accompanying drawings, in which:-

Figure 4 is a front view of the loading apron 6 in a

contracted position with the rotors 8 in a lowered position, and

Figure 5 is a view similar to Figure 5 with the apron 6 in an extended position and with the rotors in a raised position.

[0031] Each motor housing 20 is connected to a back plate 22 of the apron by a pair of arms 24 that diverge outwardly and rearwardly towards the back plate. The rotors 8 are connected to a drive shaft (not shown) that extends from the motor to the motor housing. In order to move the rotors from the operational position shown in Figure 4 to the maintenance position shown in Figure 5 the motor housings, and therefore the rotors 8, are moved about a horizontal axis defined by pivot mountings 26 at the rear of each arm 24. The arms are raised and lowered by pneumatic or hydraulic pistons (not shown) and each rotor may be raised or lowered separately from each other.

[0032] In the maintenance position the complete motor housing and rotor can be removed from the arms 24 and replaced by a spare unit at the work site, if desired. This minimises down time for the machine which is of particular importance when rail ballast is being removed. Alternatively any of the parts such as the rotor 8, the blades 9 or the motor within the housing can be separately replaced, as desired. All of this can occur with the apron resting on the ground.

[0033] In the operational position shown in Figure 4, the downwards pivoting movement of the arms 24, and therefore the spacing of the rotors from the apron, can be restricted by stops 28 (shown in Figure 5) on each arm abutting the back plate 22.

[0034] With the rotors in the operational position and with the apron in the extended or contracted position, the machine operates as described previously in relation to Figures 1 to 3.

[0035] The apron 6 is moved from the contracted position to the extended position by an hydraulic ram or rams (not shown) urging the spill plates 7 at each side outwardly with that movement being guided by arms connected to each plate 7 sliding through spaced guides fixed to the underside of the apron 6. These are not shown in the drawings. When expanded, drop in nibs 30 and funnels 32 are added and fixed into place at each side.

[0036] In one alternative embodiment the rotors may be arranged to move outwardly and inwardly with the spill plates such as by mounting the arms 24 on the spill plates.

[0037] In a further alternative, the rotors may be arranged to move outwardly and rearwardly, with respect to the leading edge of the apron when the spill plates move outwardly, possibly at the same time that the spill plates move outwardly. This may be achieved by connection of one arm 24 to the spill plate with the other being connected to the back plate such that each connection of the arm may be about an upwardly extending pivot. In order to achieve lifting of the rotors the connection of each arm in this embodiment may be a universal axis.

[0038] It is to be understood that although the present description has been particularly directed towards the excavation of ballast from a rail way bed, the apparatus and method described could equally be used for the excavation of ballast from a road bed.

[0039] Attention is directed to all papers and documents which are filed concurrently with or previous to this specification in connection with this application and which are open to public inspection with this specification, and the contents of all such papers and documents are incorporated herein by reference.

[0040] All of the features disclosed in this specification (including any accompanying claims, abstract and drawings), and/or all of the steps of any method or process so disclosed, may be combined in any combination, except combinations where at least some of such features and/or steps are mutually exclusive.

[0041] Each feature disclosed in this specification (including any accompanying claims, abstract and drawings) may be replaced by alternative features serving the same, equivalent or similar purpose, unless expressly stated otherwise. Thus, unless expressly stated otherwise, each feature disclosed is one example only of a generic series of equivalent or similar features.

[0042] The invention is not restricted to the details of the foregoing embodiment(s). The invention extends to any novel one, or any novel combination, of the features disclosed in this specification (including any accompanying claims, abstract and drawings), or to any novel one, or any novel combination, of the steps of any method or process so disclosed.

Claims

1. Ballast removal apparatus including a loading apron arranged, in use, to be advanced to collect ballast and at least one rotor arranged, in use, to cause ballast on the apron to move, the rotor being connected to the apparatus and being movable from a first, operative position to a second position.

2. Apparatus as claimed in Claim 1 in which, in the first position, the rotor is located adjacent to the plate.

3. Apparatus as claimed in Claim 1 or 2 in which, in the first position, the rotor is arranged to rotate about an axis perpendicular to the vicinity of the apron where the rotor rotates.

4. Apparatus as claimed in any preceding claim in which when the rotor is moved from the first to the second position, the rotor is moved away from the apron.

5. Apparatus as claimed in any preceding claim in

which the rotor is pivotally connected to the apparatus.

6. Apparatus as claimed in Claim 5 in which the rotor is pivotally connected to the apparatus at a region rearwards of a leading edge of the apron and rearwards of the rotor.

7. Apparatus as claimed in Claim 5 or 6 in which the rotor is pivotally connected to the apparatus by two links that are spaced from each other at a location remote from the rotor.

8. Apparatus as claimed in any preceding claim in which the rotor is connected to a motor which is arranged to move with the rotor between the first and second positions.

9. Apparatus as claimed in Claim 8 in which the rotor is connected to the apparatus via a housing of the motor.

10. Apparatus as claimed in Claim 9 in which the motor carries the rotor.

11. Apparatus as claimed in Claim 9 or 10 in which the rotor and motor are accessible from the upper side of the rotor.

12. Apparatus as claimed in any of Claims 9 to 11 in which the rotor and motor are detachable as a unit from the apparatus.

13. Apparatus as claimed in any of Claims 10 to 12 in which the rotor and motor are separately attached together.

14. Apparatus as claimed in any preceding claim in which the apron is movable between a first configuration and a second configuration in which the effective width of the apron is increased.

15. Apparatus as claimed in Claim 14 in which the rotor does not move when the apron moves between the first and second configuration.

16. Apparatus as claimed in Claim 14 in which the rotor moves towards one side as the apron moves from the first to the second configuration.

17. Apparatus as claimed in Claim 14 or 16 in which the rotor moves rearwardly as the apron moves from the first to the second position.

18. Apparatus as claimed in any preceding claim in which there is a second rotor movable between the first and second positions which second rotor is also arranged, in use, to cause ballast on the apron to move and which second rotor is connected to the apparatus.

19. Apparatus as claimed in Claim 18 in which the second rotor is movable independently of the first rotor between the first and second positions.

20. Apparatus as claimed in Claim 18 or 19 in which the second rotor has any of the features of the first rotor as claimed in any of Claims 1 to 13.

21. Apparatus as claimed in any of Claims 18 to 20 in which the first and second rotors rotate in opposed directions of rotation.

22. A method of operating ballast removal apparatus comprising moving at least one rotor connected to the apparatus from a first position in which ballast on an apron can be moved by causing rotation of a rotor to a second position.

23. A method of operating ballast removal apparatus as claimed in Claim 22 when the apparatus is as claimed in any of Claims 1 to 21.

24. Ballast removal apparatus including a loading apron arranged, in use, to be advanced to collect ballast and at least one rotor arranged, in use, to cause ballast on the apron to move, the rotor being connected to a motor located above the upper side of the apron.

25. Apparatus as claimed in Claim 24 when dependent on any of Claims 1 to 21.

26. Apparatus as claimed in Claim 24 or any of Claims 2 to 18 when dependent upon Claim 24 and when not dependent on Claim 1.

27. A method of operating ballast removal apparatus including a loading apron arranged, in use, to be advanced to collect ballast and at least one rotor arranged, in use, to cause ballast on the apron to move comprising powering the rotor by a motor located above the upper face of the apron.

28. A method as claimed in Claim 27 comprising when operating apparatus as claimed in any of Claims 24 to 26.

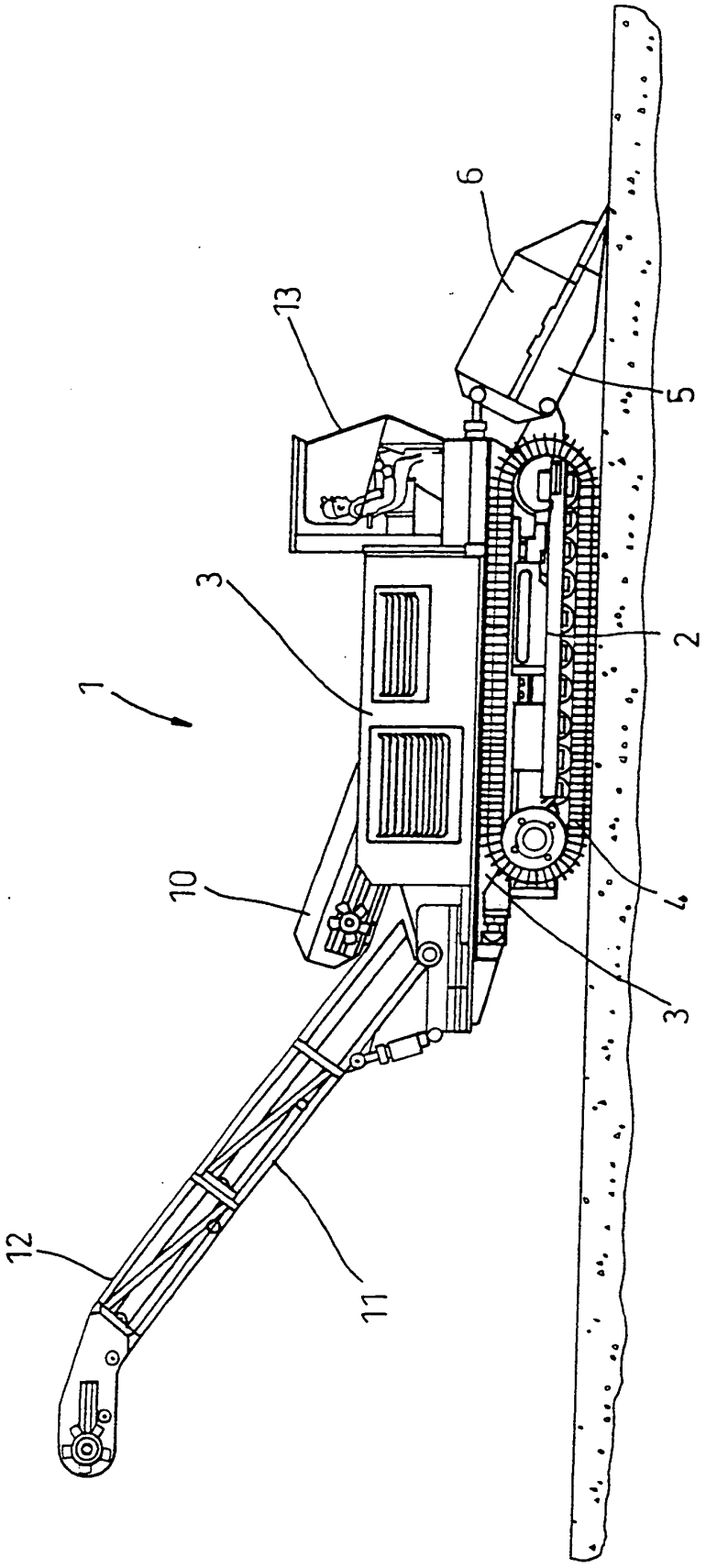

Fig. 1

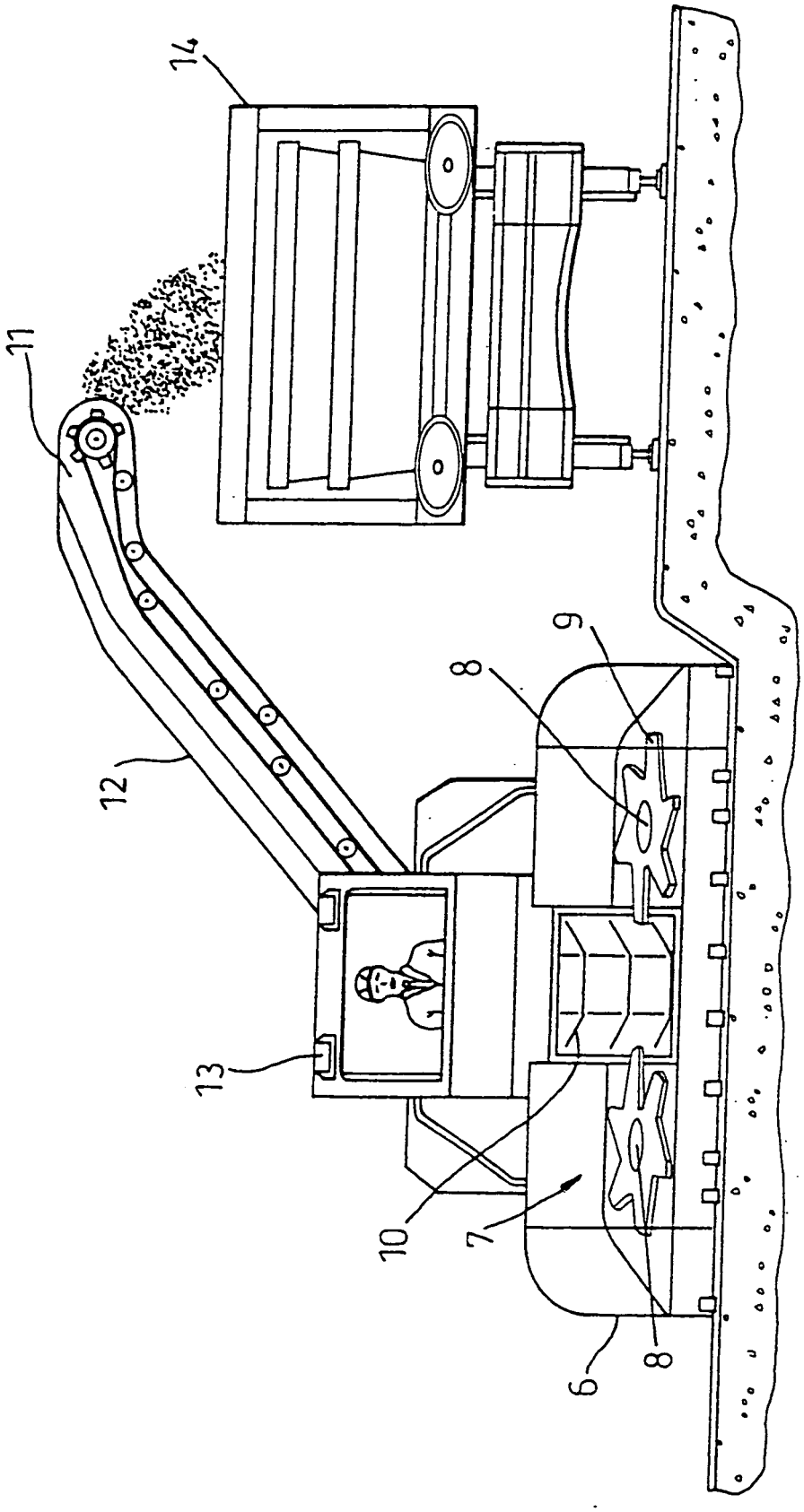

Fig. 2

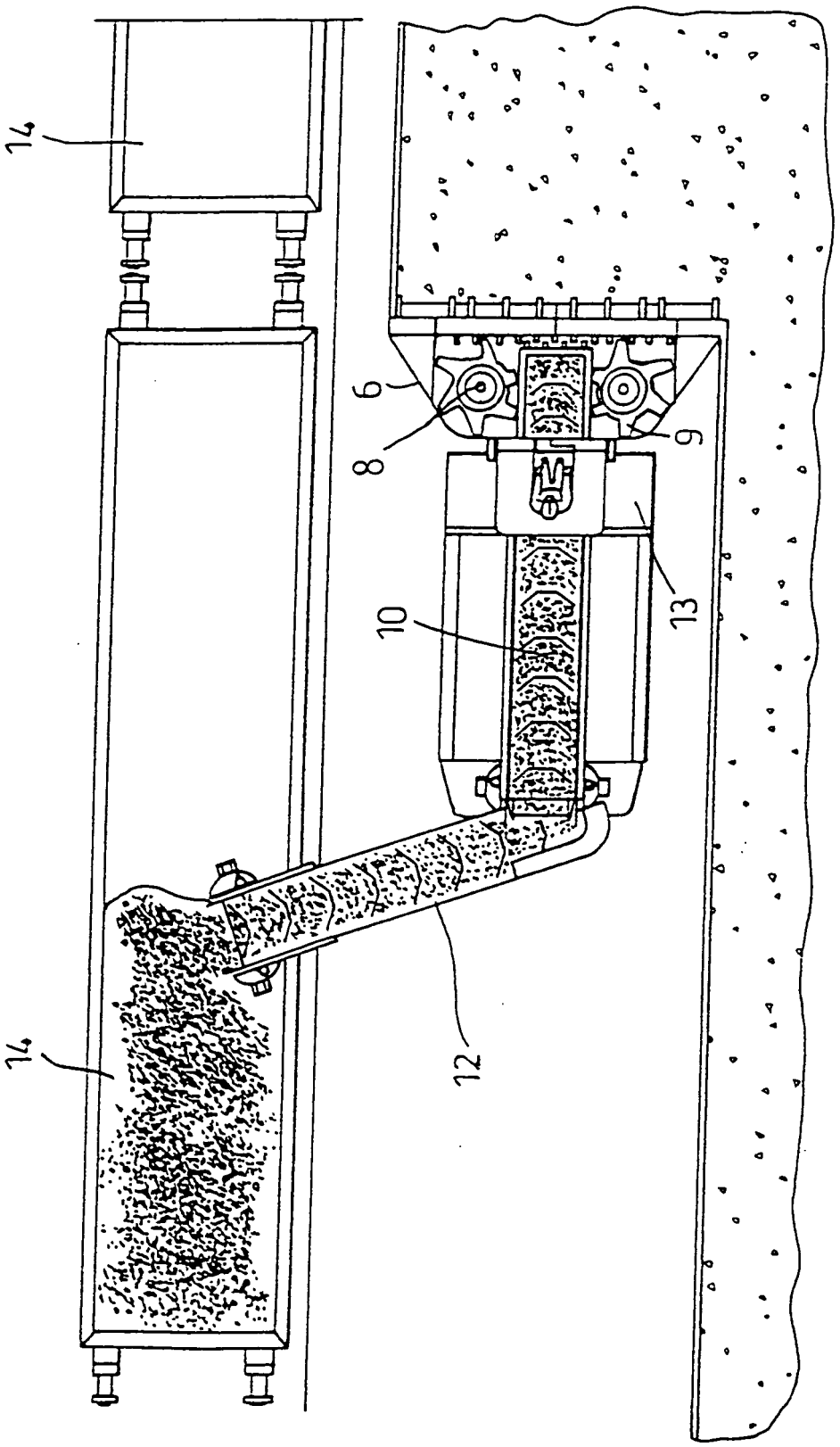

Fig. 3

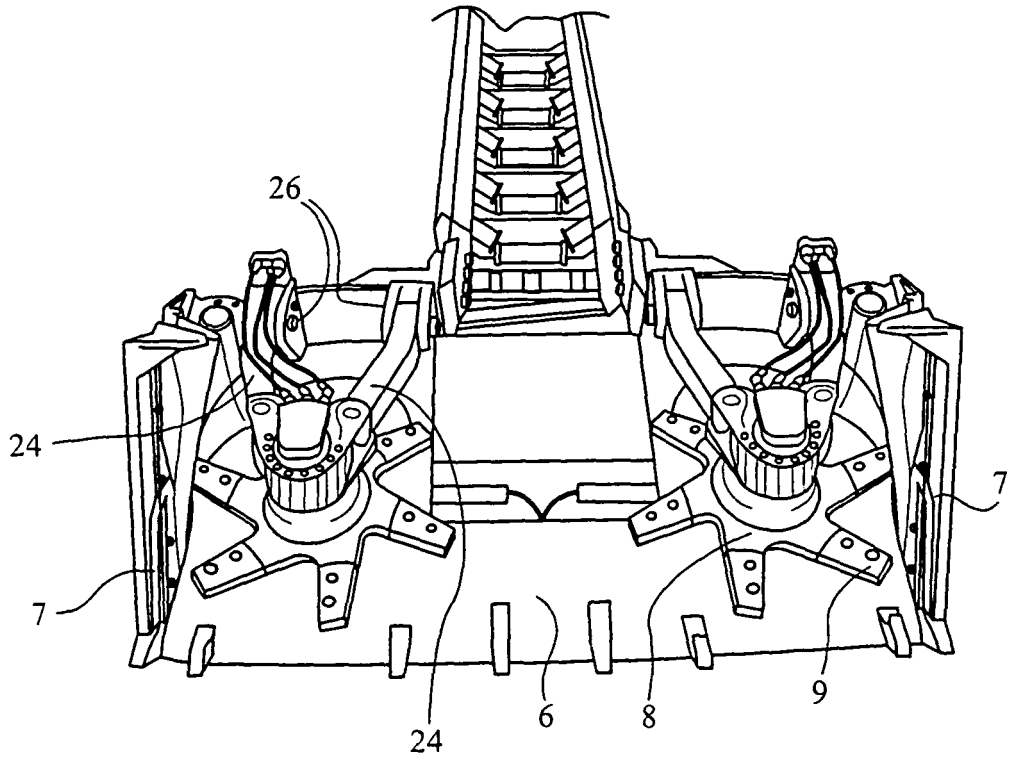

Fig. 4

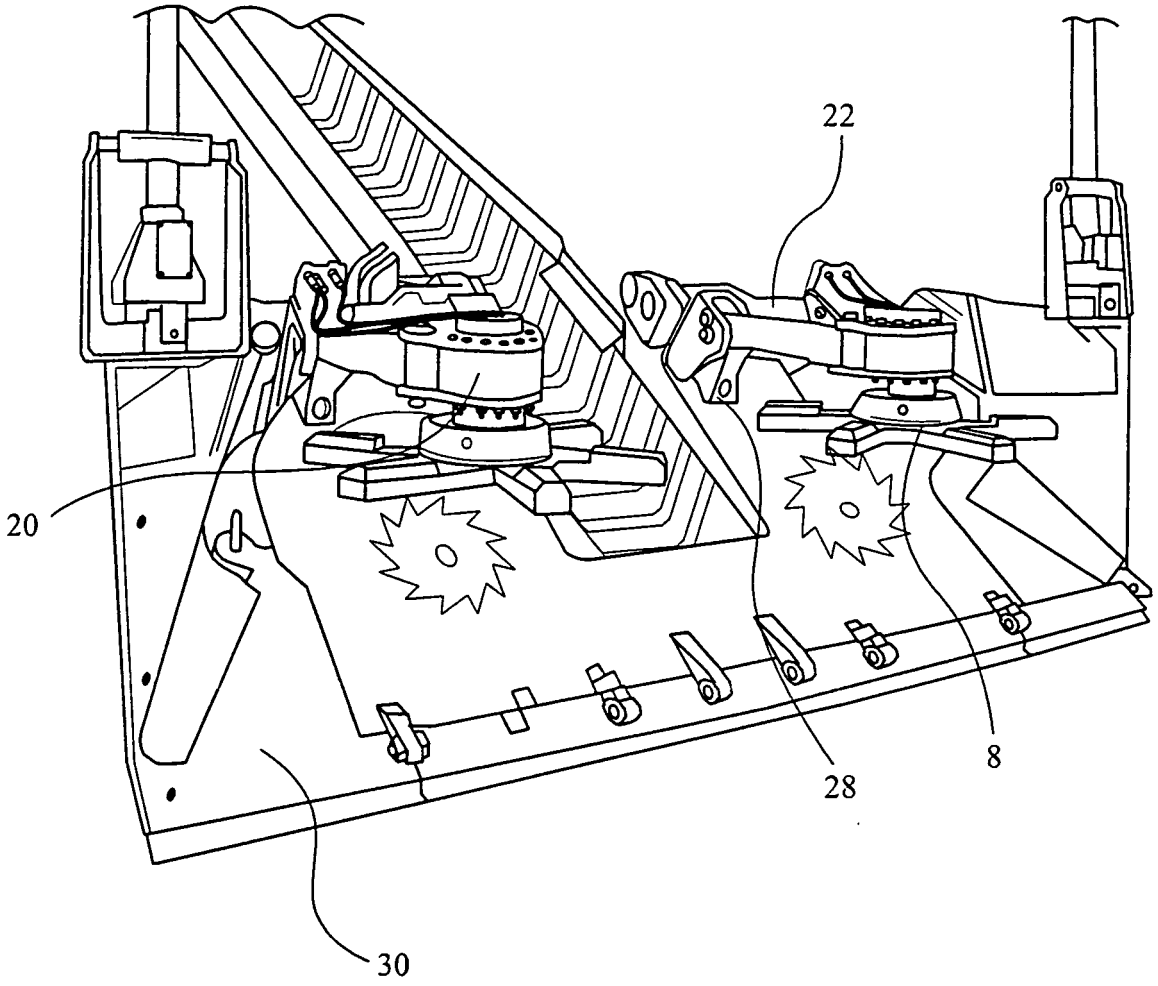

Fig. 5

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EUROPEAN SEARCH REPORT

Application Number
EP 05 25 3288

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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TECHNICAL FIELDS SEARCHED (IPC)

E01B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	21 February 2006	Geiger, H

CATEGORY OF CITED DOCUMENTS

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