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(71) Applicant: **Volker Stevin Rail & Traffic BV**
4131 NJ Vianen (NL)

(72) Inventors:
- **Tiecken, Jacques**
  4131 NJ Vianen (NL)
- **Van Meeteren, Dirk**
  4131 NJ Vianen (NL)
- **Boekhoven, Leo**
  4131 NJ Vianen (NL)

(74) Representative: **Assendelft, Jacobus H.W.**
Keukenhofdreef 20
2161 AZ Lisse (NL)

(54) Method for processing a railway track

(57) The invention relates to a method to carry out work to a railway with the steps of disconnecting the rail mounting over a predetermined length and from its initial/permanent track sideways displacing of said predetermined length part and mounting a temporary rail mounting while maintaining the track width and the connection of said length part at its longitudinal ends to the railway present in its initial/permanent track, such that work can be carried out to the railway, particularly the rail mounting, while the railway remains in service.

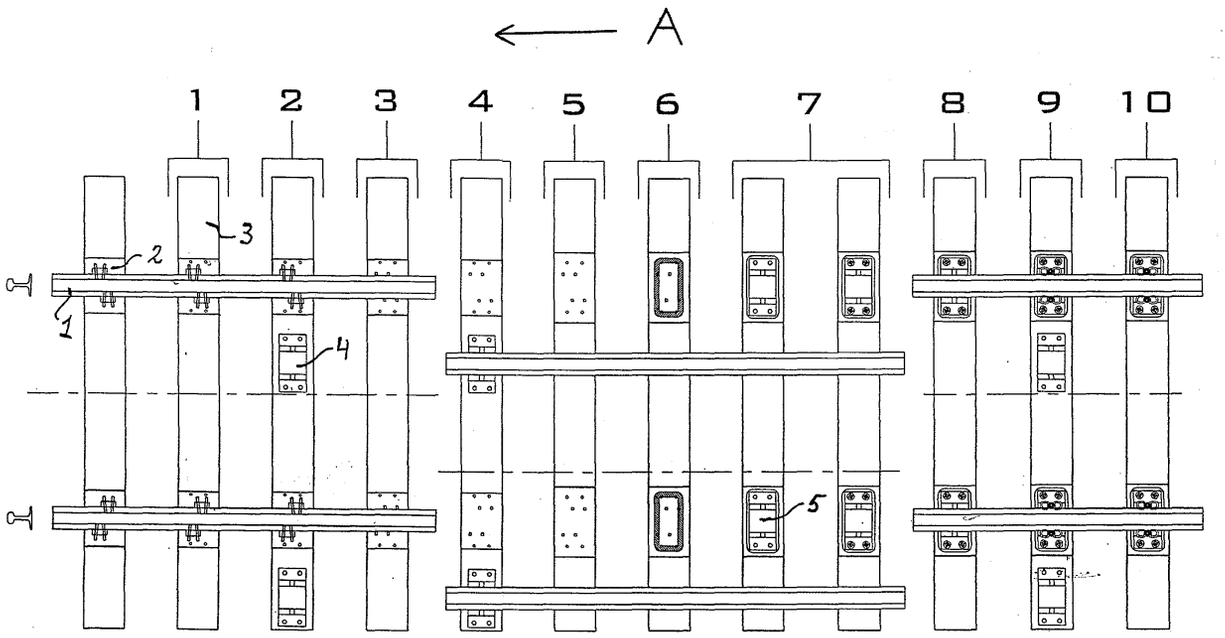


Fig 1

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Description

[0001] The invention is concerned with carrying out activities, particularly maintenance, to a railway track for transport of persons and/or goods, such as train, streetcar or subway. More particular, the invention is concerned with working on the rail mounting to its foundation, such as a sleeper.

[0002] One or more of the following aspects belong to the invention: releasing of the rail mounting over a predetermined length and from its initial/permanent track sideways displacing said predetermined length piece and mounting of a temporary rail fixation while maintaining the track width and maintaining the connection of said length part at its longitudinal ends to the railway in its initial/permanent track, wherein preferably said length part stepwise advances along the railway, such that work can be carried out to the rail mounting while the railway maintains in service; hydraulically or pneumatically advancing along the railway of an apparatus in that an actuator or element thereon is temporary connected to the railway at a fixed location and by shortening or elongating of the actuator the apparatus is advanced along the railway over the stroke length, whereafter the connection point is changed in the direction of advancement; hydraulically pulling an element, such as mounting means, from a sleeper, wherein preferably the pulling element engages and/or is located by a stop, cooperating with the front and back of said element, lengthwise of the railway; with an apparatus mounting of a new rail mounting or part thereof while in the mean time said apparatus advances along the railway; with the aid of a computer controlled robot arm picking up and/or placing at the desired location in the railway (e. g. onto a sleeper) positioning and/or mounting of a new rail mounting or part thereof; supplying with the aid of a conveyor at a frame advancing along the railway of a part (e.g. sloping backplate) mountable to the railway to a (preferably with the conveyor along the railway advancing) positioning or mounting apparatus; over the same track in a wagon train advancing behind the positioning or mounting apparatus of the supply of new rail mounting to be mounted; carrying out the work such that the equipment driving along the railway advances along the railway to which the work is carried out; a framedriving along the railway such that a person can carry out manual work to the rail and/or sleeper while sitting or lying in an ergonomically acceptable position.

[0003] The invention is further elaborated by way of a non-limiting embodiment, refering to the enclosed drawing, wherein fig. 1 and 2 show a top en side view, respectively, of the railway during different phases of the work. Fig. 2 covers succeeding pages.

[0004] Fig. 1 shows extremely to the left the initial situation, wherein the rails 1 are mounted to the sleeper 3 by rail clamps of the so called NEFIT-type 2. It will be appreciated that adjacent the illustrated railway there can be another railway for e.g. railway traffic from the oppisite direction.

[0005] In ten steps 1 to 10, the overhaul is carried out, wherein the Nefit-railclamps are replaced by a rail mounting of different type (e.g. Vossloh).

[0006] Fig. 2 shows for each step the corresponding equipment in side view, wherein said equipment advances along the railway at which the work is carried out.

[0007] In step 1 the sleeper 3 is pre-drilled for mounting the new rail mounting. In step 2 the temporary rail fixation plates 4 are provided at the sleeper 3. In step 3 the old rail mounting 2 is removed. In step 4 the rails are displaced to the side and with the plates 4 mounted at the correct track width. Thus the railway keeps available for train traffic while room is made for the required work to the sleepers to mount the new rail mounting. E.g. in this manner the railway is displaced over a length of 50 m, wherein the displaced rail parts connect to the not displaced rail parts through a curved part. In this curved part the rail deforms preferably merely elastic, such that afterwards it can be brought back to the initial shape without problems when the rails are brought back to their initial location.

[0008] In step 5 the mounting location for the new rail mounting is profiled, whereafter in step 6 preliminary work is carried out to mount the new rail mounting with glue. In step 7 the plates 5 for the new rail mounting are applied, wherein said plates are profiled according to the desired back slope. These plates 5 are mounted with glue and four bolts which are inserted in de holes drilled in step 1. In step 8 the rails are brought back to their initial position, whereafter in step 9 the rails are mounted to the plates 5 and in step 10 the plates 4 are removed.

[0009] It will be appreciated that the steps can be carried out in a different order, that steps can be eliminated, combined or added. E.g. step 1 can be carried out after step 5, or step 10 can be eliminated.

[0010] The automatic drill 6 used in step 1 (viz. fig. 2) is provided with a pneumatic propulsion, wherein a piston/cilinder unit temporary fixates to a part of the railway, e.g. sleeper, such that by extending/retracting the piston rod the drill 6 can advance over the stroke length. This propulsion is cheap, reliable, maintenance friendly, quick and accurate. The drilled holes finally determine the precise place of the new plates 5. The cilinder/piston unit can possibly be hydraulically actuated.

[0011] The dismantling unit 7 used in step 3 preferably acts hydraulic. Part thereof is a common rail/road digger, having a hydraulic motor of sufficient power and also provides for quick placing the unit 7 in and out the railway. The unit 7 has for each rail a set of hydraulic grippers 8 to grip the pins at both sides of the rail and pull them straigh up from the sleeper. At a short distance from the grippers 8 there is a running wheel 9 bearing on the rail and providing guidance and reaction forces. Grippers 8 and wheel 9 are mounted in a frame with mounting points for the universal coupling at the free end of the digger arm of the digging machine. Each pin has at its fron and back (according to the longitudinal

direction of the railway) an undercut wherein the gripper grips. For that the gripper has jaws that can be moved toward each other in longitudinal direction of the railway. One operates as follows: the unit 7 is rolled forward until a stop is obstructed by the next rail mounting to be removed. Then the unit 7 is automatically accurately positioned. Then the grippers are lowered, whereafter the jaws are moved towards each other, such that they engage the undercuts. Subsequently the grippers are pressed upward. Preferably the four grippers are substantially simultaneously actuated.

[0012] The procedure in step 5 is preferably flattening the top side of the sleeper 3 at the location where the new mounting of the rail 1 will be present. The new back slope will be provided with the correctly profiled new plates 5. With the flattening use can be made of a mill 10 with horizontal rotating axis and a width (dimension parallel to rotating axis) at least substantially equal to the width of the sleeper top side that should be processed for a new plate 5. E.g. the mill 10 is assembled from a plurality, e.g. at least 10 or 20 or 30 or 35 juxtapositioned so called "groove mills", i.e. approx. 1 cm rhick discs with at their circumference a plurality of bits, e.g. at least 5 or 8. Thus a more or less drum body is provided. The mill 10 can be set at a fixed level relative to the sleepers, such that the sleepers are automatically successively processed while advancing along the railway.

[0013] The device 11 for positioning and mounting of the new plates 5 in step 7 is preferably as follows: A frame riding along the railway has a conveyor belt 12 on which the plates 5 are placed side by side. The mounting bolts is placed in the pre-drilled holes in the plates 5. The belt 12 each time supplies a set plates 5 to a robot arm 13 mounted to the frame and provided with two screw drill heads with each four spindles, in line with the position of the mounting bolts in the plates 5. The robot arm 13 simultaneously grips two plates 5 and places them onto a sleeper. This is facilitated by making the holes drilled in step 1 "seeking" for the mounting bolts. The screw drill heads simultaneously span the eight bolts. Preferably the frame continuously advances at a preferably at least substantially constant speed during placing and mounting the plates 5 onto the sleeper 3, such that the screw drill heads move relative to the frame and stand still relative to the sleeper. For this the device 11 has preferably a control unit, such as computer, to control the robot arm. The robot arm is e.g. articulated. Maintaining a driving speed is beneficial with an embodiment wherein one or more supplies of plates 5 move with the frame, such as the lorries 14 of fig. 2. The device 11 plus supply of plates 5 can have a weight of 20 tons. 15 refers to a hoist to e.g. lift a tray with plates 5 from the lorry 14 and put it onto a working platform at the frame.

[0014] In step 9 use can e.g. be made of a frame 16, driving along the railway and having a support, e.g. chair, for a person which in that manner is positioned relatively close to the ground in a position convenient to manually position and/or manipulate a part.

[0015] In addition to the above the following: The drill 6 and/or unit 7 are preferably mounted such that they can swivel around an upright (vertical) shaft for correction of the position to a possibly tilted position of a sleeper. For that the drill 6 and/or unti 7 can be provided with a stop/sensor engaging the sleeper (e.g. its front or back, according to the longitudinal direction of the railway) such that when the drill 6 and/or unit 7 advances along the railway towards the next sleeper its attitude in the horizontal plane is automatically adapted to that of the sleeper. Further, the unit 7 can be made such that the reaction force from the grippers 8 generated during pulling of the pins is brought to the sub surface by the bearing surfaces bearing onto the top of the rail and sliding/advancing there along which, different from the line contact of the wheel 9, have a large contact surface with the rail, such that deformation generated by over stressing of the rail is avoided. E.g. the grippers 8 and bearing surfaces are therefor mounted to a sub frame, which is motoric/hydraulic liftable mounted to the frame to which the wheel 9 and the mounting points for the universal coupling are mounted. Thus the unit 7 is advanced along the rialway while the sub frame is lifted, bearing on the wheel 9, and the sub frame is lowered as soon as the pins are pulled out, wherein the bearing surfaces are resting on the rails. It will be appreciated that said bearing surfaces are immovable relative to the sub frame, while the grippers 8 can be lifted motoric/hydraulic relative to the sub frame.

[0016] Possibly the invention also covers computer controlled drilling into a sleeper with the aid of an automatic drilling machine.

[0017] Another aspect relates to making a hole pattern in the sleepers for mounting of new rail mounting means, wherein said pattern is preferably provided while the original rail mounting means are still in position. Most preferably said pattern is provided by a device driving along the railway, at least substantially simultaneously providing in a sleeper a hole pattern near each rail.

[0018] The drill 6 has a probe adapted to engage a convenient stop of a sleeper or an adhacent part, when the drill advances along the railway. If said stop and probe are engaged, corresponding detection means provide a signal on the basis of which the propulsion of the drill is stopped. Thus the drill is automatically brought in the correct position along the railway to provide the desired hole pattern. In an advantageous embodiment the probe is mounted to move up and down to be closely adjacent the rail and the drill cycles as follows: the probe is vertically lowered between two sleepers to be horizontally in line with the stop provided by the rail mounting means; the drill is advanced such that the probe nears the stop and finally contacts it followed by the drill coming to a stand still; the drive of the drill spindles is started and they are moved down to drill the holes; the

drill spindels and probe are lifted such that when the drill advances further the probe can pass the stop overhead; after passing the stop the probe is lowered, after which the cycle is repeated.

[0019] The wagons 14 can be constructed as follows: two carriages with each two running wheels to bear onto both rails; a frame that is loosely positioned on top of both carriages which are at a mutual distance in lengthwise direction of the track to keep the carriages in the desired position; a pallet, with pockets for the teeth of a forklifttruck, loosely positioned on top of the frame; a tray to contain the sloping back plates, loosely placed on top of the pallet. Thus a wagon 14 can easily be disassembled into relatively small parts by one or two persons to (as soon as the tray is empty) be manually lifted from the railway.

[0020] Fig. 3 shows in perspective an embodiment of the unit 7 showing the rails and sleepers 3. On both sides of each rail there is a gripper 8 with a fixed jaw 17 and a jaw 18 pivoting around a horizontal axis 19, perpendicular to the railway. An actuator is present between two grippers 8 with at its bottom end a foot (not shown) that is pressed down onto the rail head such that the grippers 8 pull the mounting upward. The grippers 8 are mounted to a cross beam 21 which (if the unit 7 is standing on the rails) can swivel in the horizontal plane around the central, vertical shaft pin 22. The king pin 22 is present in an elongated hole 23 and is biassed in the illustrated extreme position by springs 24 or such, such that the beam 21, and thus the grippers 8, can move back over the stroke length relative to the coupling plate 25. Thus over stressed situations can be avoided. The coupling plate 25 is vertically movably mounted to a frame driving along the rails, such that coupling plate 25, beam 21 and grippers 8 can move vertically as one while the mounting 2 is pulled out. While in fig. 2 it is shown that the rail/road digger is behind the unit 7, relative to the lengthwise direction of the railway, it is also feasible that said machine is in front of it, wherein preferably attachment of the unit 7 to the mast is at the back of the unit, such that the mast of said machine engages over the unit 7. Thus the operator has good sight onto the unit from its cabin.

[0021] Fig. 4 shows a possible embodiment to allow a person 26 to drive along the railway at a low level. The frame 16 driving along the railway is adapted such that the seats for the persons 26 can move upward, such that the seated level can be very low while switches, crossings and such elevations can be passed. In use the persons are partly below the top of the rails. Preferably the frame 16 offers seats for two persons next to each other (possibly mutually displaced in longitudinal direction of the railway), each close to a relevant rail and between the rails. Supply of parts is provided through e. g. a slide gutter 27, such that the persons 26 can remain seated.

[0022] It will be appreciated that the invention also covers embodiments, based on an embodiment as disclosed in here, wherefrom possibly one or more features/aspects have been removed and possibly combined with one or more other embodiments as disclosed in here, wherein from said one or more other embodiments also one or more features/aspects can be removed, wherein furthermore a feature/aspect can be replaced by the (functional) equivalent (e.g. hydraulic/pneumatic propulsion replaced by electic/linear motor).

Claims

1. Method to carry out work to a railway with the steps of disconnecting the rail mounting over a predetermined length and from its initial/permanent track sideways displacing of said predetermined length part and mounting a temporary rail mounting while maintaining the track width and the connection of said length part at its longitudinal ends to the railway present in its initial/permanent track, such that work can be carried out to the railway, particularly the rail mounting, while the railway remains in service.

2. Method according to claim 1, wherein said length part advances stepwise along the railway.

3. Method according to claim 1 or 2, wherein first the sleepers of the existing railway are pre-drilled, whereafter the temporary rail fixation plates (4) are applied onto the sleepers (3) whereafter the old rail mounting (2) is removed whereafter both rails (1) are displaced sideways to rest onto said plates (4) such that both longitudinal ends of the displaced rails connecting to the original railway are elastically deformed into an approximately S-shaped curved part, whereafter new permanent rail fixation plates (5) are mounted onto the sleepers using the in advance pre-drilled holes, whereafter the rails (1) are released from the plates (4) and placed onto the plates (5) to resume their initial track.

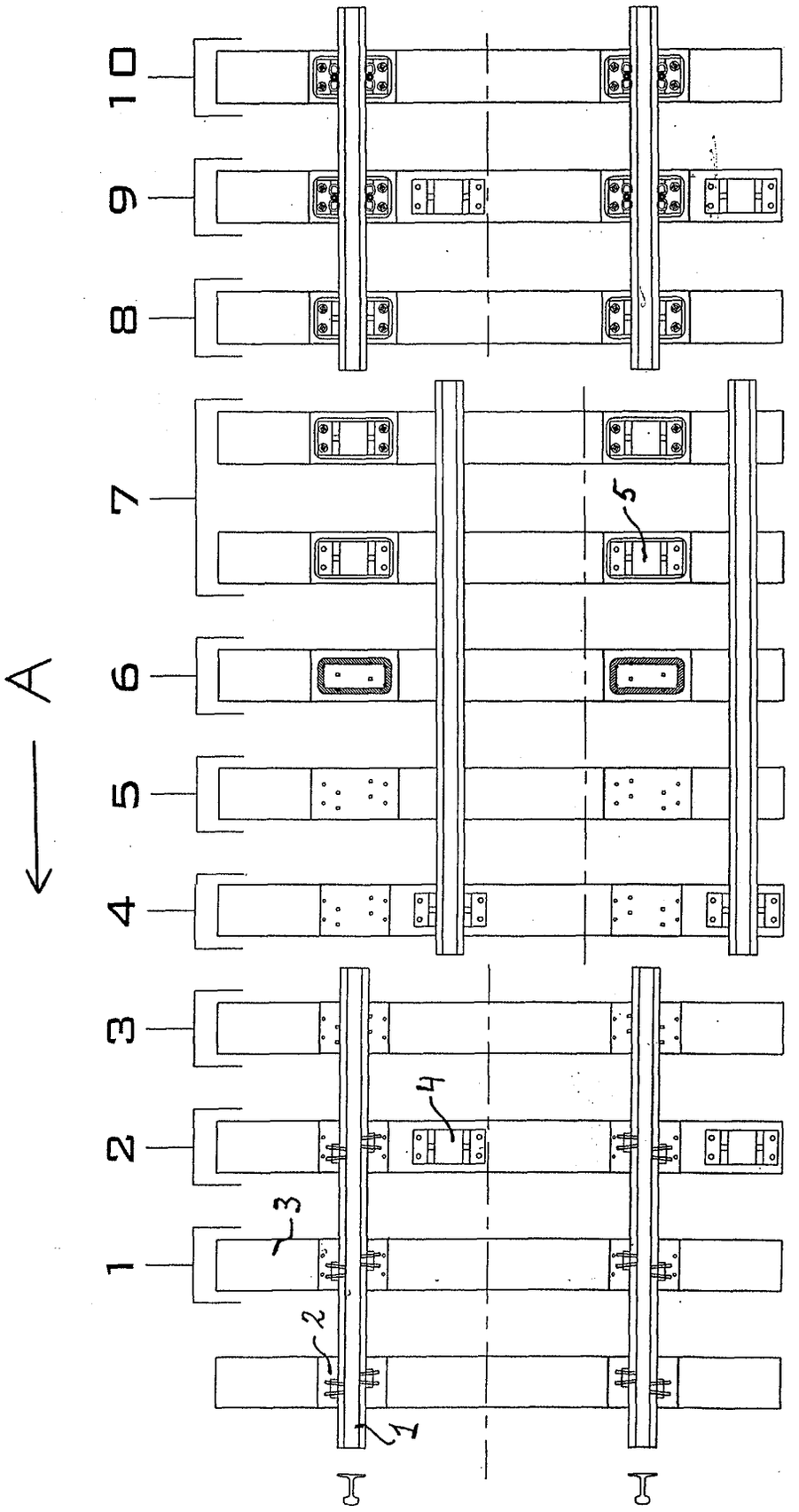


Fig 1

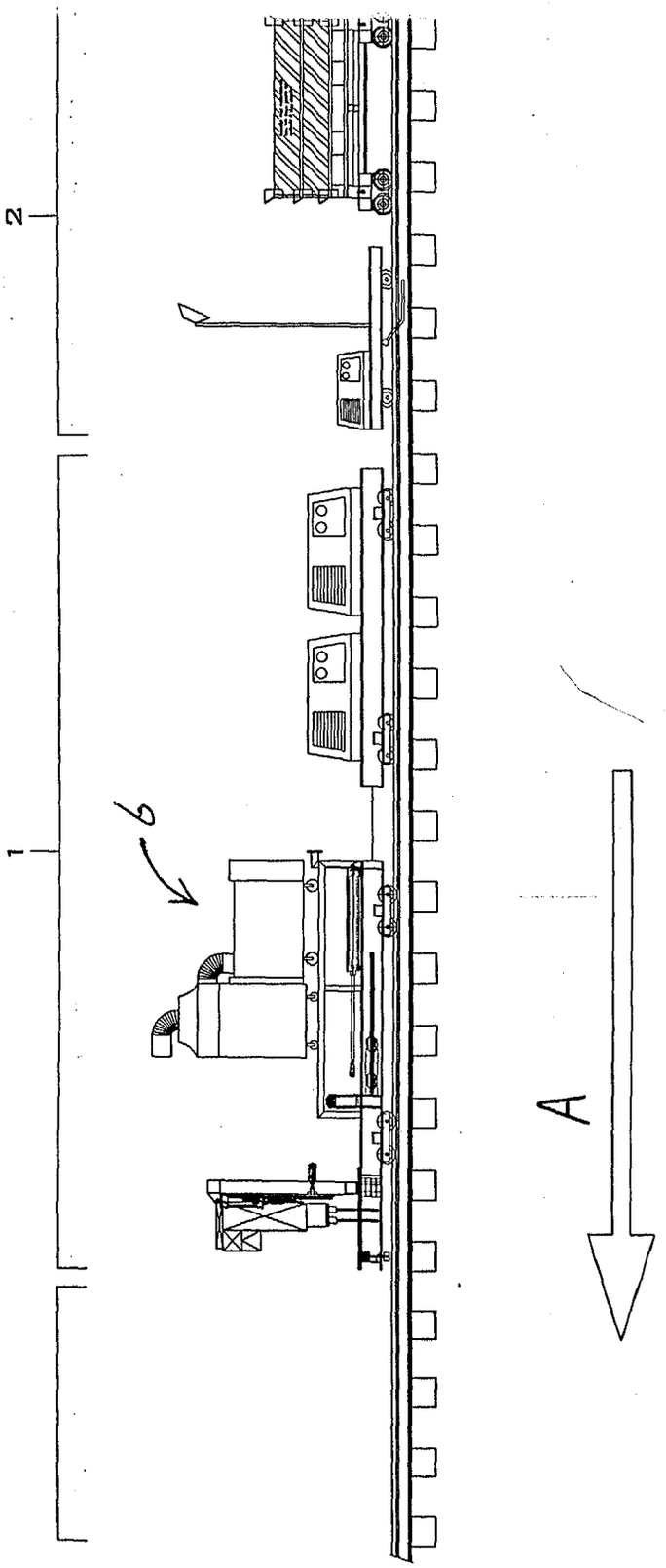


Fig 2a

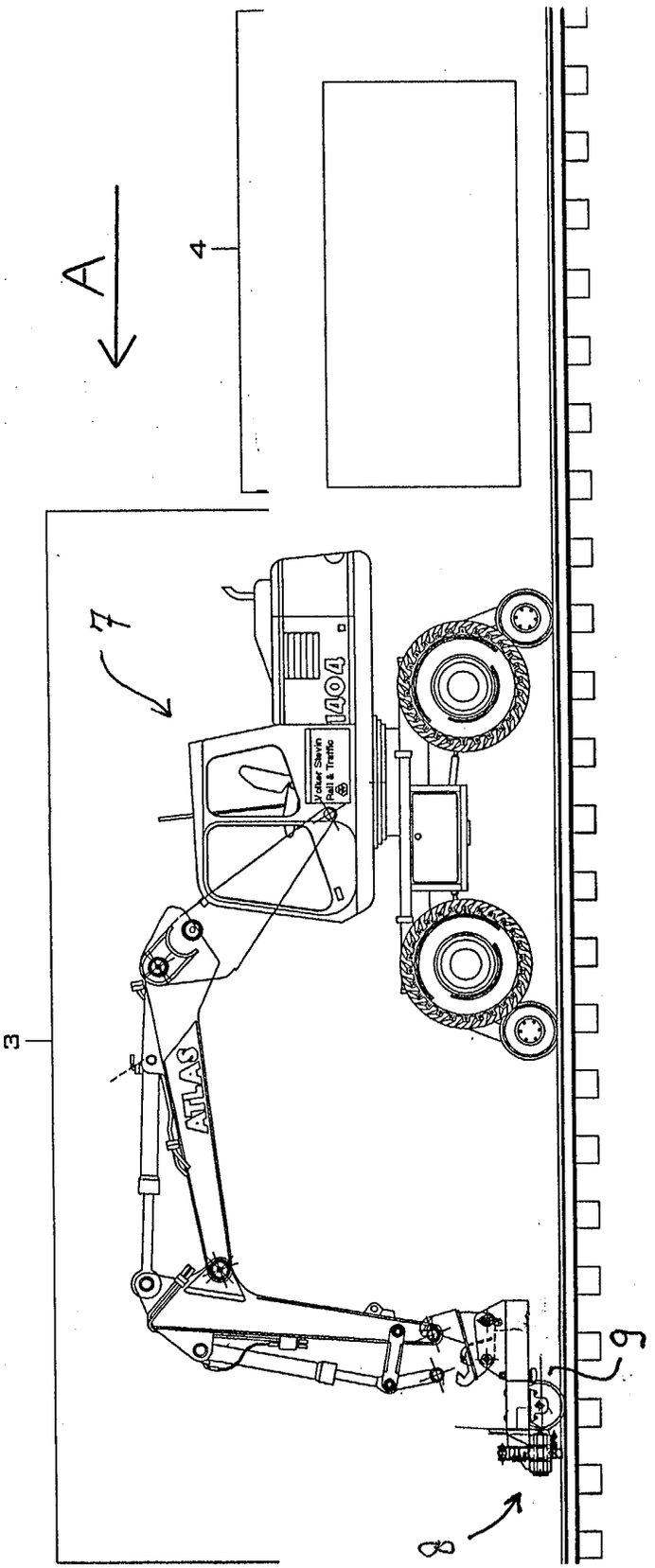


Fig 2b

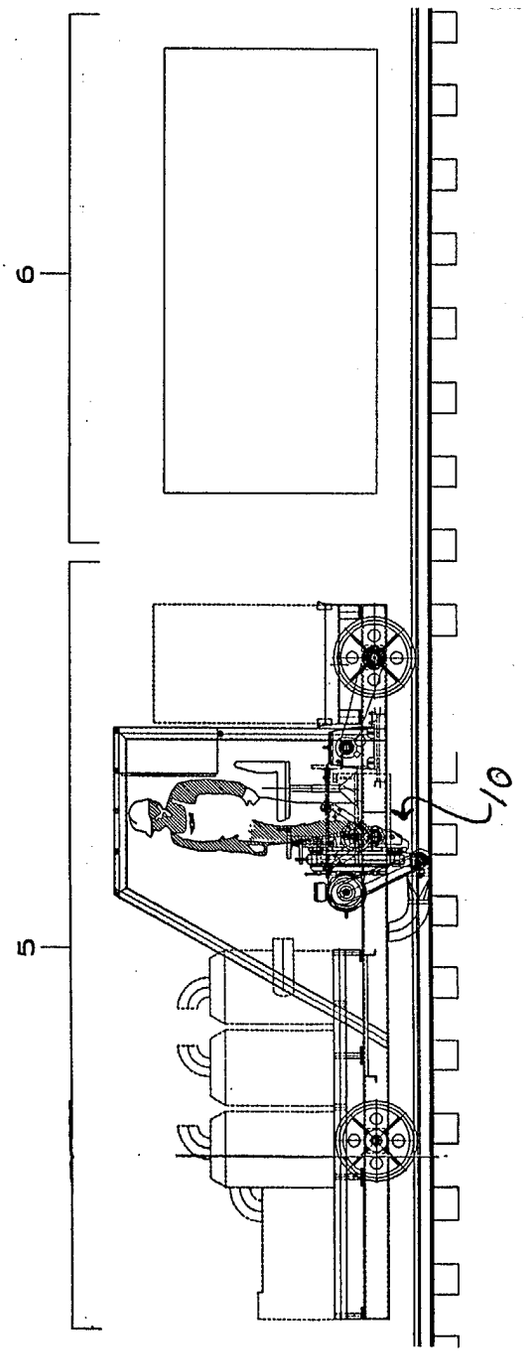


Fig 2c

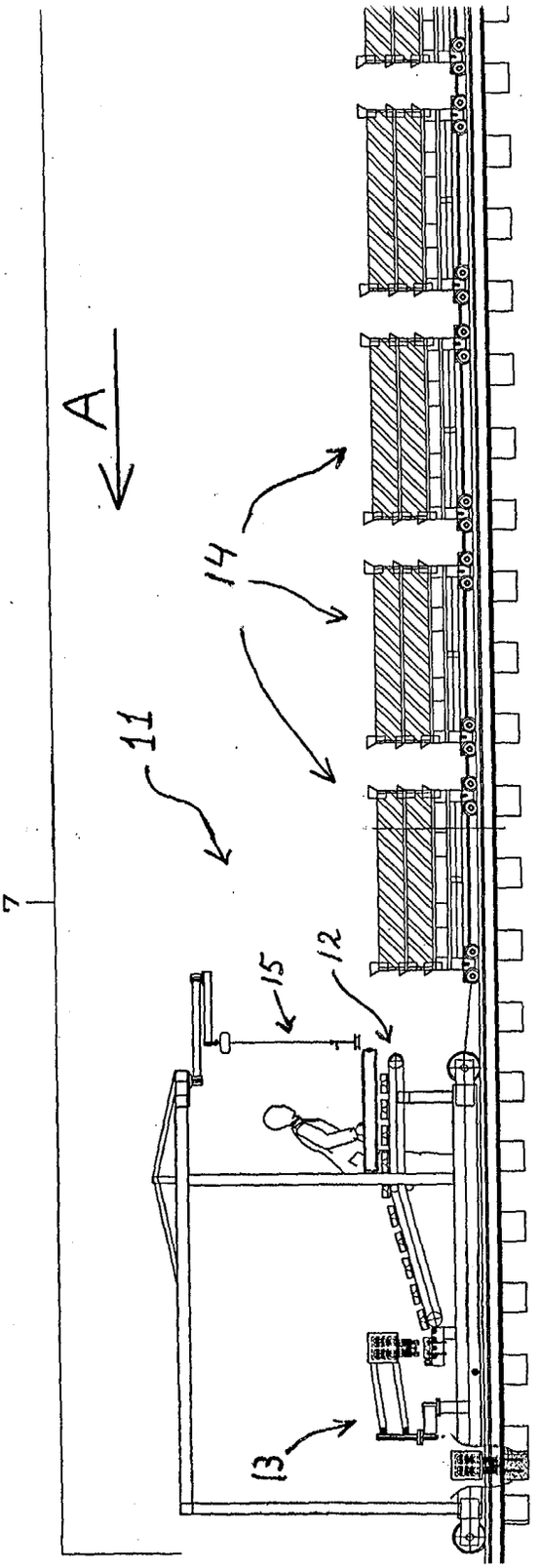


Fig 2d

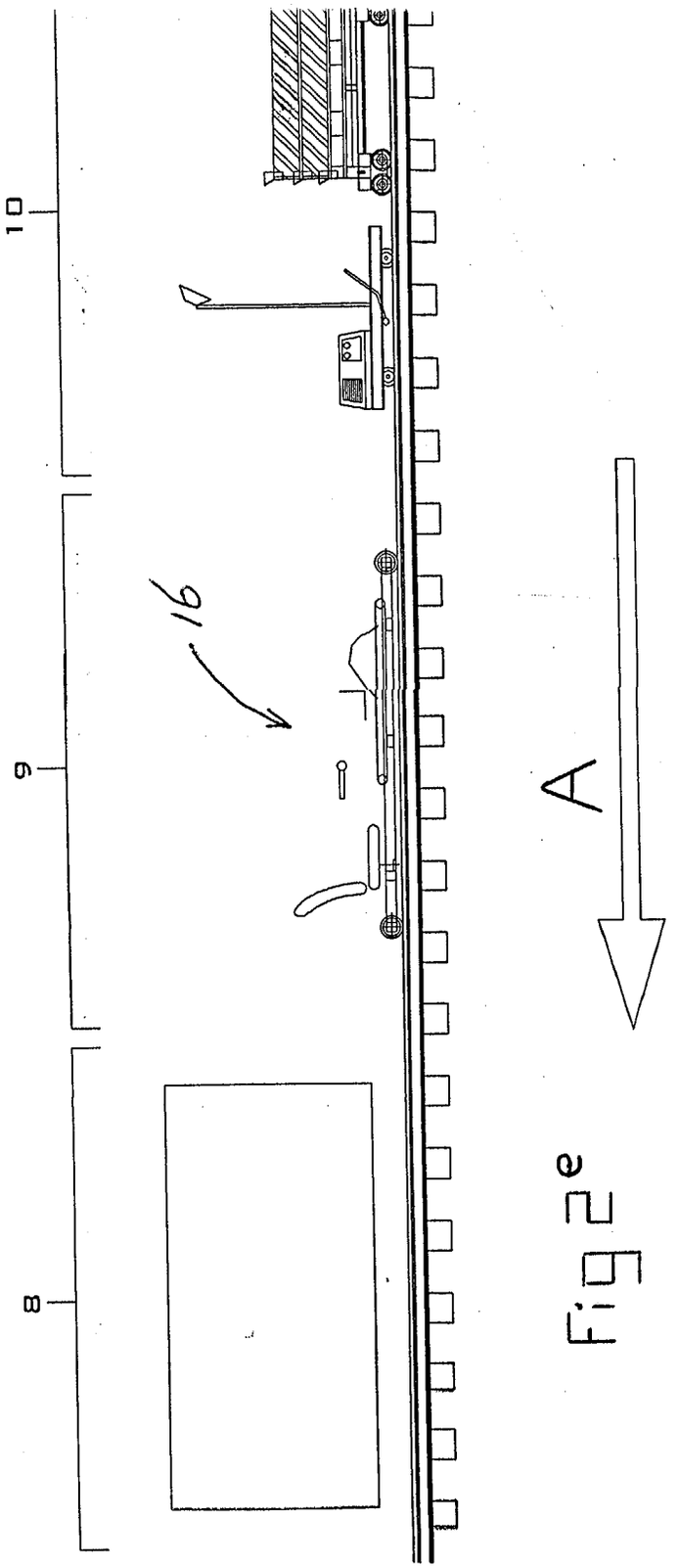


Fig 2e

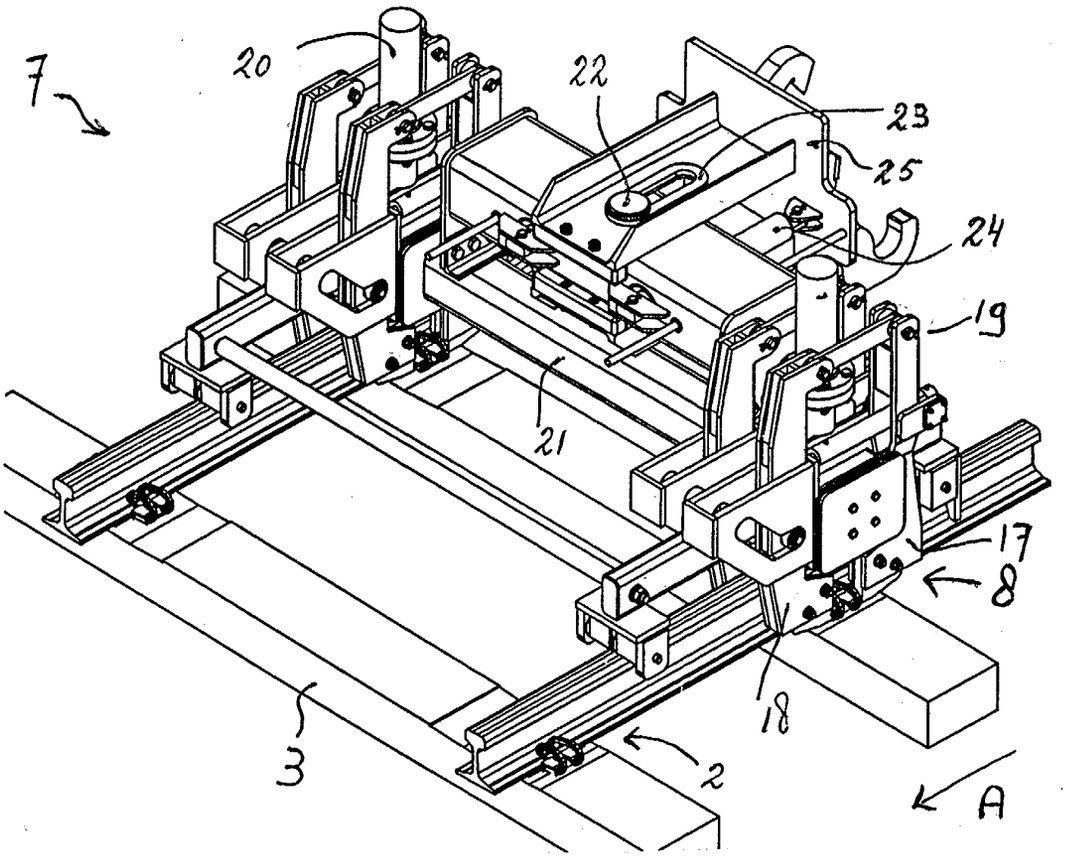


Fig 3

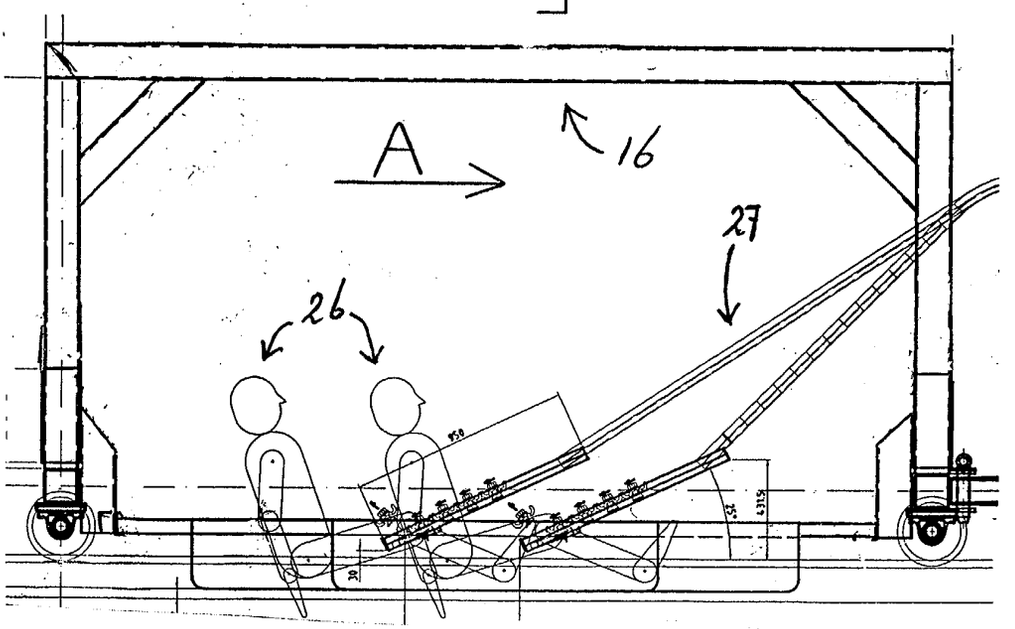


Fig 4

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EUROPEAN SEARCH REPORT

Application Number
EP 03 07 7770

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
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			TECHNICAL FIELDS SEARCHED (Int.Cl.7) E01B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	26 November 2003	Kergueno, J

CATEGORY OF CITED DOCUMENTS

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 03 07 7770

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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