Office de la Propriété Intellectuelle du Canada
Un organisme d'Industrie Canada

Canadian Intellectual Property Office
An agency of Industry Canada

CA 2661425 C 2014/09/30

(11)(21) 2 661 425

(12) BREVET CANADIEN
CANADIAN PATENT

(13) C

(86) Date de dépôt PCT/PCT Filing Date: 2007/08/10
(87) Date publication PCT/PCT Publication Date: 2008/02/28
(45) Date de délivrance/Issue Date: 2014/09/30
(85) Entrée phase nationale/National Entry: 2009/02/23
(86) N° demande PCT/PCT Application No.: CH 2007/000392
(87) N° publication PCT/PCT Publication No.: 2008/022475
(30) Priorité/Priority: 2006/08/25 (CH1360/06)

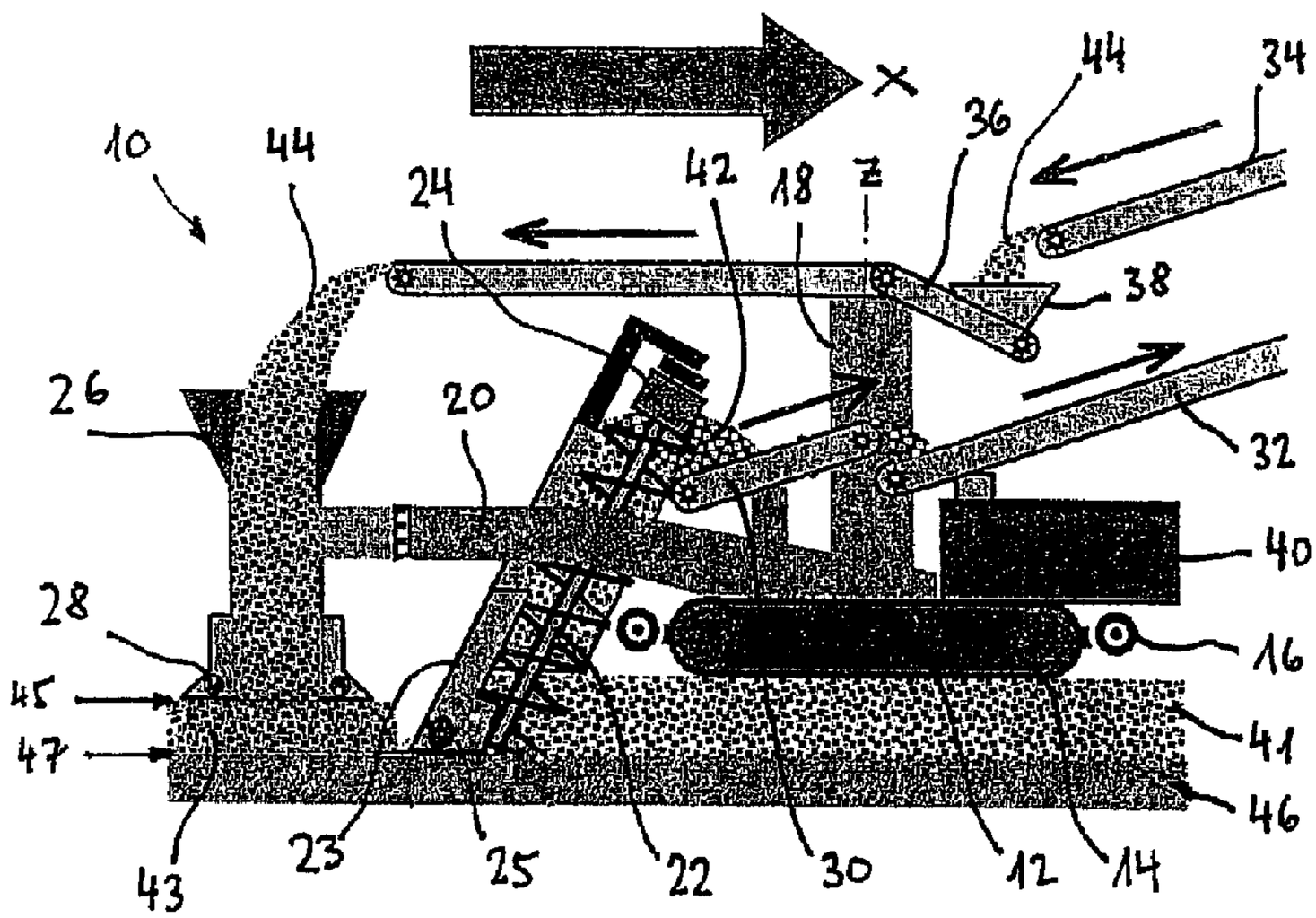
(51) Cl.Int./Int.Cl. *E01B 27/08* (2006.01)

(72) Inventeur/Inventor:
JAGER, HEINZ, CH

(73) Propriétaire/Owner:
SERSA MASCHINELLER GLEISBAU AG

(74) Agent: CASSAN MACLEAN

(54) Titre : PROCEDE ET DISPOSITIF POUR RENOUVELER UN LIT DE BALLAST
(54) Title: METHOD AND DEVICE FOR RENEWING A BALLAST BED



(57) Abrégé/Abstract:
In a method for the continuous renewal of a ballast bed (41) of a track from which the rails and sleepers have been removed, by carrying away old ballast (42) and depositing cleaned ballast or new ballast (44) on the underlying surface (46) from which the old ballast (42) has been removed, a removal device (22) which can travel in the working direction (x) continuously picks up the old ballast (42) of the ballast bed (41). The excavated material is conveyed away from the excavation area and possibly passed on for ballast cleaning. At the same time, cleaned ballast or new ballast (44) is continuously deposited in the working direction (x) on the underlying surface (46) from which the old ballast (42) has been removed, to form a new ballast bed (43). The removal device (22), as part of an excavating machine (10) travelling in the working direction (x) on the old ballast bed (41), is arranged downstream of the running gear (14, 16) of the excavating machine (10).

(12) NACH DEM VERTRAG ÜBER DIE INTERNATIONALE ZUSAMMENARBEIT AUF DEM GEBIET DES PATENTWESENS (PCT) VERÖFFENTLICHTE INTERNATIONALE ANMELDUNG

(19) Weltorganisation für geistiges Eigentum
Internationales Büro

(43) Internationales Veröffentlichungsdatum
28. Februar 2008 (28.02.2008)

PCT

(10) Internationale Veröffentlichungsnummer
WO 2008/022475 A1

(51) Internationale Patentklassifikation:
E01B 27/08 (2006.01)

(21) Internationales Aktenzeichen: PCT/CH2007/000392

(22) Internationales Anmeldedatum:
10. August 2007 (10.08.2007)

(25) Einreichungssprache: Deutsch

(26) Veröffentlichungssprache: Deutsch

(30) Angaben zur Priorität:
1360/06 25. August 2006 (25.08.2006) CH

(71) Anmelder *(für alle Bestimmungsstaaten mit Ausnahme von US)*: **J. MÜLLER AG, MASCHINELLER GELEISE-UNTERHALT** [—/CH]; Vogelsangstrasse 6, CH-8307 Effretikon (CH).

(72) Erfinder; und

(75) Erfinder/Anmelder *(nur für US)*: **JÄGER, Heinz** [CH/CH]; Chilegasse 9, CH-8604 Volketswil (CH).

(74) Anwalt: **WIEDMER, Edwin**; Isler & Pedrazzini AG, Gotthardstrasse 53, Postfach 1772, CH-8027 Zürich (CH).

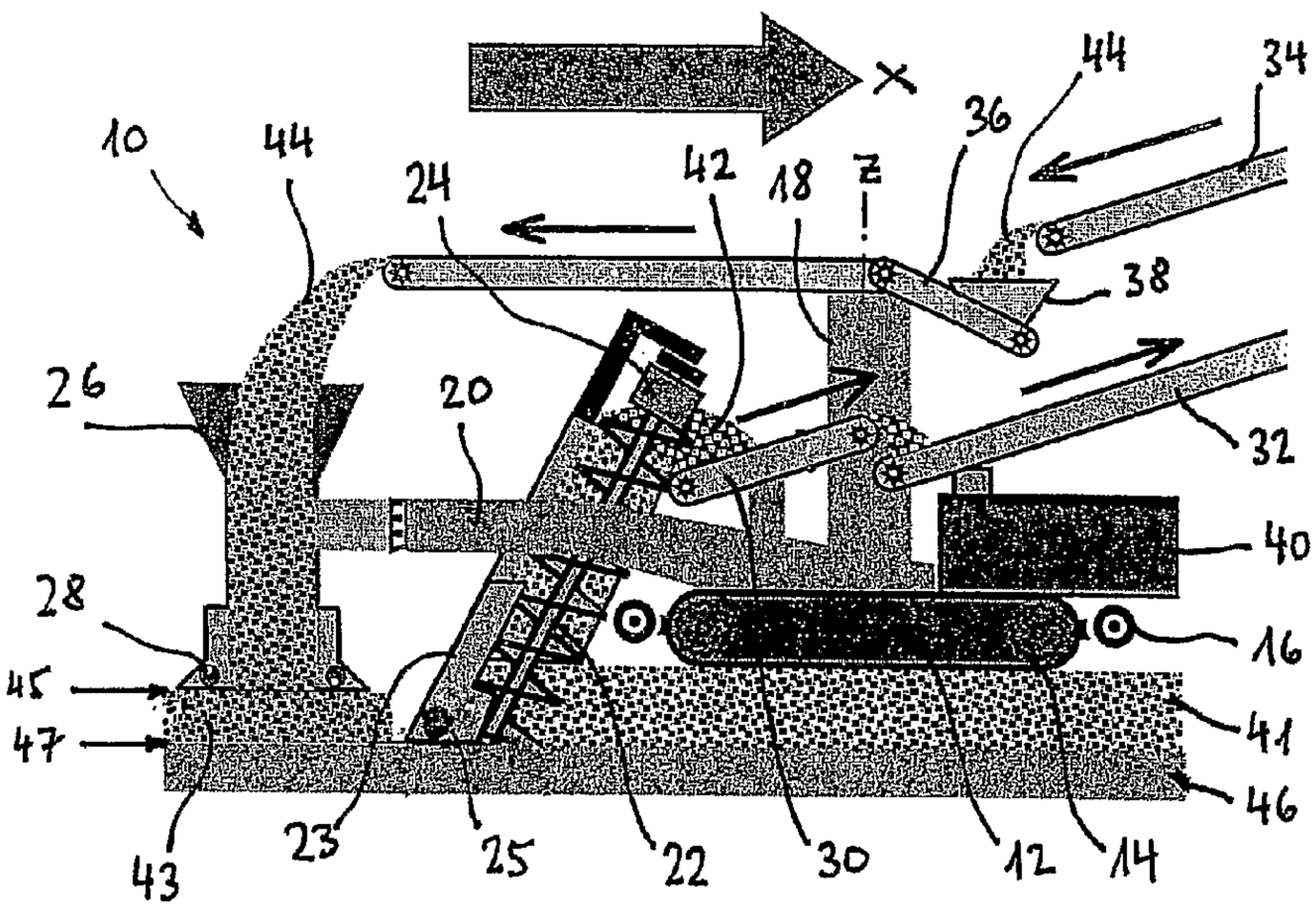
(81) Bestimmungsstaaten *(soweit nicht anders angegeben, für jede verfügbare nationale Schutzrechtsart)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Bestimmungsstaaten *(soweit nicht anders angegeben, für jede verfügbare regionale Schutzrechtsart)*: ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), eurasisches (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), europäisches (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC,

[Fortsetzung auf der nächsten Seite]

(54) Title: METHOD AND DEVICE FOR RENEWING A BALLAST BED

(54) Bezeichnung: VERFAHREN UND VORRICHTUNG ZUR ERNEUERUNG EINER SCHOTTERBETTUNG



(57) Abstract: In a method for the continuous renewal of a ballast bed (41) of a track from which the rails and sleepers have been removed, by carrying away old ballast (42) and depositing cleaned ballast or new ballast (44) on the underlying surface (46) from which the old ballast (42) has been removed, a removal device (22) which can travel in the working direction (x) continuously picks up the old ballast (42) of the ballast bed (41). The excavated material is conveyed away from the excavation area and possibly passed on for ballast cleaning. At the same time, cleaned ballast or new ballast (44) is continuously deposited in the working direction (x) on the underlying surface (46) from which the old ballast (42) has been removed, to form a new ballast bed (43). The removal device (22), as part of an excavating machine (10) travelling in the working direction (x) on the old ballast bed (41), is arranged downstream of the running gear (14, 16) of the excavating machine (10).

[Fortsetzung auf der nächsten Seite]

WO 2008/022475 A1

WO 2008/022475 A1

MT, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Veröffentlicht:
— *mit internationalem Recherchenbericht*

(57) Zusammenfassung: Bei einem Verfahren zur kontinuierlichen Erneuerung einer von Schienen und Schwellen befreiten Schotterbettung (41) eines Gleises durch Abtragen von Altschotter (42) und Ablagern von gereinigtem Schotter oder Neuschotter (44) auf dem vom Altschotter (42) befreiten Untergrund (46) nimmt ein in Arbeitsrichtung (x) verfahrbares Abtraggerät (22) den Altschotter (42) der Schotterbettung (41) kontinuierlich auf. Das Aushubmaterial wird aus dem Aushubbereich weggefördert und gegebenenfalls einer Schotterreinigung zugeführt. Gleichzeitig wird gereinigter Schotter oder Neuschotter (44) zur Bildung einer neuen Schotterbettung (43) kontinuierlich in Arbeitsrichtung (x) auf dem vom Altschotter (42) befreiten Untergrund (46) abgelagert. Das Abtraggerät (22) als Teil einer in Arbeitsrichtung (x) auf der alten Schotterbettung (41) fahrenden Aushubmaschine (10) ist dem Fahrwerk (14, 16) der Aushubmaschine (10) nachgeordnet.

WO 2008/022475 PCT/CH2007/000392

METHOD AND DEVICE FOR RENEWING A BALLAST BED

Technical field of the invention

The invention relates to a method for the continuous renewal of a ballast bed of a track from which the rails and sleepers have been removed, by carrying away old ballast and depositing cleaned ballast or new ballast on the substrate from which the old ballast has been removed, in which method a removal device which can travel in the working direction continuously picks up the old ballast of the ballast bed, the excavated material is conveyed away from the excavation region and possibly passed on for ballast cleaning and at the same time cleaned ballast or new ballast is continuously deposited in the working direction on the substrate from which the old ballast has been removed, to form a new ballast bed. The scope of the invention also includes an arrangement of appliances for carrying out the method and a transport carriage.

Prior art

A method for the cleaning of ballast of a track is known from EP-A-1 191 147. A ballast cleaning machine which is used for this purpose is moved over the section of track to be cleaned for the purposes of cleaning the ballast. Using an endless, rotating clearing chain, which is fed through transversely to the longitudinal direction of the machine below the locally raised track, the ballast located below the track is continuously carried away and passed on to a screening installation. The cleaned ballast issuing from the screening installation is subsequently discarded back onto the track.

If a track renewal or relaying of the existing tracks is carried out at the same time as the ballast cleaning, the ballast bed is renewed in a portion in which the track has in each case been removed

beforehand. As the ballast cleaning advances, in each case on the one hand a new or the previously dismantled piece of track is laid out on the renewed ballast bed and on the other hand a piece of track is removed on a ballast bed which has not yet been renewed.

In the case of a known method of the type mentioned at the outset, the old ballast of the ballast bed to be renewed is continuously carried away by a bucket conveyor which is arranged upstream of a ballast cleaning machine through the machine moving forward in the working direction, cleaned in a screening installation on the machine and subsequently, immediately after the bucket conveyor, brought out again as cleaned ballast on the substrate from which the old ballast has been removed. The excavated earth is conveyed, for the purposes of disposal, counter to the working direction into a transport carriage positioned after the machine.

The method described hereinbefore has the drawback that the relaying of a track which was previously removed from the old ballast bed on the renewed ballast bed cannot be carried out directly at the same location and the track portions must for this reason in each case be placed in a relatively short time and at great expense after the machine, wherein the relaying of the tracks can be carried out only when the excavation has been completed and the ballast cleaning machine has left the excavation region. A further drawback is the high weight of the known excavation and cleaning machine.

Account of the invention

The invention is based on the object of providing a method of the type mentioned at the outset and also an arrangement which is suitable for carrying out the method, allowing the drawbacks from which the methods and devices according to the prior art suffer to be

avoided. A further aim of the invention is the provision of a method and an arrangement which are suitable both for normal ballast cleaning and for substrate redevelopment with total excavation.

With regard to the method, the object is achieved, in accordance with the invention, in that the removal device, as part of an excavating machine traveling in the working direction on the old ballast bed, is arranged downstream of the running gear of the excavating machine.

In the case of a preferred implementation of the method according to the invention, the old ballast, which is carried away by the removal device from the ballast bed, is conveyed as excavated material in the working direction into a first transport carriage, which is provided before the excavating machine and can travel on the old ballast bed, and the cleaned ballast or the new ballast is conveyed from the first transport carriage counter to the working direction after the removal device and deposited onto the substrate from which the old ballast has been removed.

For ballast cleaning without total excavation, the first transport carriage expediently comprises a ballast cleaning unit and the old ballast, which is conveyed from the removal device, is cleaned in the ballast cleaning unit and the cleaned ballast is conveyed back after the removal device and deposited on the substrate from which the old ballast has been removed.

For substrate redevelopment with total excavation, the first transport carriage preferably contains new ballast and sand separately from each other and new ballast and sand are conveyed from the first transport carriage separately after the removal device and

deposited as separate layers on the substrate from which the old ballast has been removed and which is covered by an underlay made of geotextile or geogrid.

In the case of a first preferred manner of carrying out the method according to the invention, the first transport carriage oscillates, for loading and/or unloading, between the excavating machine and a second transport carriage which is positioned on a track ending at the ballast bed to be removed and provided for the supply and removal of materials. In the case of this procedure, the excavating machine is stationary during the oscillating travel of the first transport carriage, i.e. its excavating performance is zero during this time.

In the case of a second preferred manner of carrying out the method according to the invention, the first transport carriage remains stationary in the excavating machine and a third transport carriage oscillates, for loading and/or unloading, between the first transport carriage and a second transport carriage which is positioned on a track ending at the ballast bed to be removed and provided for the supply and removal of materials. In the case of this shuttle mode of a third transport carriage, the excavating machine can be used for continuous conveyance at maximum power.

An arrangement which is suitable for carrying out the method according to the invention comprises an excavating machine which can travel on the old ballast bed in the working direction and has a removal device which is arranged following the running gear of the excavating machine, at least one transport carriage for loading and/or unloading with/of materials which are produced/required during renewal of a ballast bed, optionally a ballast and sand distributing machine, and also conveying means for transporting the materials

which are produced/required during renewal of a ballast bed.

The removal device of the excavating machine and a ballast silo provided for the depositing of ballast are preferably arranged on a swivel arm which can swivel about a vertical axis of rotation and a horizontal pitch axis.

The removal device is preferably a feed screw. A feed screw is less noisy than other excavation systems, has a compact design, is effective and displays good efficiency. A further preferred removal device is an impeller wheel.

For ballast cleaning without total excavation, one of the transport carriages preferably comprises a ballast cleaning unit.

For substrate redevelopment with total excavation, the transport carriages preferably have a first loading plane for the interim storage of excavated material and a second loading plane arranged above the first loading plane for the interim storage of ballast and/or sand and the second loading plane for the supply of ballast and/or sand can be lowered for the purposes of lowering the center of gravity of the transport carriage and can be raised above the first loading plane for increasing the size of the loading volume which is provided for the interim storage of excavated material.

The loading surfaces of the transport carriages are preferably embodied as conveyor belts.

The ballast and sand distributing machine preferably comprises a swivel arm which can swivel about a vertical axis of rotation and a horizontal pitch axis and two silos, which are provided for the depositing of

sand and ballast, are arranged on the swivel arm. At their lower end, the silos are preferably equipped with a compressor.

The machines and vehicles which are provided for traveling on the ballast bed and on tracks, in particular the excavating machine, the ballast and sand distributing machine and the transport carriages, are expediently equipped with an alternately usable tracked running gear and a rail running gear.

Brief description of the drawings

Further advantages, features and details of the invention will emerge from the subsequent description of preferred exemplary embodiments and also with reference to the drawings, in which:

Fig. 1 is a schematic side view of an excavating machine;

Fig. 2 shows schematically a measurement and control scheme for the excavating machine of Fig. 1;

Fig. 3 is a schematic side view of a ballast cleaning arrangement with the excavating machine of Fig. 1 and a transport carriage;

Fig. 4 - 6 show schematically a shuttle mode of the arrangement of Fig. 3;

Fig. 7 is a schematic side view of the excavating machine of Fig. 1 in combination with a ballast and sand distributing machine;

Fig. 8 is a schematic side view onto the arrangement of Fig. 7 in combination with a transport carriage;

Fig. 9 is a schematic section through the transport carriage of Fig. 8 along the line I/I thereof in transport mode;

Fig. 10 shows schematically the section of Fig. 9 through the transport carriage in working mode; and

Fig. 11 shows schematically a shuttle mode with the arrangement of Fig. 8.

Description of exemplary embodiments

An excavating machine 10 illustrated in Fig. 1 has a movable base 12 with a tracked running gear 14 for advancing on a ballast bed and a rail running gear 16 for advancing on tracks. A swivel tower 18 having a vertical swivel axis z protrudes from the movable base 12 perpendicularly to a notional bearing plane of the running gears 14, 16. A swivel arm 20 is mounted on the swivel tower 18 so as to be able to rotate about the swivel axis z.

A feed screw 22, which is inclined in the working direction x and encloses an acute angle with the notional bearing plane of the running gears 14, 16, is secured to the swivel arm 20. On its back, the feed screw 22 is surrounded by a dozer blade 23 with a compressor 25. The lower edge of the dozer blade 23 rests on the excavated track formation. A ballast silo 26, with a compressor 28 arranged at the bottom-side end thereof, is located at the free end of the swivel arm 20.

The excavating machine 10 is equipped with conveyor belts 30, 32, 36, the function of which will be examined in greater detail hereinafter. A drive and energy unit 40 serves inter alia to advance the excavating machine, to carry out swiveling movements of the swivel arm 20 about the swivel axes z, y and to drive 24 the feed screw 22.

The tracked running gear 14 of the excavating machine 10 rests on a ballast bed 41 made of old ballast 42. During the traveling of the excavating machine 10 in the working direction x, the old ballast 42 is continuously conveyed by the feed screw 22 onto the conveyor belt 30, which is secured to the swivel arm 20, and therefrom further onto the conveyor belt 32,

which is fixedly mounted on the movable base. To the same degree as the carrying-away of old ballast 42 via the feed screw 22 and the two conveyor belts 30, 32, cleaned ballast or new ballast 44 is passed on via the conveyor belt 34 into a silo 38 arranged on the conveyor belt 36. From the conveyor belt 36, the cleaned ballast or new ballast 44 falls into the ballast silo 26 and is continuously deposited on the excavated track formation 47 of the earth foundation 46 and compressed via the compressor 28 onto the desired ballast track formation 45 of the ballast bed 43.

The measurement and control scheme shown in Fig. 2 for the excavating machine 10 illustrated in Fig. 1 reveals the swiveling movements which are carried out by the swivel arm 20 and thus by the feed screw 22 and by the ballast silo 26. A swiveling movement of the swivel arm 20 about the vertical swivel axis z leads to a horizontal swiveling movement of the feed screw 22 and of the ballast silo 26 over the entire width of the ballast bed 41, 43 to be carried away or to be newly constructed. The height of the lower edge of the feed screw 22 and the height of the lower edge of the ballast silo 26 with respect to a reference value are set by a corresponding swiveling movement of the swivel arm 20 about a horizontal pitch axis y, which is arranged at right angles to the swivel axis z, by means of a lifting cylinder 39.

The excavation depth and excavation width are each measured using an angle gauge 118 for the angle of rotation of the vertical swivel axis z and an angle gauge 120 for the angle of rotation of the horizontal pitch axis y and passed on to a computer unit 122. Based on the inputs via a keyboard 124, the computer unit 122 defines the vertical and transverse positions for the excavated track formation 47 and the ballast track formation 45. Construction site data, such as for

example the construction site geometry, the excavated depth, the excavated transverse position, the ballast track formation height and the ballast track formation transverse position, can be collected off-line, i.e. before work commences, and stored on a floppy disk 126.

The measurement and control scheme is designed for at least three different levels of automation, so that in the event of problems with the electronics it is possible to switch back to the respectively simpler level. In the event of a computer failure, work can nevertheless be continued using a manual or emergency controller by direct activation of the hydraulic valves. The following control commands can be sent to the excavating machine via a remote controller: advancement, excavation width, material flow, various interventions into the automatic controller such as for example stop, start, etc.

As shown in Fig. 3, the excavated earth of the old ballast 42 is removed by the excavating machine 10 via the conveyor belt 32 to a first transport carriage 48 from which cleaned ballast 44 is passed on to the silo 38 via the conveyor belt 34 and to the ballast silo 26 via the conveyor belt 36.

The first transport carriage 48 is equipped both with a tracked running gear 50 and with a rail running gear 52. The excavated earth of the old ballast 42 is passed on via a cleaning unit 54 which is arranged in the carriage interior, in the region of one of the carriage ends, and from which the cleaned ballast 44 is returned via the conveyor belt 34. The residual material, consisting of undersize particles and oversize particles, remains as excavated earth 49 in the first transport carriage 48, which serves as an interim storage means, and is conveyed away from the cleaning

unit 54 toward the more remote carriage end via a conveyor belt 56 spanning the bottom of the carriage.

As soon as the first transport carriage 48 is filled with excavated earth 49 (Fig. 4), the excavation is interrupted and the first transport carriage 48 returns, on the ballast bed 41 made of old ballast 42, up to a second transport carriage 58 which is deposited at a free track end 57. The excavated earth 49 is transferred from the first transport carriage 48 into the second transport carriage 58, which is ready for use, via the conveyor belt 56, which spans the bottom of the carriage, and a further conveyor belt 60 which is adjoined to said conveyor belt 56 (Fig. 5). The emptied first transport carriage 48 subsequently returns back to the excavating machine 10.

In the case of the variant shown in Fig. 6 of the removal of excavated earth 49 from first transport carriages 48, a third transport carriage 62, which corresponds to a first transport carriage 48 without a cleaning unit 54 but with a conveyor belt bottom 56, is used as a shuttle between the first transport carriage 48, which remains in the excavating machine 10, and the second transport carriage 58. In this shuffle mode, the excavating machine 10 can continuously convey at maximum power.

The arrangement shown in Fig. 7 is used when the ballast bed 41 made of old ballast 42 has to be removed within a total excavation and a new ballast bed having an underlay 64 made of geotextile or a geogrid, a first layer 66 made of sand 67 and a second layer 68 made of new ballast 44 has to be constructed.

An excavating machine 10' used for this purpose is substantially identical in its basic construction to the excavating machine 10 shown in Fig. 1, but does not

have a ballast silo 26. Furthermore, a second conveyor belt 35, with a silo 37 which is arranged upstream for the transportation of sand 67, is arranged parallel to the conveyor belt 36, with a silo 38 which is arranged upstream for the transportation of new ballast 44.

A stand and ballast distributing machine 70, which is substantially identical in its basic construction to the excavating machine 10', is arranged downstream of the excavating machine 10' in the working direction x.

The sand and ballast distributing machine 70 has a movable base 72 with a tracked running gear 74 and a rail running gear 76. A swivel tower 78 having a vertical swivel axis z protrudes from the movable base 72 perpendicularly to a notional bearing plane of the running gears 74, 76. A swivel arm 80 is mounted on the swivel tower 78 so as to be able to rotate about the vertical swivel axis z.

A ballast silo 82 and a sand silo 84 are arranged one after the other and offset from each other on the swivel arm 80, the sand silo 84 being further removed from the swivel tower 78 than is the ballast silo 82. Two silos 86, 88, each having conveyor belts 90, 92 leading from the silos 86, 88 via the sand silo 84 or the ballast silo 82, are also secured to the swivel tower 78. In the region of their bottom-side ends, the sand silo 84 and the ballast silo 82 are equipped with compressors 85 and 83 respectively.

The sand and ballast distributing machine 70 rests with its tracked running gear 74 on a newly constructed ballast bed consisting of an underlay made of geotextile or geogrid 64, a first layer 66 made of sand 67 and a second layer 68 made of new ballast 44.

As may be seen from Fig. 8, a first transport carriage 94 for passing on sand and ballast is mounted upstream of the excavating machine 10' in the working direction x. The first transport carriage 94 for passing on sand and ballast is equipped both with a tracked running gear 96 and with a rail running gear 98. The first transport carriage 94 has a carriage bottom 100 with a first conveyor belt 101 spanning said carriage bottom for the interim storage of excavated material made of old ballast 42 and an intermediate bottom 102 which is arranged above the carriage bottom 100 and is in the form of two conveyor belts 104, 106, which are guided in the carriage longitudinal direction parallel next to each other, for the interim storage of sand 67 and new ballast 44. The height of the intermediate bottom 102 can be adjusted via hydraulic cylinders 108. During the transfer on the rail from a ballast and sand loading site to a work site, the intermediate bottom 102 is lowered in order to keep the center of gravity S as low as possible (Fig. 9). In working mode, the intermediate bottom 102 is raised to provide an interim storage space which is as large as possible for the excavated material (Fig. 10). The excavated earth of the old ballast 42 is passed on by the excavating machine 10' via the conveyor belt 32 onto the carriage bottom 100 or onto the conveyor belt 101 resting on the carriage bottom 100. Sand 67 and new ballast are passed on from the intermediate bottom 102 of the first transport carriage 94 to the sand and ballast distributing machine 70 via further conveyor belts 110, 112 into the silos 37, 38 which are mounted upstream of the conveyor belts 35, 36.

The sand and ballast distributing machine 70, the excavating machine 10' and the first transport carriage 94 for passing on sand and ballast are moved during the working operation in synchronization and at the same speed in the working direction x.

As soon as the first transport carriage 94 has been emptied of sand 67 and new ballast 44 and at the same time loaded with old ballast 42, the excavation is interrupted and the carriage 94 returns, on the ballast bed 41 made of old ballast 42, up to a second transport carriage 114, which is deposited at a free track end 57, for passing on sand and ballast. The excavated earth made of old ballast 42 is transferred from the first transport carriage 94 into the second transport carriage 114, which is ready for use, via the conveyor belt 101 forming the carriage bottom 100 and a further conveyor belt 103 which is adjoined to said conveyor belt 101. At the same time, sand 67 and new ballast 44 are transferred from the second transport carriage 114 into the first transport carriage 94. The first transport carriage 94 subsequently returns, freshly loaded with sand 67 and new ballast 44, back to the excavating machine 10'.

In the case of the variant shown in Fig. 11 of the removal of excavated earth into, and the passing-on of sand and new ballast from, the first transport carriage 94 for the passing-on of sand and ballast, a third transport carriage 116 is used as a shuttle between the first transport carriage 94, which now remains in the excavating machine 10', and the second transport carriage 114. In this shuttle mode, the excavating machine 10' can convey continuously at maximum power.

List of reference numerals

10 Excavating machine
12 Movable base
14 Tracked running gear
16 Rail running gear
18 Swivel tower
20 Swivel arm
22 Feed screw
23 Dozer blade
24 Drive of 22
25 Compressor
26 Ballast silo
28 Compressor
30 Conveyor belt
32 Conveyor belt
34 Conveyor belt
36 Conveyor belt
37 Silo on 35
38 Silo on 36
39 Lifting cylinder on 20
40 Drive and energy unit
41 Ballast bed made of old ballast
42 Old ballast
43 Ballast bed made of cleaned ballast or new ballast
44 Cleaned ballast or new ballast
45 Ballast track formation
46 Earth foundation
47 Excavated track formation
48 First transport carriage
49 Excavated earth
50 Tracked running gear
52 Rail running gear
54 Cleaning unit
56 Conveyor belt as bottom of 48
57 Free track end
58 Second transport carriage
60 Conveyor belt on 48
62 Third transport carriage

64 Underlay made of geotextile or geogrid
66 Layer made of sand
67 Sand
68 Layer made of new ballast 44
70 Ballast and sand distributing machine
72 Movable base
74 Tracked running gear
76 Rail running gear
78 Swivel tower
80 Swivel arm
82 Ballast silo
84 Sand silo
86 Silo
88 Silo
90 Conveyor belt
92 Conveyor belt
94 First transport carriage
96 Tracked running gear
98 Rail running gear
100 Carriage bottom
101 Conveyor belt
102 Intermediate bottom
103 Conveyor belt
104 Conveyor belt
106 Conveyor belt
108 Hydraulic cylinder
110 Conveyor belt
112 Conveyor belt
114 Second transport carriage
116 Third transport carriage
118 Angle gauge for the angle of rotation of z
120 Angle gauge for the angle of rotation of y
122 Computer unit
124 Keyboard
126 Floppy disk
x Working direction
S Center of gravity
y Pitch axis

z Vertical axis

Patent claims

1. A method for the continuous renewal of a ballast bed of a track from which rails and sleepers have been removed, by carrying away old ballast and depositing cleaned ballast or new ballast on a substrate from which the old ballast has been removed, in which method a removal device which can travel in a working direction continuously picks up the old ballast of the ballast bed, excavated material is conveyed away from an excavation region and at the same time the cleaned ballast or the new ballast is continuously deposited in the working direction on the substrate from which the old ballast has been removed, to form a new ballast bed,

wherein the removal device, as part of an excavating machine traveling in the working direction on an old ballast bed, is arranged downstream of a running gear of the excavating machine,

wherein the old ballast, which is carried away by the removal device from the ballast bed, is conveyed as excavated material in the working direction into a first transport carriage, which is provided before the excavating machine and can travel on the old ballast bed, and the cleaned ballast or the new ballast is conveyed from the first transport carriage counter to the working direction after the removal device and deposited onto the substrate from which the old ballast has been removed,

wherein the first transport carriage oscillates, for loading and/or unloading, between the excavating machine and a second transport carriage which is positioned on a track ending at the ballast bed to be removed and provided for the supply and removal of materials,

or

wherein the first transport carriage remains stationary in the excavating machine and a third transport carriage oscillates, for loading and/or unloading, between the first transport carriage and a second transport carriage which is

positioned on a track ending at the ballast bed to be removed and provided for the supply and removal of materials.

2. The method as claimed in claim 1, characterized in that the excavated material that is conveyed away from the excavation region is passed on for ballast cleaning.

3. The method as claimed in claim 1, characterized in that the first transport carriage comprises a ballast cleaning unit and the old ballast, which is conveyed from the removal device, is cleaned in the ballast cleaning unit and the cleaned ballast is conveyed back after the removal device and deposited onto the substrate from which the old ballast has been removed and which is covered by an underlay made of geotextile or geogrid.

4. The method as claimed in any one of claims 1 to 3, characterized in that the first transport carriage contains new ballast and sand separately from each other and new ballast and sand are conveyed from the first transport carriage separately after the removal device and deposited as separate layers onto the substrate from which the old ballast has been removed.

5. An arrangement for carrying out the method as claimed in any one of claims 1 to 4, characterized by an excavating machine which can travel on the old ballast bed in the working direction and has a removal device which is arranged downstream of the running gear of the excavating machine, at least one transport carriage for loading and/or unloading with/of materials which are produced/required during renewal of a ballast bed, and also conveying means for transporting the materials which are produced/required during renewal of a ballast bed.

6. The arrangement as claimed in claim 5, characterized further by a ballast and sand distributing machine.

7. The arrangement as claimed in claim 5 or 6, characterized in that the removal device of the excavating machine and a ballast silo provided for the depositing of ballast are arranged on a first swivel arm which can swivel about a vertical axis of rotation and a horizontal pitch axis.

8. The arrangement as claimed in any one of claims 5 to 7, characterized in that the removal device is a feed screw or an impeller wheel.

9. The arrangement as claimed in claim 8, characterized in that one of the transport carriages comprises a ballast cleaning unit.

10. The arrangement as claimed in any one of claims 5 to 9, characterized in that the transport carriage has a first loading plane for interim storage of excavated material and a second loading plane arranged above the first loading plane for interim storage of new ballast and/or sand and the second loading plane for the supply of new ballast and/or sand can be lowered for the purposes of lowering the center of gravity of the transport carriage and can be raised above the first loading plane for increasing the size of the loading volume which is provided for the interim storage of excavated material.

11. The arrangement as claimed in any one of claims 5 to 10, characterized in that loading surfaces of the transport carriages are embodied as conveyor belts.

12. The arrangement as claimed in claim 6, characterized in that the ballast and sand distributing machine comprises a second swivel arm which can swivel about a vertical axis of rotation and a horizontal pitch axis and two further silos, which are provided for the depositing of sand and new ballast, are arranged on the swivel arm.

13. The arrangement as claimed in claim 12, characterized in that the further silos are equipped at their lower end with a compressor.

14. The arrangement as claimed in any one of claims 5 to 12, characterized in that machines and vehicles which are provided for traveling on the ballast bed and on tracks are equipped with an alternately usable tracked running gear and a rail running gear.

15. The arrangement as claimed in claim 14, characterized in that the machines and vehicles are the excavating machine and the transport carriages.

16. The arrangement as claimed in claim 6, characterized in that machines and vehicles which are provided for traveling on the ballast bed and on tracks are equipped with an alternately usable tracked running gear and a rail running gear, said machines and vehicles being the excavating machine, the ballast and sand distributing machine and the transport carriages.

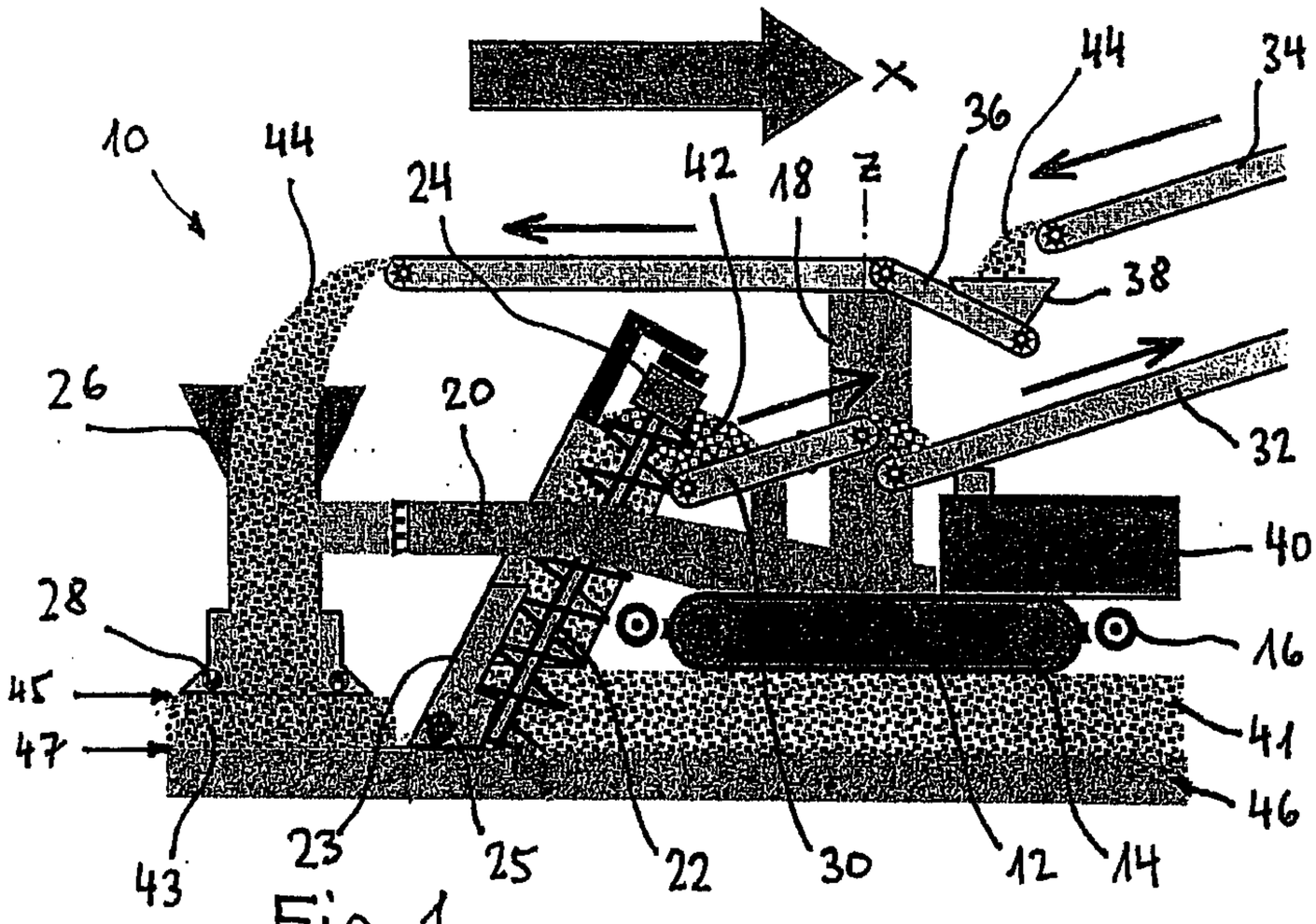

X
10
44
24
42
18
Z
36
44
34
38
26
20
32
40
28
16
45
41
47
46
43
23
25
22
30
12
14

Fig. 1

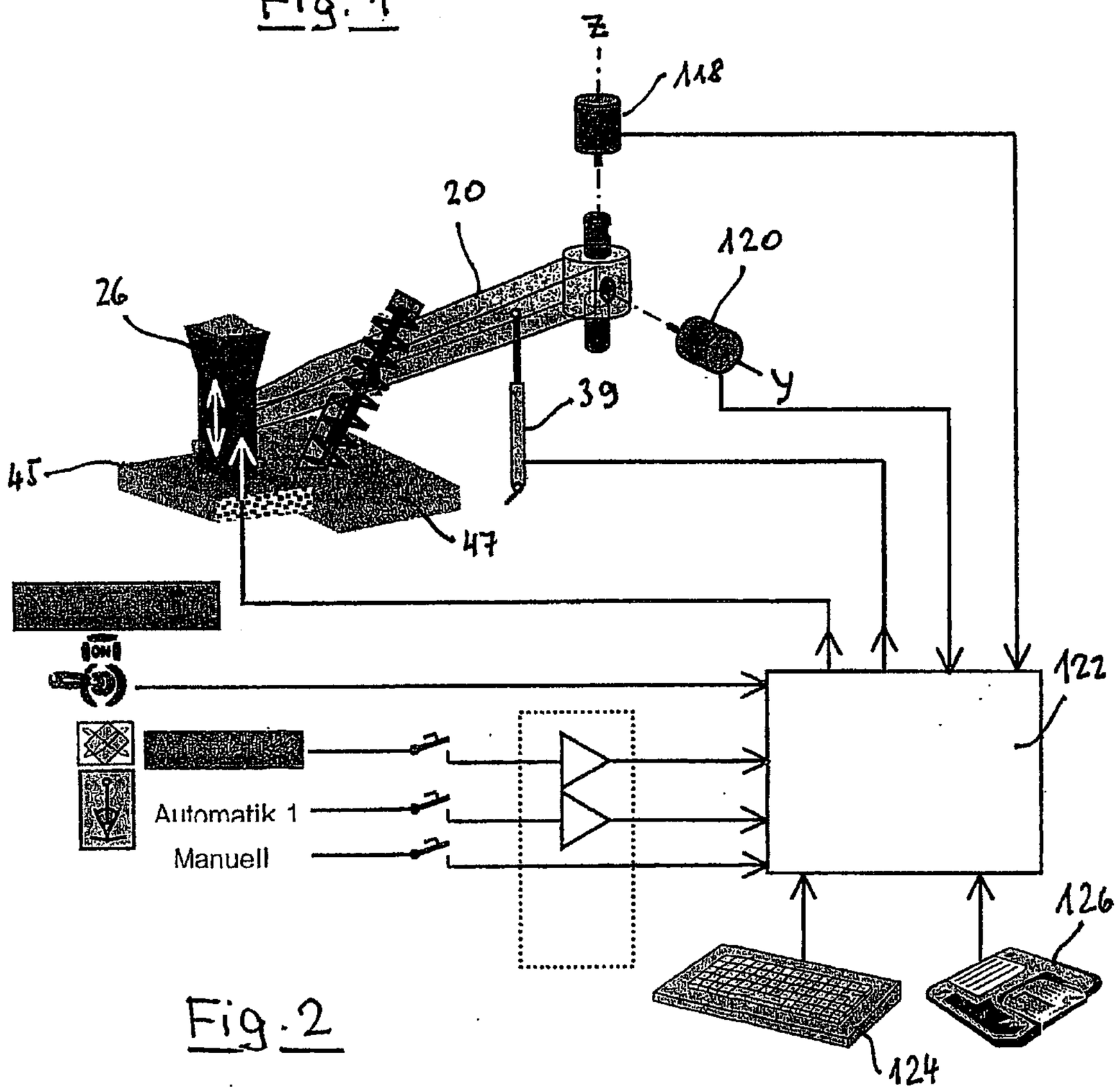

Z
118
20
120
26
39
45
47
Y
122
Automatik 1
Manuell
126
124

Fig. 2

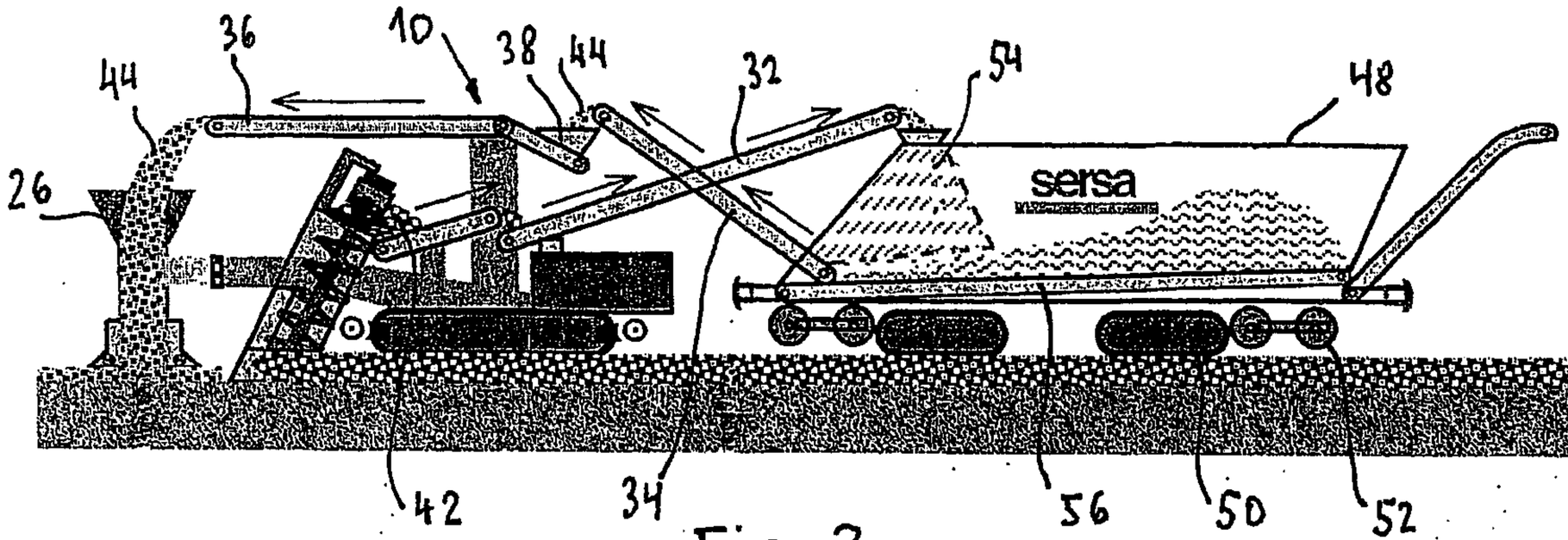


Fig. 3

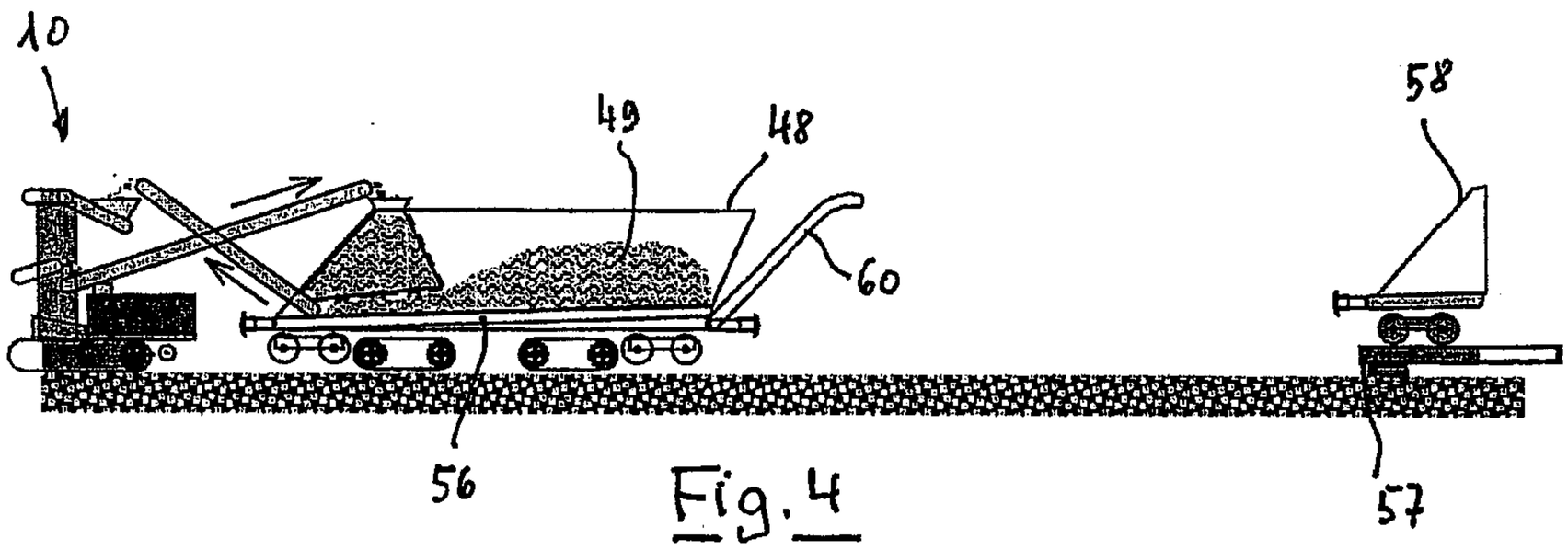


Fig. 4

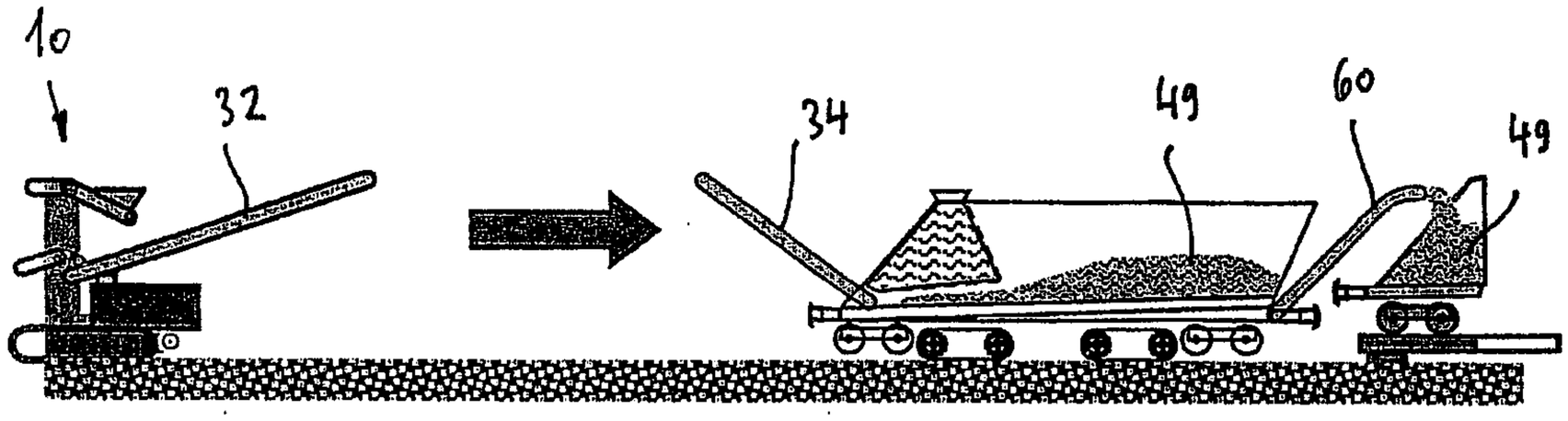


Fig. 5

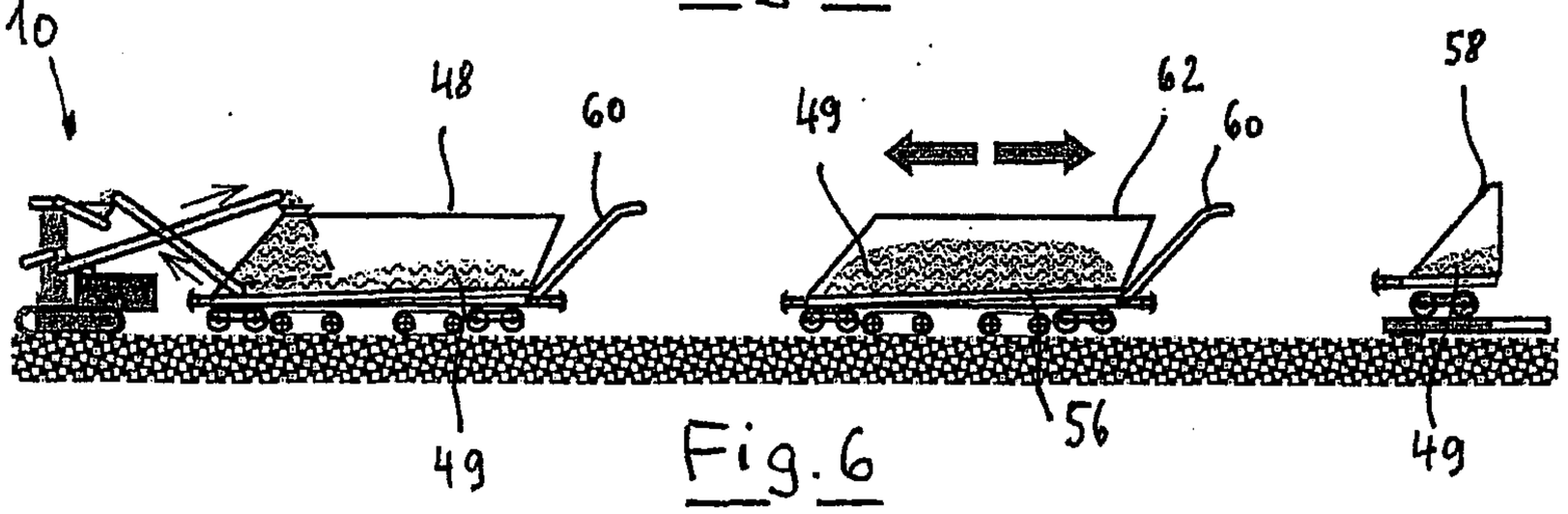


Fig. 6

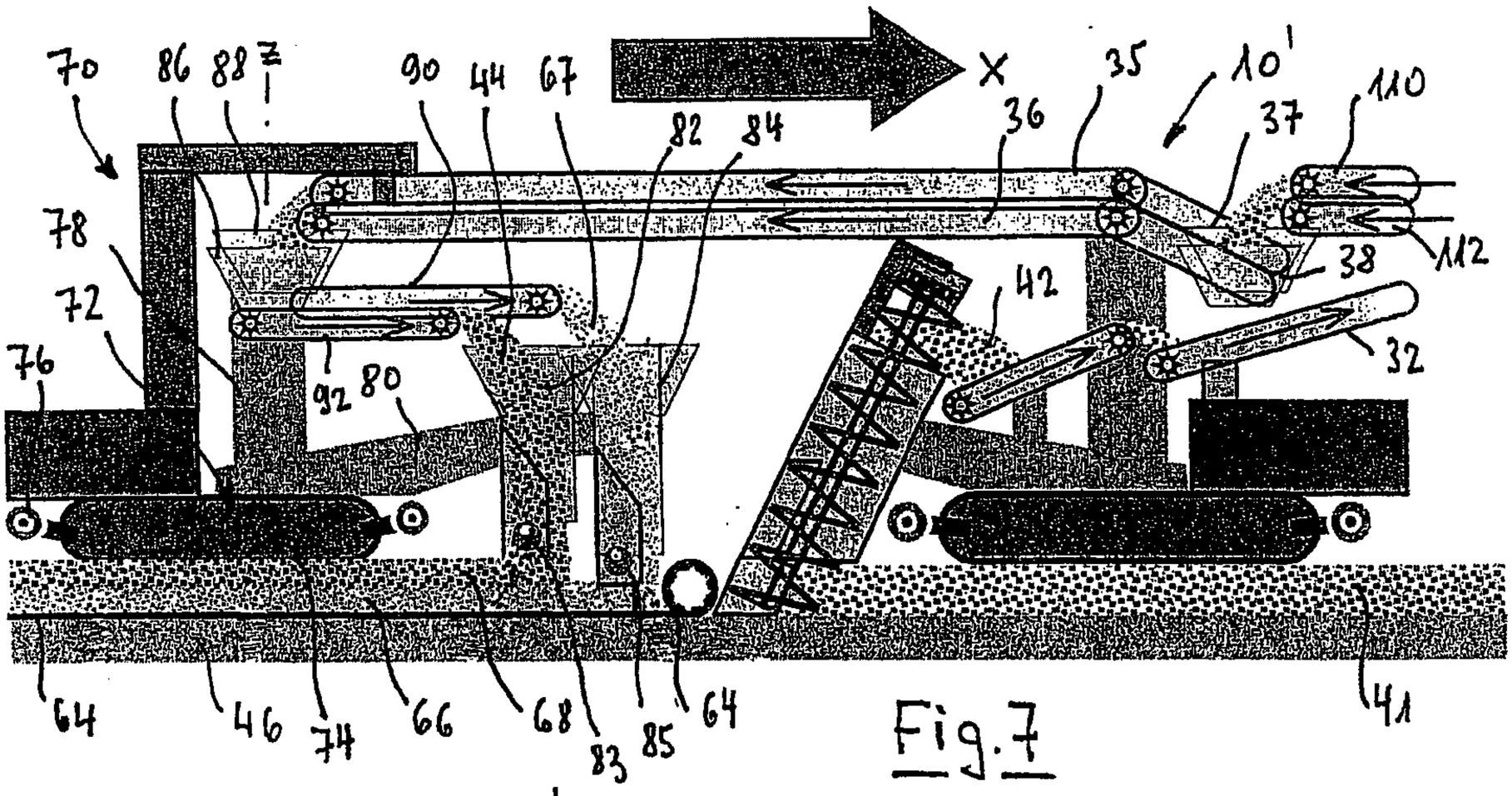


Fig.7

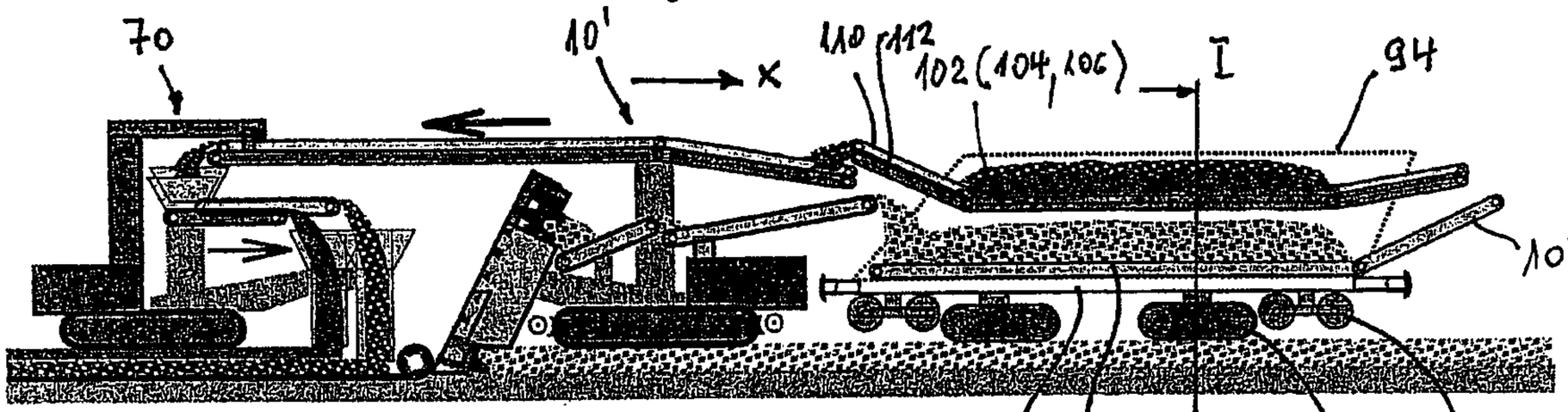


Fig.8

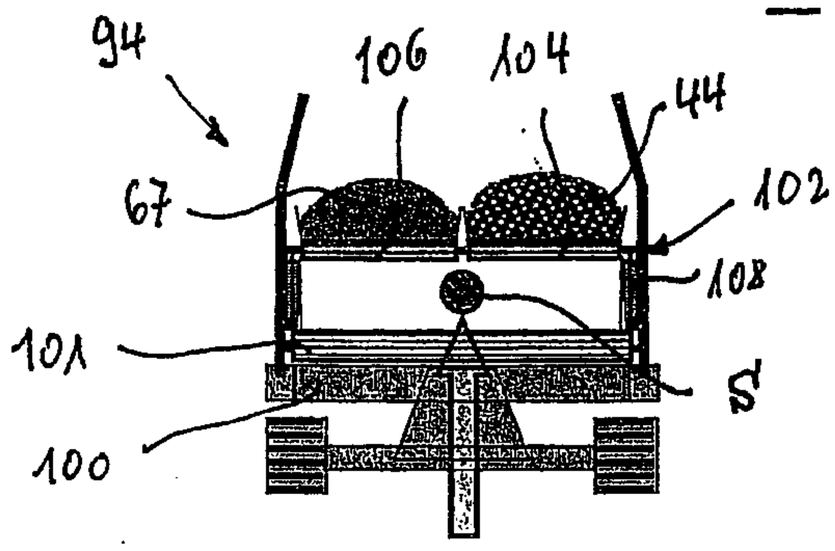


Fig.9

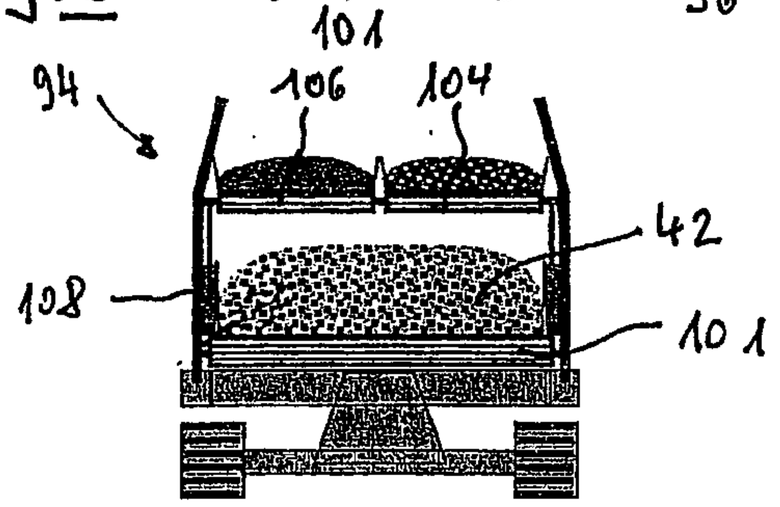


Fig.10

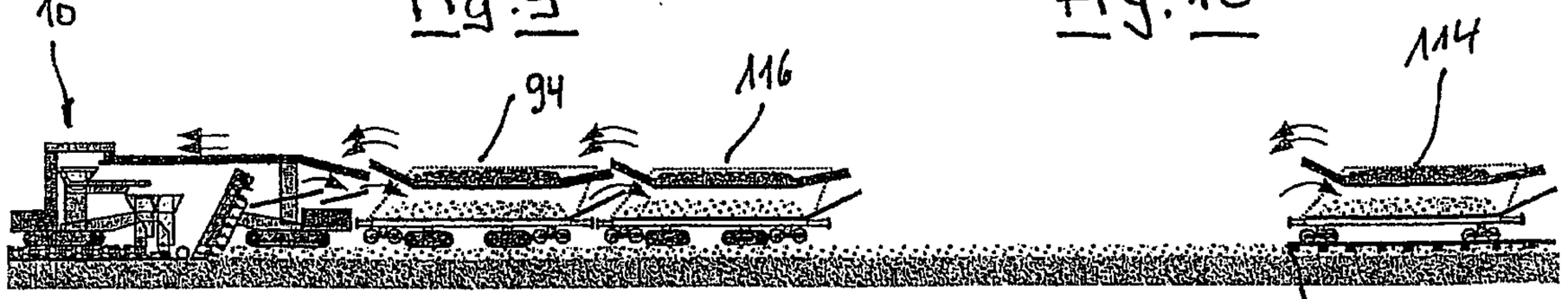
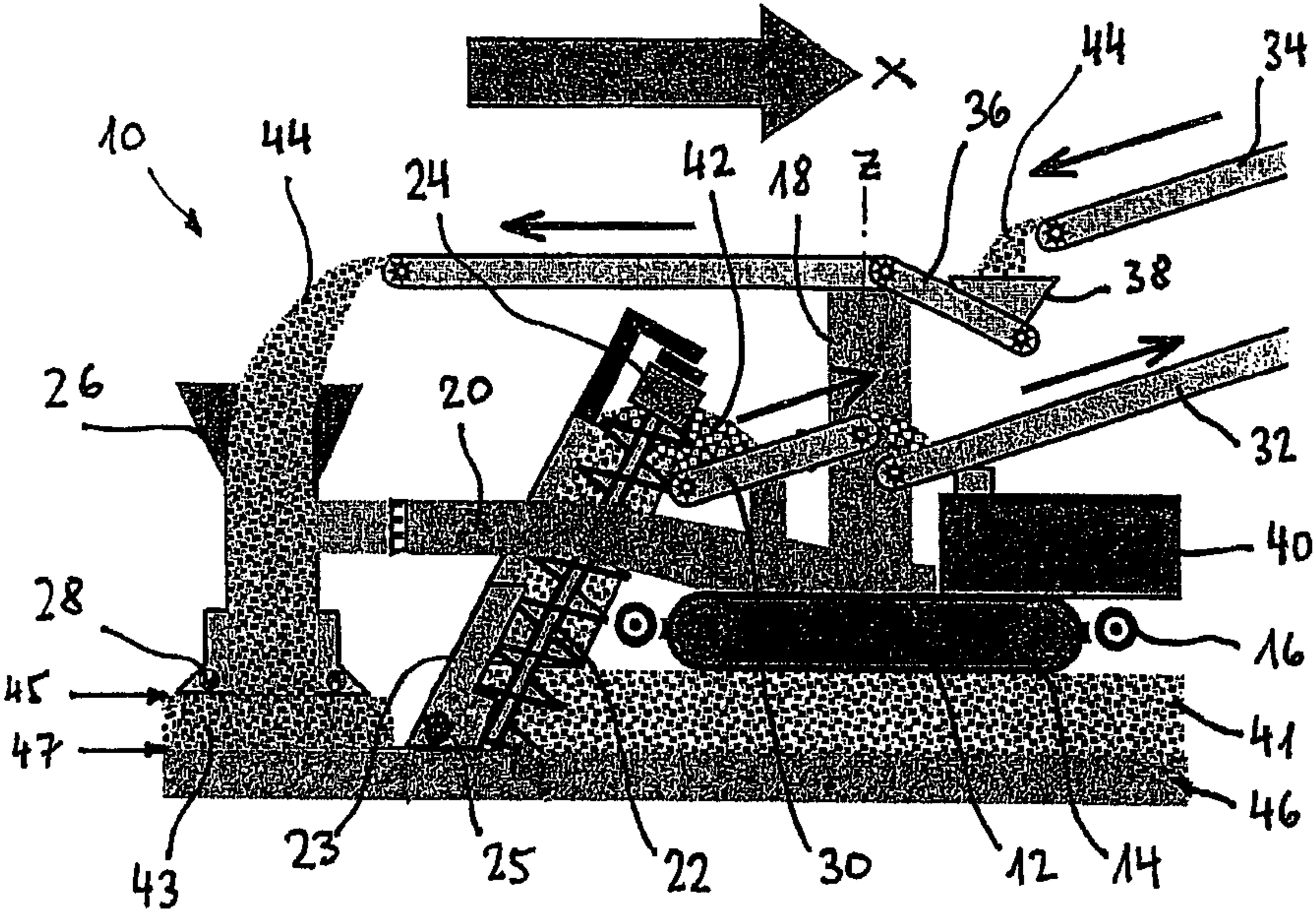


Fig.11


X
10
44
24
42
18
Z
36
44
34
38
26
20
32
40
28
16
45
41
47
46
43
23
25
22
30
12
14