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(54) BALLAST REMOVAL METHOD AND APPARATUS

VORRICHTUNG UND VERFAHREN ZUR ENTFERNUNG VON SCHOTTERBETTUNG
PROCEDE ET APPAREIL DE DEBALLASTAGE

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EP-A- 0 626 483 **FR-A- 1 387 729**
FR-A- 2 588 023 **US-A- 1 752 714**
US-A- 5 228 552

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Description

[0001] This invention relates to a method and an apparatus for removing ballast from a road bed and, more particularly, to an improved method and apparatus for removing ballast from a rail road bed, which apparatus can be controlled by a sole operator using a single vehicle to lift and remove ballast.

[0002] When preparing an area of ground for the laying of a road or railroad, the designated area is excavated and ballast material is laid along the route. The ballast material generally takes the form of gravel or broken stone and, in the case of a railroad, is placed on the excavated bed to provide a firm surface upon which the track is supported. The ballast also functions to hold the track in position when laid. Furthermore, the ballast material facilitates drainage of surface water from the rail bed to avoid flooding in bad weather.

[0003] Under some conditions, the ballast may become dislodged from the rail bed or, in some cases where safety checks or rail maintenance operations must be carried out, the ballast may require removal either for replacement or cleaning operations to be carried out. This is particularly important if the ballast becomes clogged with dirt and debris as the proper drainage function will be impaired which could lead to flooding in low lying areas thereby requiring further safety operations to be carried out on the same stretch of track.

[0004] Traditional methods of removing ballast require the removal of the rails, which are stored at a location perhaps adjacent to the railway line. A fleet of vehicles is then transported to the site to handle the removal operation. It is not unusual for at least 4 separate vehicles to be required, with personnel required for each vehicle.

[0005] Ballast is dug up from the rail bed for example using suitable earth moving equipment and the recovered ballast is then loaded into wagons to be removed from the site. Often the area in which the operation is taking place is difficult to access from road networks and this can add further time delays caused by the removal operation itself.

[0006] These traditional methods are both labour intensive in requiring different personnel to operate the various pieces of equipment and also time consuming in requiring equipment to be brought to the site and removed therefrom as required. For example, the earth moving equipment may have to be moved to and from the work site several times in order to fill a wagon with sufficient ballast. Furthermore, the earth moving equipment may have to be removed from the work site to allow the wagon access to the work site for loading. This leads to a situation where either the work is progressed in stages to allow for the required equipment to be on hand at the appropriate times, or alternatively in a labour intensive operation which relies on a fleet of vehicles and a work force to operate the vehicles as and when required.

[0007] The present invention aims to provide a method and apparatus for removing ballast from a road way and

particularly from a railway line, which overcomes or at least mitigates some of the above mentioned disadvantages which are associated with traditional methods and apparatus used for removing ballast from such locations.

[0008] US 5 228 552 discloses a mineral mining apparatus which can be moved into a mining position by tracks 1. Then a stabilising foot is dropped at the rear of the device prior to a cutter drum scavaging mining material with mined material then being carried onto the loading platform and swept onto a conveyor by rotatably mounted loading star-wheels. Then the mining is ceased before the apparatus is advanced again and the operation repeated.

[0009] FR 2 588 023 and FR 1 387 729 disclose the swinging down of an excavator-elevator about a pivoting axis. In FR 2 588 028 after the excavator has made contact with the ballast 9 at the head of a stretch, the excavator removes the ballast to the depth of the formation bed. A shovel 10 is then activated to pick up ballast and push it towards the excavator. Once a section has been removed the whole apparatus is then advanced again and the operation is repeated.

[0010] According to one aspect of the present invention there is provided a method of continuous removal of ballast material from a bed comprising the steps of:

positioning ballast removal apparatus (1) at a work site;

advancing (2) the apparatus along the bed to excavate and lift ballast from the bed with a loading apron (6) thereby introducing the lifted ballast into the apparatus at one end thereof; and

conveying (10) the lifted ballast from the point of lifting, through the apparatus, to a selectively positionable delivery means (11) at the other end of the apparatus remote from the excavation site, from which the ballast is fed to a containment means for collection.

[0011] According to a further aspect of the present invention, ballast removal apparatus for the continuous removal of ballast, from a bed, said apparatus comprising:

excavating and lifting means comprising a loading apron (6) and control means for advancing the loading apron, the control means, when activated being arranged, in use, to cause the loading apron (6) to excavate and lift ballast from the bed;

conveying means (10) for moving the ballast from the lifting means through the apparatus, and selectively positionable delivery means (11) for delivering ballast from the conveying means to a point of collection.

[0012] Advantageously, the above apparatus can be controlled by a sole operator. As the operation of the apparatus is continuous, the operator does not need to carry out the removal operation in stages but can drive

the apparatus the length of the rail bed within which the ballast is to be removed and excavate and collect the ballast in a single operation.

Figure 1 is a schematic side view of an apparatus for removing ballast from a road way in accordance with one aspect of the present invention;

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.

[0013] 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.

[0014] 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 also 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.

[0015] 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.

[0016] 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.

[0017] 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 feedings 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 are provided within the loading apron of the vehicle for rotating the rotors **8** in opposite directions to facilitate advancement of the ballast.

[0018] 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.

[0019] 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.

[0020] 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.

[0021] 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.

[0022] 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.

[0023] 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 to-

gether with the excavation apparatus in order to facilitate continuous operation of the apparatus.

[0024] 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.

[0025] Additional control means (not shown) for the various components of the apparatus may also be mounted on the mainframe **3** of the vehicle. This may include for example, power packs, fuel tank, electric and hydraulic equipment, service jacks and other associated means.

[0026] 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 excavate 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.

[0027] 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.

[0028] 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.

[0029] 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.

[0030] 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.

[0031] 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.

[0032] 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.

[0033] 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.

[0034] 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.

[0035] It is to be understood that although the above 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.

[0036] As has been described above, the method and apparatus allows for the continuous excavation of ballast from a road or railroad bed by a sole operator in a single vehicle with a single pass along the bed by the vehicle. This provides a significant advantage over prior art excavation methods and apparatus used therein.

Claims

1. A method of continuous removal of ballast material from a bed comprising the steps of:
 - (i) positioning ballast removal apparatus (1) at a work site;
 - (ii) advancing (2) the apparatus along the bed to excavate and lift ballast from the bed with a loading apron (6) thereby introducing the lifted ballast into the apparatus at one end thereof; and
 - (iii) conveying (10) the lifted ballast from the point of lifting, through the apparatus, to a selectively positionable delivery means (11) at the other end of the apparatus remote from the excavation site, from which the ballast is fed to a containment means for collection.
2. The method is claimed in claim 1 characterised in that it further comprises:

bringing a front portion of the loading apron (6)

of said ballast removal apparatus into engagement beneath ballast to be removed.

3. The method as claimed in claim 2 **characterised in that** said loading apron (6) is a generally C-shaped member having an upwardly inclined inner lifting surface.

4. The method as claimed in claim 2 **characterised in that** it further comprises:

adjusting the vertical position of the front portion of the loading apron (6) as the ballast removal apparatus advances grading down into the ballast in order to locate the front of the apron beneath ballast on the bed.

5. The method as claimed in claim **characterised in that** it further comprises:

prior to said step of lifting ballast, removing rails from a railway line previously laid on the ballast in a region of the railway line from which ballast is to be removed.

6. Ballast removal apparatus for the continuous removal of ballast from a bed, said apparatus comprising:

(a) excavating and lifting means;
(b) conveying means (10) for moving the ballast from the lifting means through the apparatus, and
(c) selectively positionable delivery means (11) for delivering ballast from the conveying means to a point of collection **characterised in that** the excavating and lifting means comprises a loading apron (6) and control means for advancing the loading apron, wherein the control means, when activated in use, causes the loading apron (6) to continuously excavate and lift ballast from the bed.

7. An apparatus according to claim 6, **characterised in that** the lifting means comprises feeding means (8) for feeding the lifted ballast onto the conveying means.

8. An apparatus as claimed in claim 6, **characterised in that** said loading apron (6) is mounted for independent vertical and/or transverse movement with respect to said main body.

9. An apparatus as claimed in claim 6 **characterised in that** said loading apron (6) is substantially C-shaped.

10. An apparatus according to claim 6, **characterised in that** the selectively positionable delivery means

comprises a boom (11) mounted on the rear of the apparatus.

11. An apparatus according to claim 10, **characterised in that** the boom (11) is provided with conveyor means (12) for moving the ballast along the length of the boom.

12. An apparatus according to claim 11, **characterised in that** the conveying means passing through the apparatus comprises a conveyor belt (10) from which ballast can fall onto the conveyor means (12) of the boom (11).

13. An apparatus according to claim 7, **characterised in that** the feeding means comprises a pair of contra rotating rotors (8) provided with blades which direct the lifted ballast therebetween and deposit it onto the conveyor means.

14. An apparatus according to any one of claims 6 to 13, **characterised in that** the apparatus is provided with means for transporting the apparatus to and from the rail bed.

15. An apparatus according to claim 14, **characterised in that** the apparatus may be provided with caterpillar tracks (4) to allow the apparatus to be driven over rough or uneven ground as well as normal road surfaces.

Patentansprüche

1. Verfahren zum kontinuierlichen Entfernen von Ballastmaterial von einem Bett, umfassend die Schritte:

(i) Positionieren der Ballastentfernungsvorrichtung (1) an einer Arbeitsstelle;
(ii) Vorrücken (2) der Vorrichtung entlang des auszuhebenden Bettes und Heben des Ballasts vom Bett mit einer Ladeschaufel (6), wobei der gehobene Ballast in die Vorrichtung an einem ihrer Enden geführt wird; und
(iii) Fördern (10) des angehobenen Ballasts von der Stelle des Aushubs durch die Vorrichtung zu einem selektiv positionierbaren Übergabemittel (11) am anderen Ende der Vorrichtung, welches entfernt von der Stelle des Aushubs liegt, von welchem der Ballast zur Sammlung einem Aufnahmemittel zugeführt wird.

2. Verfahren nach Anspruch 1, **dadurch gekennzeichnet, dass** es weiters umfasst:

Eingreifen eines vorderen Abschnitts der Ladeschaufel (6) der genannten Ballastentfernungsvorrichtung unter dem zu entfernenden Ballast.

3. Verfahren nach Anspruch 2, **dadurch gekennzeichnet, dass** die genannte Ladeschaufel (6) ein im Wesentlichen C-förmiges Bauteil mit einer nach oben ansteigenden inneren Hebefläche ist.

4. Verfahren nach Anspruch 2, **dadurch gekennzeichnet, dass** es weiters umfasst:

Einstellen der vertikalen Position des vorderen Abschnitts der Ladeschaufel (6), wenn die Ballastentfernungs Vorrichtung vorrückt und nach unten in den Ballast eindringt, um die Front der Schaufel unter dem Ballast auf dem Bett zu positionieren.

5. Verfahren nach Anspruch 1, **dadurch gekennzeichnet, dass** es weiters umfasst:

vor dem genannten Schritt des Hebens des Ballasts, Entfernen der Schienen von einer Schienenstrecke, welche zuvor auf den Ballast verlegt wurden, in einem Bereich der Schienenstrecke, aus welchem der Ballast entfernt werden soll.

6. Ballastentfernungs Vorrichtung für das kontinuierliche Entfernen von Ballast von einem Bett, wobei die Vorrichtung umfasst:

(a) Aushub- und Hebemittel;
(b) Fördermittel (10), um den Ballast vom Hebemittel durch die Vorrichtung zu bewegen;
(c) selektiv positionierbare Übergabemittel (11), um den Ballast vom Fördermittel zu einem Sammel punkt zu bringen, **dadurch gekennzeichnet, dass** das Aushub- und Hebemittel eine Ladeschaufel (6) und eine Kontrolleinrichtung umfasst, um die Ladeschaufel voranzutreiben, wobei die Kontrolleinrichtung, wenn sie im Betrieb aktiviert ist, die Ladeschaufel (6) dazu veranlasst, kontinuierlich Ballast auszuheben und vom Bett zu heben.

7. Vorrichtung nach Anspruch 6, **dadurch gekennzeichnet, dass** die Hebeeinrichtung Zuführmittel umfasst, um den gehobenen Ballast dem Fördermittel zuzuführen.

8. Vorrichtung nach Anspruch 6, **dadurch gekennzeichnet, dass** die genannte Ladeschaufel (6) für unabhängige vertikale und/oder transversale Bewegung in Bezug auf den genannten Hauptkörper geeignet montiert ist.

9. Vorrichtung nach Anspruch 6, **dadurch gekennzeichnet, dass** die genannte Ladeschaufel (6) im Wesentlichen C-förmig ist.

10. Vorrichtung nach Anspruch 6, **dadurch gekennzeichnet,**

dass das selektiv positionierbare Übergabemittel einen Ausleger (11) umfasst, welcher am Heck der Vorrichtung montiert ist.

11. Vorrichtung nach Anspruch 10, **dadurch gekennzeichnet, dass** der Ausleger (11) mit einem Fördermittel (12) versehen ist, um den Ballast entlang der Länge des Auslegers zu bewegen.

12. Vorrichtung nach Anspruch 11, **dadurch gekennzeichnet, dass** das Fördermittel, welches durch die Vorrichtung läuft, einen Förderband (10) umfasst, von welchem der Ballast auf das Fördermittel (12) des Auslegers (11) fallen kann.

13. Vorrichtung nach Anspruch 7, **dadurch gekennzeichnet, dass** das Zuführmittel ein Paar von sich gegenseitig drehenden Rotoren (8) aufweist, welche mit Blättern versehen sind, welche den angehobenen Ballast zwischen sich führen und auf dem Fördergürtel deponieren.

14. Vorrichtung nach einem der Ansprüche 6 bis 13, **dadurch gekennzeichnet, dass** die Vorrichtung mit Mitteln zum Transportieren der Vorrichtung zu und von dem Schienenbett ausgestattet ist.

15. Vorrichtung nach Anspruch 14, **dadurch gekennzeichnet, dass** die Vorrichtung mit einem Raupenantrieb (4) ausgestattet ist, um der Vorrichtung zu ermöglichen, sowohl über rauen oder unebenen Grund als auch über normale Straßenoberflächen gefahren zu werden.

Revendications

1. Procédé de retrait continu d'un matériau de ballast d'une infrastructure (ou assiette) de voie, comprenant les étapes consistant à :

(i) positionner un dispositif de déballastage (1) sur un chantier ;
(ii) faire avancer (2) le dispositif le long de l'infrastructure pour excaver et soulever le ballast de l'infrastructure avec un tablier de chargement (6), introduisant ainsi le ballast soulevé dans le dispositif à une extrémité de celui-ci ; et
(iii) transporter (10) le ballast soulevé depuis le point de soulèvement, à travers le dispositif, jusqu'à un moyen de décharge positionnable sélectivement (11) à l'autre extrémité du dispositif, distante du site d'excavation, depuis lequel le ballast est introduit dans un moyen de rétention en vue de sa collecte.

2. Procédé selon la revendication 1, **caractérisé en ce qu'il** comprend de plus :

- le fait d'amener une partie antérieure du tablier de chargement (6) dudit dispositif de déballastage en engagement sous le ballast à retirer.
3. Procédé selon la revendication 2, **caractérisé en ce que** ledit tablier de chargement (6) est un élément globalement de forme générale en C ayant une surface de levage intérieure inclinée vers le haut.
 4. Procédé selon la revendication 2, **caractérisé en ce qu'il** comprend de plus :

l'ajustement de la position verticale de la partie antérieure du tablier de chargement (6) à mesure que le dispositif de déballastage avance en s'enfonçant dans le ballast pour placer l'avant du tablier sous le ballast situé sur l'infrastructure.
 5. Procédé selon la revendication 1, **caractérisé en ce qu'il** comprend de plus :

avant ladite étape de soulèvement du ballast, le retrait des rails d'une ligne de chemin de fer précédemment posée sur le ballast dans une portion de la ligne de chemin de fer de laquelle le ballast doit être retiré.
 6. Dispositif de déballastage pour le retrait continu de ballast d'une infrastructure (ou assiette) de voie, ledit dispositif comprenant :
 - (a) des moyens d'excavation et de soulèvement ;
 - (b) des moyens de transport (10) pour déplacer le ballast depuis les moyens de soulèvement, à travers le dispositif ; et
 - (c) des moyens de décharge (11) positionnables sélectivement pour décharger le ballast depuis les moyens de transport jusqu'à un point de collecte, **caractérisé en ce que** les moyens d'excavation et de soulèvement comprennent un tablier de chargement (6) et des moyens de contrôle pour faire avancer le tablier de chargement, dans lequel les moyens de contrôle, quand ils sont activés en service, forcent le tablier de chargement (6) à excaver et soulever de manière continue le ballast de l'infrastructure.
 7. Dispositif selon la revendication 6, **caractérisé en ce que** les moyens de soulèvement comprennent des moyens d'alimentation (8) pour alimenter le ballast soulevé sur les moyens de transport.
 8. Dispositif selon la revendication 6, **caractérisé en ce que** ledit tablier de chargement (6) est monté pour un mouvement vertical et/ou transversal indépendant par rapport audit corps principal.
 9. Dispositif selon la revendication 6, **caractérisé en ce que** ledit tablier de chargement (6) a sensiblement la forme d'un C.
 10. Dispositif selon la revendication 6, **caractérisé en ce que** les moyens de décharge positionnables sélectivement comprennent une flèche (11) montée à l'arrière du dispositif.
 11. Dispositif selon la revendication 10, **caractérisé en ce que** la flèche (11) est munie de moyens transporteurs (12) pour déplacer le ballast sur la longueur de la flèche.
 12. Dispositif selon la revendication 11, **caractérisé en ce que** les moyens de transport traversant le dispositif comprennent une bande transporteuse (10) depuis laquelle le ballast peut tomber sur les moyens transporteurs (12) de la flèche (11).
 13. Dispositif selon la revendication 7, **caractérisé en ce que** les moyens d'alimentation comprennent une paire de rotors (8) tournant en sens inverse, munis de lames qui dirigent entre elles le ballast soulevé et le déposent sur la bande transporteuse.
 14. Dispositif selon l'une quelconque des revendications 6 à 13, **caractérisé en ce que** le dispositif est muni de moyens pour transporter le dispositif jusqu'à, et depuis, l'infrastructure de voie de chemin de fer.
 15. Dispositif selon la revendication 14, **caractérisé en ce que** le dispositif peut être muni de chenilles (4) pour permettre au dispositif d'être conduit sur un terrain accidenté ou irrégulier aussi bien que sur des chaussées normales.

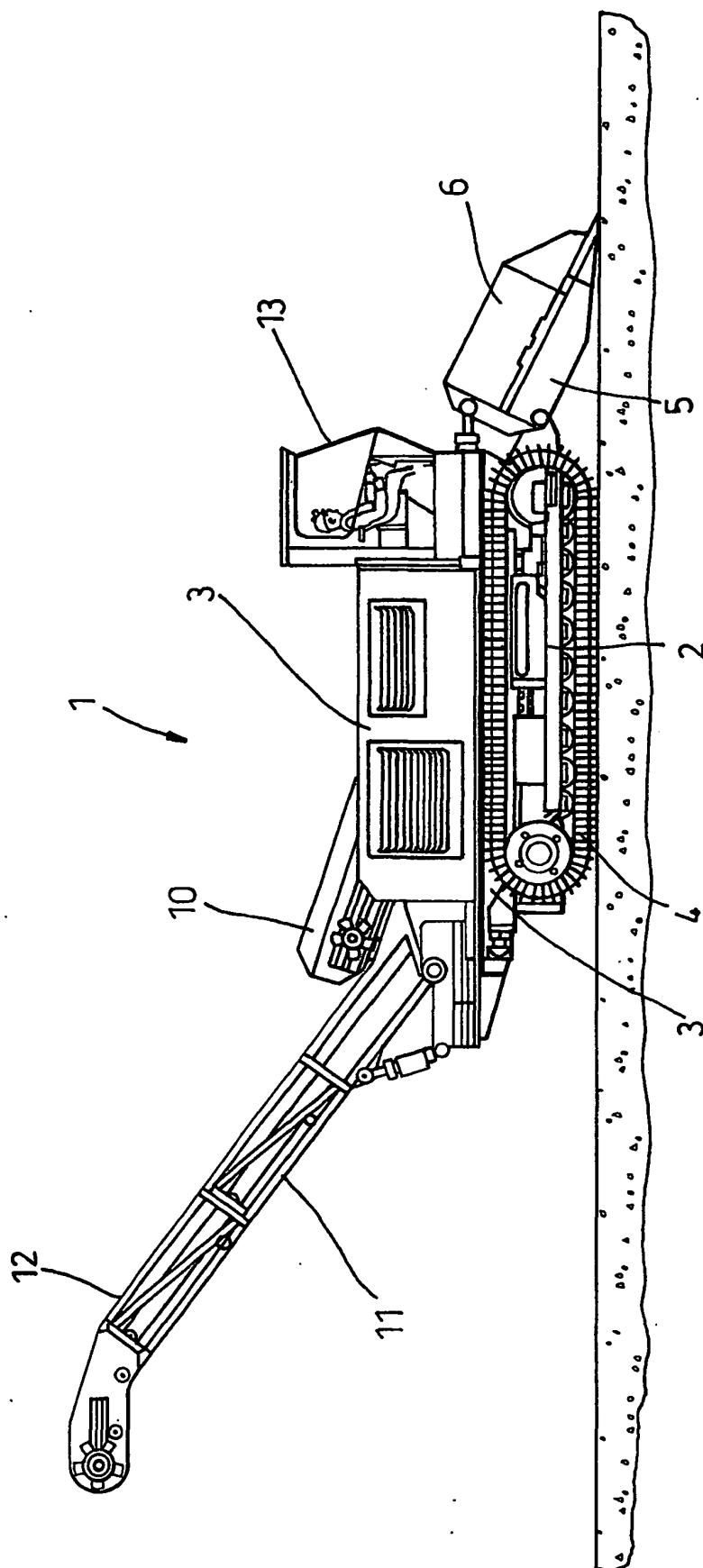


Fig. 1

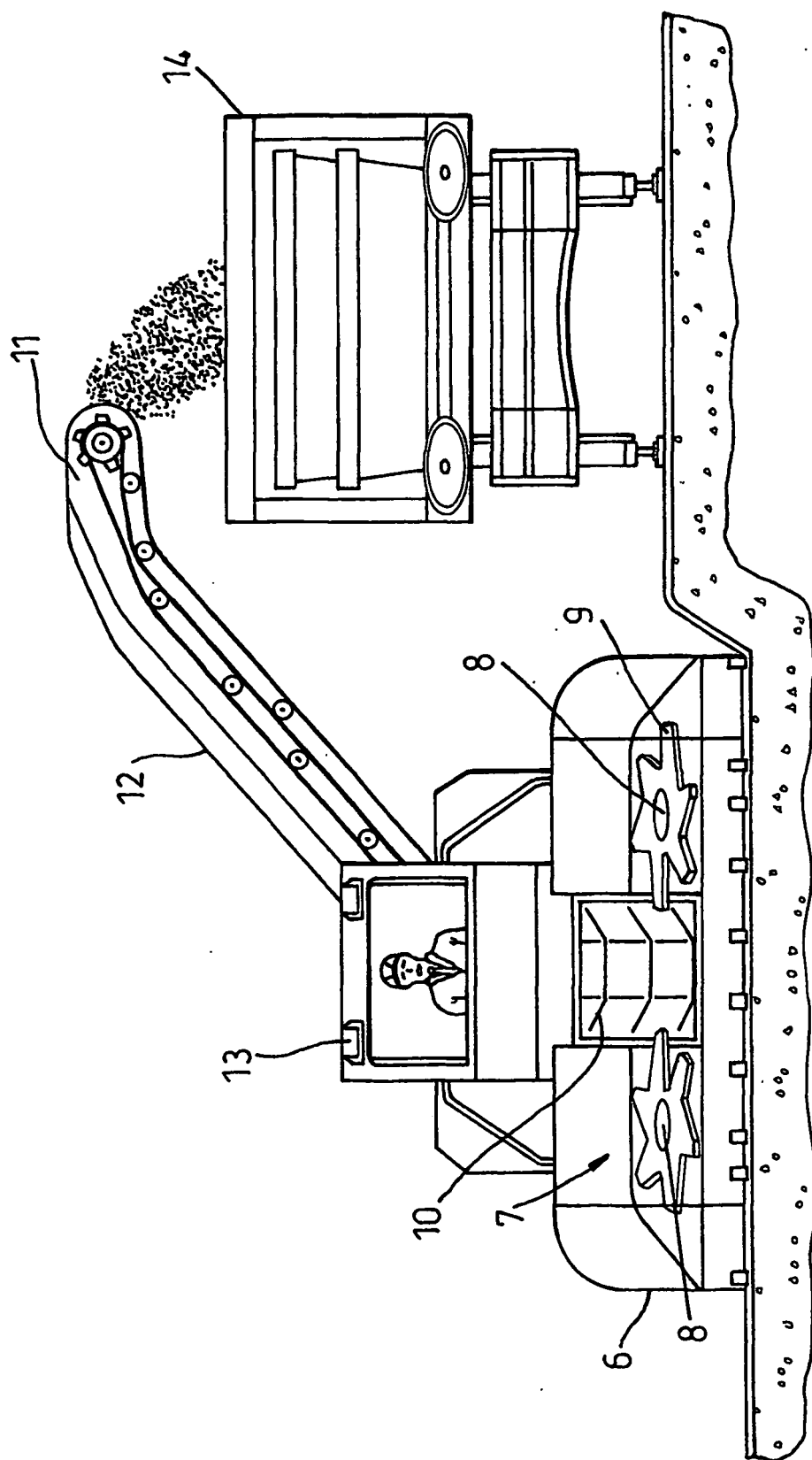


Fig. 2

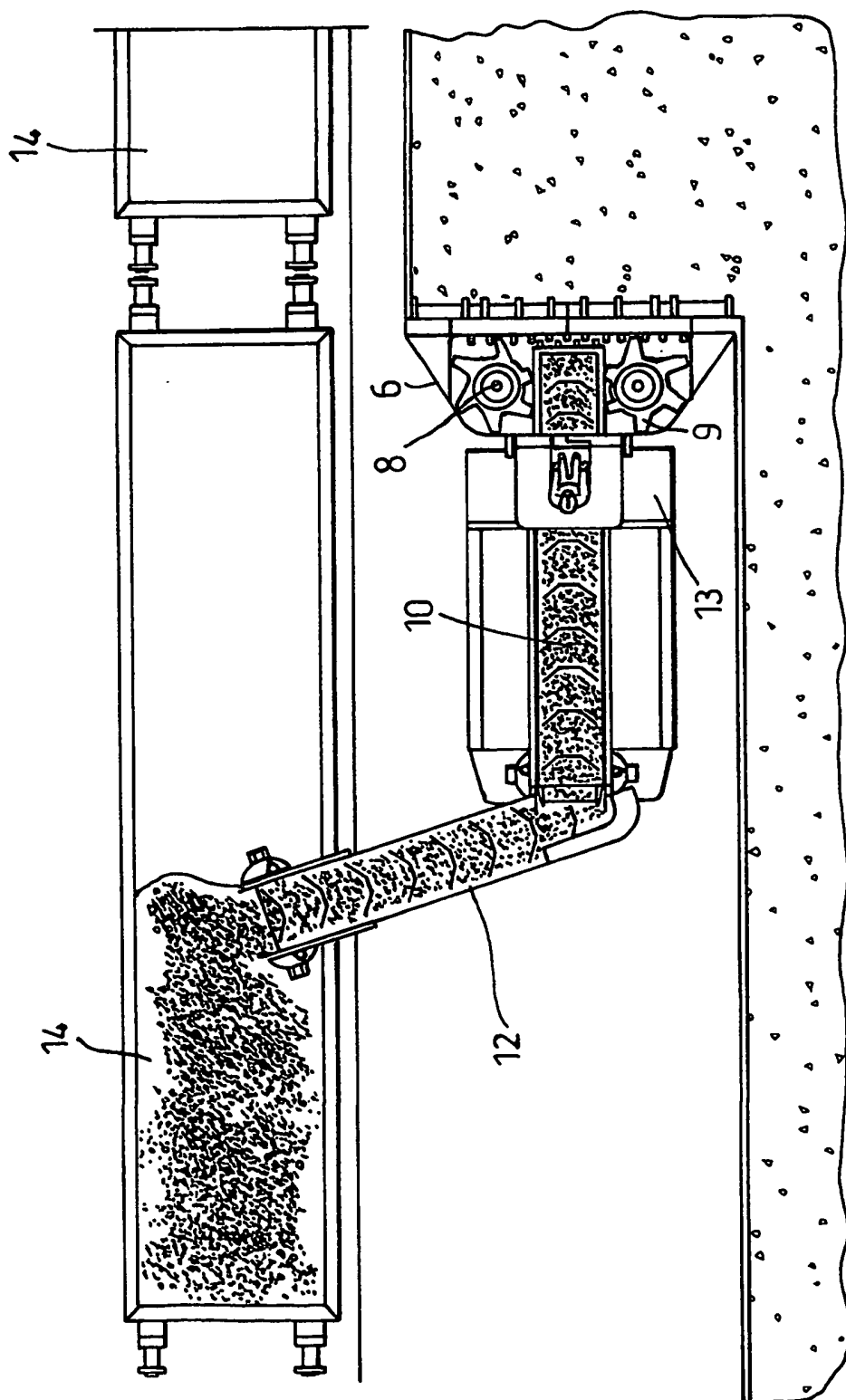


Fig. 3

REFERENCES CITED IN THE DESCRIPTION

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