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(54) **Equipment for connecting rails and movement of the rails, in particular during unloading from a transport truck**

(57) Equipment for connecting rails (2, 3) and movement of the rails (2, 3) during unloading from a transport truck (4), comprising a first coupling device (5) which engages a portion of a rail (2) and a second coupling device (6), constrained to the first coupling device via a connecting element (7), and configured such as to engage a portion of a further rail (3). The first coupling device (5) exhibits a guide system (50) comprising a seating (8) complementarily shaped to a transversal section of the rail (2) and configured such as to enable a sliding of the first coupling device (5) with respect to the rail (2). A blocking system (9) of the first coupling device (5) to the rail (2) is active exclusively when the first coupling device (5) is in proximity of a free end (2b) of the rail (2), enabling sliding of the first coupling device (5) on the rail (2) into the other relative coupling positions.

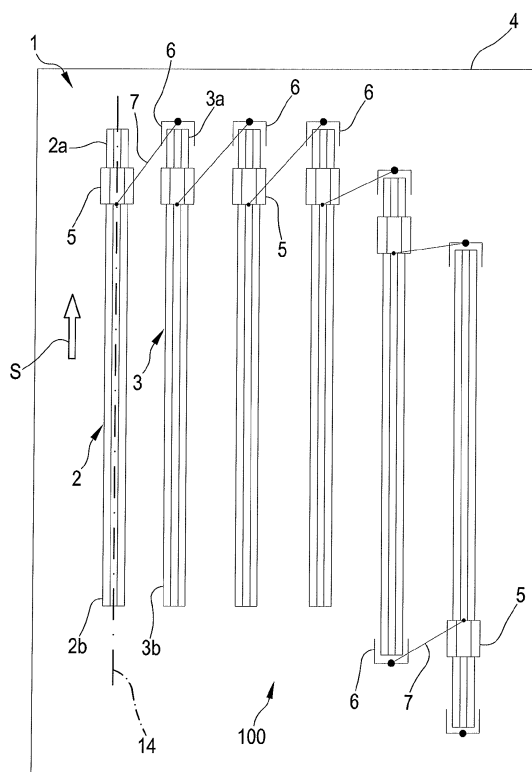


FIG.1A

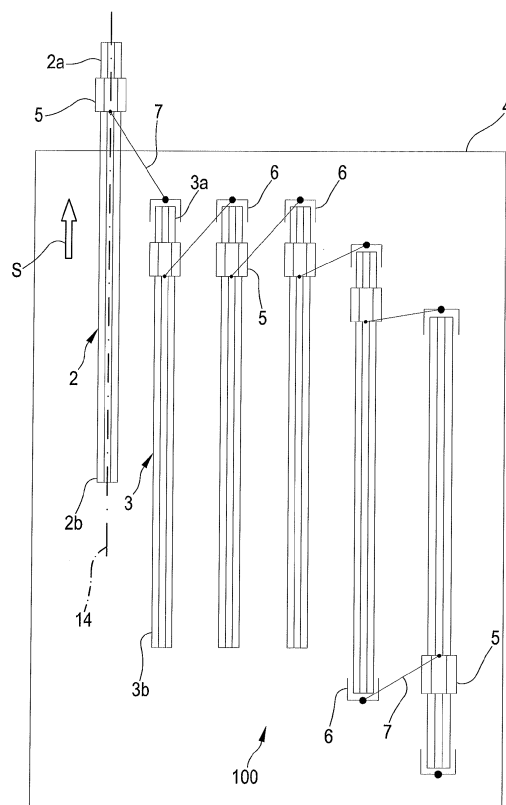


FIG. 1B

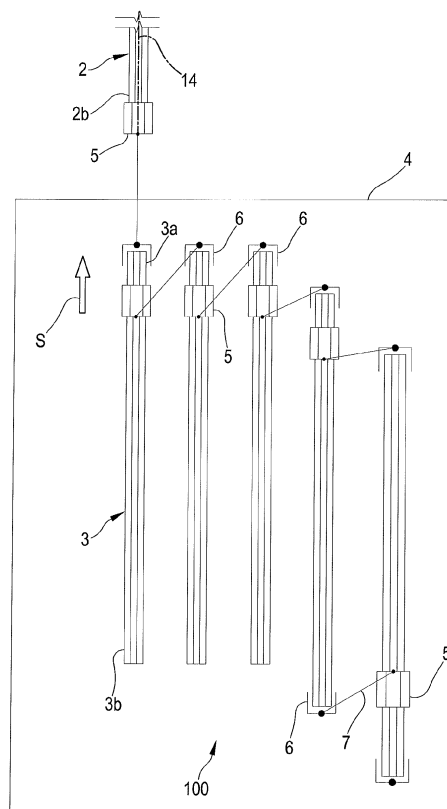


FIG. 1C

Description

[0001] The present description relates to equipment for connecting rails and movement of the rails during unloading thereof from a transport truck, in particular during operations of replacement of rails during normal maintenance of the rail or even during the step of laying new rails for realising a line.

BACKGROUND

[0002] During renewal operations of a railway line a plurality of rails is transported, which typically each exhibit a length of greater than 100 metres, using one or more transport trucks in which a plurality of rails are arranged parallel and flanked on a plurality of respective lie planes in a configuration such as to enable an unloading step which is as easy as possible for the subsequent laying operation in proximity of the work seating.

[0003] During the unloading, the two opposite end rails of the truck, for example of the highest row, are singly gripped using appropriate gripping pliers and are then drawn (for example with a winch) in advancement and projectingly externally of the truck.

[0004] Each rail, apart from being drawn using the respective pliers, is made to pass through a containing and guide organ, for example frame-shaped and exhibiting a predetermined number of rest and sliding rollers in order to enable a simpler and more precise unloading of the rail during the further movement thereof and the laying thereof on the ground.

[0005] Two projecting arms of the transport truck, which are also mobile with respect to the truck (at least according to a rotation axis arranged vertically in order to enable laying the gripped rail at lateral distances from the truck) support and enable laying of the front ends and therefore, progressively, the whole rail over the whole length thereof.

[0006] A "dated" example (less sophisticated than present-day machines but conceptually close) of the above-mentioned trucks is described in U.S. patent no. US 3635164.

[0007] Other types of transport and rail-laying trucks are described in European patents EP 1028194 and EP 1043448.

[0008] During the collecting operations of the rails and the laying operations flanking the bedding, with the aim of increasing productivity of the machine and laying a plurality of rails aligned and close to one another, during unloading the rear end of the rail is connected to the front end of the rail which is to be unloaded next, using pliers that are capable of gripping the ends and keeping them neared to one another during the movement steps.

[0009] A type of such pliers is shown in patent no. US 3552647 and is constituted by two specular elements connected centrally by appropriate blocking means such that two respective inclined opposite wings that converge towards the axis of symmetry can grip terminal portions

of the web of two respective consecutive rails.

[0010] The convergence of the wings is such that the gripping can guarantee sufficient grip and holding of the rails.

5 [0011] The unloading steps therefore comprise, for each flank of the truck, the first rail being moved up to when the rear end thereof is at the front end of the successive rail.

10 [0012] The unloading operation is stopped, a pliers is constrained to the rear end of the rail being unloaded and the other side of the pliers is constrained to the front portion of the rail to be unloaded immediately successively.

15 [0013] The pliers solution briefly described above is however very complex, especially during the step of setting-up, as it requires first of all the aligning of the rails and the blocking thereof with a controlled blocking step of the pliers.

20 [0014] Considering the masses, lengths and weights involved, the operation has to be performed/controlled by personnel, and therefore requires steps of human manipulation which are dangerous for personal safety and at the same time significantly slow down the laying operations of the rails.

25 [0015] In an attempt at least partially to obviate the above-described drawbacks, various types of blocking pliers have been developed to perform the above-described operations.

30 [0016] A first type according to US patent US 5295440 includes use of U-shaped elements provided with gripping rollers which are blocked to the rail by means of insertion of wedges coupled to U-shaped elements in an opposite direction to the advancement direction of the rail.

35 [0017] This type of solution requires human intervention and the type of blocking is not precisely repeatable, in the sense that the blocking force generated by the friction caused by the wedge is difficult to control and therefore is variable from blocking element to blocking element of the pliers.

40 [0018] Patent no. FR 2720084 discloses a further solution using offset wheels which enables an easier insertion of the terminal portion of the rail which is blocked on extraction thanks to the offset positions of the opposite wheels in the insertion seating of each of the two ends.

45 [0019] This solution facilitates the blocking operations of two successive rails but in any case leads to a necessary human intervention during the unloading step for engaging the rail to the pliers.

50 [0020] A more advanced solution disclosed in patent EP 1057933 comprises use of a pliers in which the blocking of each end of successive rails is obtained thanks to the cooperation of two opposite wheels slidable on inclined guides directed towards the axis of the wheel and maintained in the extracted position by suitable elastic elements.

55 [0021] During the inserting step the elastic elements are compressed, enabling introduction of the web of the rail.

[0022] During the drawing step the opposite release movement is prevented by the inclined profiles which prevent the wheels from rotating on the webs during the drawing step.

SUMMARY

[0023] The above-described technical solutions, though having enabled improvements both during the step of constraining successive rails, and in terms of holding and safety for operators, have however not substantially obviated all the previously-mentioned drawbacks.

[0024] Firstly the presence of operators is always necessary, not only during the step of supervising the unloading operations, but also during the step of constraining successive rails.

[0025] Every time a rail during the unloading step exhibits an end at the opposite end of the successive rail, the operator has to intervene to move the rails in such a way as to enable engagement thereof by the above-described pliers.

[0026] As mentioned above, this operation is dangerous and also slows down unloading operations, thus considerably reducing the productivity of the machine.

[0027] The aim of the embodiments described herein below is substantially to obviate the drawbacks encountered in the summarily-described prior art.

[0028] A first aim, according to some aspects of the description, is to enable a more rapid and easier unloading of the rails.

[0029] A further aim according to an aspect of the following description is to minimise human intervention, in particular when laying the rails.

[0030] A further aim according to some embodiments described is to provide an instrument that is simple and effective and which can associate a novel operating principle with excellent gripping during unloading.

[0031] In a first independent aspect of the invention, equipment is provided for connecting rails and movement of the rails, in particular during unloading from a transport truck, comprising: a first coupling device configured such as to engage a portion of a rail; a second coupling device configured such as to engage a portion of a further rail; and at least a connecting element suitable for constraining the first coupling device to the second coupling device; at least the first coupling device exhibits a guide system comprising for example a seating at least partially complementarily shaped to a transversal section of the rail, the guide system being configured such as to enable a sliding of the first coupling device with respect to the rail from an end to another end thereof, and further comprising a blocking system of the first coupling device to the rail, the system being active such as to block the first coupling device to the rail at least when the first coupling device is in proximity of a free end of the rail, the system enabling sliding of the first coupling device on the rail into the other relative coupling positions.

[0032] In a second aspect, in accordance with the pre-

ceding aspect, equipment is provided in which the seating is delimited, in transversal section, by at least and a second tract, opposite and facing one another, the first and the second tract being substantially parallel and the distance thereof being such as to enable receiving a rail, a base of the rail being able to face the first tract, a head of the rail being able to face the second tract.

[0033] In a third aspect according to any one of the preceding aspects, equipment is provided in which the seating of the first coupling device is a through-seating and is of such dimensions as to enable passage there-through of a rail.

[0034] In a fourth aspect according to any one of the preceding aspects, equipment is provided in which the first coupling device is configured for a prismatic coupling with the rail, with a sliding motion according to an axis of development of the rail.

[0035] In a fifth aspect according to any one of the preceding aspects, equipment is comprised in which the guide system comprises a predetermined number of coupling elements for rotating coupling, such as wheels, small wheels, rollers, castors, destined to abut respective portions of the rail such as to determine a sliding coupling between the first coupling device and the rail, in particular the guide system comprising, on at least one and optionally both flanks of the rail, two rotating coupling elements suitable for abutting against a foot of the rail and two rotating coupling elements suitable for abutting against a head of the rail.

[0036] In a sixth aspect, according to the preceding aspect, equipment is provided in which the rotating coupling elements exhibits parallel rotation axes, two rotating coupling elements abutting an upper portion of the foot and two rotating coupling elements abutting a lower portion of the head.

[0037] In a seventh aspect according to any one of the preceding aspects, equipment is comprised in which the blocking system comprises activating means for enabling activation of the blocking system at the free end of the rail and for maintaining the blocking system inactive during the sliding of the first coupling device along the rail, the activating means enabling activation of the blocking system automatically on reaching the free end of the rail.

[0038] In an eighth aspect, according to the preceding aspect, equipment is provided in which the activating means comprise at least a body, for example a roller, mobile at and along the rail (2) during relative motion between the first coupling device and the rail, the mobile body being maintained in a first inactive position of the blocking means by the rail, the activating means being configured, for example by force of gravity and/or by means of an elastic element, such as to displace into a working position of the blocking means at least when the first coupling element reaches the free end of the rail, the inactive position of the mobile body corresponding to the inactive condition of the blocking system, the working position of the mobile body corresponding to the active condition of the blocking system.

[0039] In a ninth aspect, according to the preceding aspect, equipment is provided in which the activating means comprise at least an arm bearing the mobile body and hinged to the first coupling device about an axis, the displacement from the inactive position to the working position of the mobile body corresponding to a rotation of the arm about the axis.

[0040] In a tenth aspect, according to the preceding aspect, equipment is provided in which each arm exhibits a seating suitable for receiving the respective command element, a rotation of the arm about the axis following the displacement from the inactive position to the working position of the mobile body moving the command element such as to configure the stop means from the rest condition to the working condition.

[0041] In an eleventh aspect, according to the preceding aspect, equipment is provided in which the command element is hinged to the first coupling device and rigidly constrained to the blocking body, a rotation of the arm about the axis following the displacement from the inactive position to the working position of the mobile body leading to a rotation of the command body of the blocking body with respect to the first coupling device, the blocking body abutting the web of the rail.

[0042] In a twelfth aspect, according to the preceding aspect, equipment is provided in which the blocking system comprises stop means for selectively blocking relative longitudinal sliding of the first coupling device with respect to the rail, the stop means being configurable between a rest condition in which the stop means enable sliding and a working condition in which the stop means prevent sliding, in particular the stop means being commanded by the activating means. In a thirteenth aspect according to the thirteenth and the eleventh aspect, equipment is provided in which the stop means comprise at least a pair of locking bodies such as bodies with a curved active profile or rollers, destined, in use conditions, to abut a web of the rail such as to prevent a sliding motion between the rail and the first coupling device, at least in an extraction direction of the rail from the coupling device, and comprise respective command elements for abutting the locking bodies to the web of the rail, the activating means being active on the command elements of the stop means in the inactive condition of the blocking system in order to enable relative sliding between the rail and the first coupling device and optionally being active in the active condition of the blocking system such as to prevent relative sliding.

[0043] In a fourteenth aspect, according to the preceding aspect, equipment is provided in which the connecting element comprises an abutting structure, the first coupling device exhibiting a stop wing destined to abut the abutting structure in the aligned configuration of the connecting element in order to prevent further rotating elements, the second coupling device exhibiting an abutting portion destined to abut the abutting structure in the aligned configuration of the connecting element in order to prevent further rotary movements.

[0044] In a fifteenth aspect according to any one of the preceding aspects, equipment is comprised in which the first coupling device comprises a support structure suitable for defining the seating, the support structure being defined by at least two parts, optionally distanceable from one another, for example hinged, such as to enable opening the seating and disengaging a rail contained in the seating.

[0045] In a sixteenth aspect according to any one of the preceding aspects, equipment is comprised in which the second coupling device comprises blocking means for generating a blocking force on the web of the rail, in particular the second coupling device being configured such as to selectively block the equipment to an end of the further rail.

[0046] In a seventeenth aspect according to any one of the preceding aspects, equipment is comprised in which the second coupling device comprises a first and a second wing that are interfaced, coupled to one another and longitudinally spaced such as to define a cavity between them which is suitable for receiving a web of the rail, the blocking means being associated to at least one of the wings such as to generate the blocking force on the web, the blocking means enabling an insertion of the web into the cavity according to a coupling direction and an insertion direction and generating the blocking force in a situation of extraction movement of the web in an extraction direction that is opposite the insertion direction along the coupling direction.

[0047] In an eighteenth aspect according to any one of the preceding aspects, equipment is comprised wherein the blocking means comprise at least one and in particular at least two blocking bodies having a curved profile and suitable for enabling an insertion of the web into the cavity in the coupling direction and insertion direction and generating the blocking force in an extracting movement direction of the web according to the extracting direction opposite the inserting direction.

[0048] In a nineteenth aspect according to any one of the preceding aspects, equipment is comprised in which the curved-profile bodies are mounted in such a way as to projectingly emerge towards an inside of the cavity, each body exhibiting a hinging to the wings.

[0049] In a twentieth aspect according to the seventeenth aspect, equipment is provided in which the second coupling device comprises guide seatings having an inclined wall with respect to the inserting axis of the cavity, the bodies being defined by wheels that are mobile in and guided by the seatings, the second coupling device comprising respective elastic elements suitable for positioning the bodies in a condition of maximum extraction, inserting the rail in the cavity opposing the elastic resistance of the elements and positioning the wheels in a condition of less extraction.

[0050] In a twenty-first aspect according to any one of the preceding aspects, equipment is comprised in which the connecting element is configurable between an inclined rest position with respect to the first and the second

coupling device and a working position in which it is aligned to the first and the second coupling device along a development direction of the equipment, the connecting element being for example hinged to the first and/or the second coupling device.

[0051] In a twenty-second aspect according to any one of the preceding aspects, equipment is comprised which includes a stop structure active in an aligned configuration of the connecting element such as to prevent a further rotary movement of the equipment once the aligned configuration has been reached, the stop structure intervening in particular automatically on reaching the aligned configuration.

[0052] In an independent twenty-third aspect of the invention, an apparatus is provided for connecting rails and movement thereof during unloading from a transport truck, comprising: a plurality of rails arranged substantially parallel to one another and flanked, borne by a truck; a predetermined number of sets of equipment for connecting rails and moving the rails of any of the preceding aspects, each set of equipment connecting a rail to an adjacent rail.

[0053] In a twenty-fourth aspect according to the preceding aspect, an equipment is provided in which at least an equipment connects a front portion of a rail to a front portion of an adjacent rail, the first blocking device in particular being constrained to the front portion of the rail to be unloaded, the second blocking device being constrained to the front portion of the adjacent rail, still more in particular the connecting element being in the rest position and the equipment being arranged in an inclined configuration.

[0054] In an independent twenty-fifth aspect of the invention, a method is provided for connecting rails and moving the rails, particularly during unloading from a transport truck, comprising steps of: constraining a first coupling device to a portion of a rail; constraining a second coupling device to a portion of a further rail, the first and second coupling devices being constrained to one another by means of a connecting element; and extracting the rail from the transport truck, the first coupling device sliding along the rail up to an end thereof and blocking the relative sliding at the end, a further extraction of the rail causing transmission of an extraction force, by means of the connecting element, to the second coupling device and to the further rail, the further rail also being drawn in extraction.

[0055] These and other aims besides will better emerge during the following description, and are substantially attained by equipment for connecting rails and movement thereof, particularly during unloading thereof from a transport truck.

[0056] Further characteristics and advantages will more fully emerge from the detailed description that follows of the equipment, provided purely by way of non-limiting example.

BRIEF DESCRIPTION OF THE DRAWINGS

[0057]

5 Figures 1A - 1C illustrate three successive steps of an unloading operation of rails from a transport truck using equipment according to what is described.

10 Figure 2 is a perspective view of equipment for connecting rails in a first working configuration.

Figure 3 is a transversal section of the equipment illustrated in figure 2.

15 Figure 4 illustrates a second according to a horizontal plane of the equipment of figure 2.

Figure 5 illustrates the second fixed coupling device as in figure 2.

20 Figure 6 illustrates the first coupling device of figure 2.

25 Figures 7-9 illustrate a perspective view and lateral views and views from above, partially transparent, of the equipment for the connecting of rails in a second working configuration.

30 Figures 10 and 11 are views from above by way of example of equipment for connecting rails.

Figure 12 is a schematic frontal view of the first coupling device.

35 Figure 13 is a second fixed coupling device configured such as to engage a portion of a rail.

40 Figures 14, 15 and 16 illustrate a second embodiment of a second coupling device configured such as to engage a portion of a further rail.

Figure 17 is a variant of the device of figure 2 in cross section.

45 Figure 18 is a possible loading sequence of the rails from a transport truck.

DETAILED DESCRIPTION

50 **[0058]** With reference to the accompanying drawings, 1 denotes in its entirety equipment for connecting rails and the moving them, particularly during unloading from a transport truck.

55 **[0059]** As can be seen from figure 1A, an arrangement of rails is represented in schematic form (of which only the first two have been numbered for simplicity of description) side by side and parallel to each other in a respective same lie plane in the transport configuration

by a railway truck 4 before the unloading operation, for example at the sides of the bedding.

[0060] In particular the rails 2, 3 can be flanked on the transport truck 4 and aligned to one another (see the first four tracks from the left of figure 1a) or even slightly staggered in the longitudinal direction when so required in particular because of the requirements of the equipment described in the following.

[0061] However, the precise transport configuration is substantially irrelevant for the purposes of this description.

[0062] Still with reference to figure 1A, it can be seen that in general the apparatus 1 for connecting adjacent rails (e.g. rails 2 and 3) firstly comprises a first coupling device 5, which is configured to engage a portion of a rail.

[0063] Observing the figures, it can be observed that the first coupling device 5 of each equipment is arranged substantially at a front end 2a of the rail 2.

[0064] The equipment further comprises a second coupling device 6 configured such as to engage a portion of a further adjacent rail 3.

[0065] In particular the second coupling device 6 is also coupled to a front portion 3a of the adjacent rail 3.

[0066] In general, before the moving operations of the rails 2, 3, the two coupling devices 5, 6 will be positioned substantially at the portions (front or rear) of the adjacent rails.

[0067] The two coupling devices 5, 6 are constrained together by at least one connecting element 7 which prevents distancing between them.

[0068] As can be seen once more in figures 1A to 1C, each pair of adjacent rails is constrained by means of one of the described sets of equipment.

[0069] In still other terms, each of the internal rails of the present configuration will exhibit the front end thereof with the second coupling device of an equipment constrained thereto and an immediately-adjacent portion with a first coupling device of the equipment of the next connecting equipment constrained thereto.

[0070] IN a comparison of the unloading steps illustrated schematically in sequence in figures 1A, 1B and 1C note that the first coupling device 5 is configured such as to enable unloading of the first rail 2 by allowing a relative sliding between the first coupling device 5 and the rail 2 during the unloading step (comparison of the configurations of 1A, 1B and 1C).

[0071] In other words, the first rail 2 is engaged using common winches or like structures (not shown) present on the transport carriage 4 and is transported in an unloading direction S illustrated in figure 1B.

[0072] During this phase, the first coupling device 5 substantially allows free movement of the rail 2 by relative sliding without generating substantial forces on the connecting element 7 and/or the second coupling device 6.

[0073] Observing figure 1C it can be seen how, once the first coupling device 5 has reached the rear end 2b of the rail 2 in the unloading phase, a blocking system 9 constrains the end 2b of the first rail 2 to the first coupling

device 5. In this condition the first coupling device 5 can no longer slide relative to the rail 2, but is rigidly constrained thereto.

[0074] The first coupling device 5, in turn, moves the connecting element 7, as better clarified in the following, which is in turn constrained to the second coupling device 6.

[0075] Once the connecting element 7 is in an aligned configuration along the unloading direction S, the second coupling device 6, which is rigidly connected to the end 3a of the adjacent rail 3, starts to drag the rail to unload it.

[0076] At this point both the first 2 and the second rail 3 advance along the unloading direction S and the second coupling device 6 of the adjacent equipment mounted on the second rail 3 begins to slide from the front portion 3a of the rail up to the rear portion 3b, exactly repeating the unloading steps described above.

[0077] Note also that figure 18 illustrates a further sequence that enables automated unloading and automatic and sequential arrangement of all the rails loaded on the three planes of the transport truck (the numbers in this figure indicate the sequence of unloading of the rails from one to eighteen for each side of the truck).

[0078] In particular, the first rail is unloaded from the upper floor of the truck to the left and the first rail to the right, independently such as to arrange them at the sides of the bedding; the dragging of the first rail in effect means the second rail is also drawn along after (as described above) and so on until the sixth rail (each side) is drawn.

[0079] At this point, the sixth and seventh rail will be connected via a like device (see figure 17, for example, described below) which following the unloading of the sixth rail enables the seventh to be drawn, which is positioned in the second floor of the transport truck.

[0080] The unloading sequence continues until the twelfth rail, which once extracted will drag the thirteenth track positioned on the last floor of the truck.

[0081] Unloading continues in this way until the eighteenth rail on each side has been unloaded, so that no further rail-connecting operations are necessary using the pliers during the unloading step.

[0082] With reference to the first coupling device 5, it is clear that substantially any configuration enabling a relative sliding of this element with respect to the rail 2 up to the rear end 2b, and then a constraint of the coupling device 5 itself to this end 2b, may be used for the purposes described herein above.

[0083] Figures 1 to 9 illustrate the equipment for the connection of rails according to a preferred embodiment; vice versa the further figures 10-16 totally schematically illustrate a number of possible alternative embodiments of the first and second coupling device which may be used in combination with or alternatively to those shown in figure 2.

[0084] Observing figures 2 and 3 it can be seen how the first coupling device 5 is first provided with a suitable guide system 50 which enables the first coupling device 5 to make a rectilinear translational movement in relation

to the rail 2 along a direction coinciding with the development axis 14 of the rail itself.

[0085] In this regard, the guidance system 50 has a predetermined number of rotating coupling elements 51, in the specific embodiment, defined by suitable rollers shaped such as to marry with the relevant surfaces of the rail to which they have to couple.

[0086] Obviously, alternatively to wheels, rollers can be used, or rollers or wheels having other shapes or natures, also coupled to the rail differently from what is illustrated in the accompanying figures.

[0087] In detail, the rotating coupling members 51 are configured and suitable for abutting to respective portions of the rail such as to determine the sliding coupling between the first sliding device 5 and the rail 2.

[0088] In detail, at least one side, but in reality both sides of the rail 2, each receive two rotating coupling elements 51 active and abutted to an upper surface of the foot 12 such as to roll thereon, and two corresponding rotating coupling elements 51 abutted to a lower surface of the head 13 as shown in the figure.

[0089] In an entirely non-limiting way, the upper wheels 51 will have a larger diameter than the lower wheels 51 (see figure 3).

[0090] This particular configuration enables the upper wheels 51 to be contained within the vertical dimensions of the head 13, and the wheels 51 which roll on the foot 12, being of smaller diameter, mean that the overall dimensions of the equipment can be very modest.

[0091] Obviously, these coupling elements 51 are mounted by idle rotation on the structure of the first coupling device 5, but in more complex embodiments there might be braked and/or motorised. Still observing the embodiment of figure 3, note that the guidance system 50 also includes a seating 8 at least partially complementarily profiled to the cross-section of the rail 2. The seating allows the sliding of the first coupling device 5 relative to the rail 2 from one end to the other end 2b of the same.

[0092] Moreover, the seating 8 is delimited in cross-section by at least a first and a second portion 10, 11 opposite to and facing each other, which are substantially parallel and their reciprocal distance being such as to receive the rail.

[0093] In particular, the base 12 of the rail faces the first section 10 while the head 13 of the rail faces the second section 11.

[0094] The first coupling device 5 is also constituted by a support structure 26 which defines the said seating 8 and which is constituted by at least two parts 26a and 26b in which, the first, superiorly located, has an inverted U-shape section and is destined intended to be keyed at the head 13 and the web 18 of the rail 2, while the second 26b, the lower, is also constituted by a portion of upwards-facing U-shaped sheet metal intended to receive the aforementioned foot 12 and therefore to exhibit a larger seating.

[0095] The constraining means joining the portions 26a and 26b are located at the superposing part of the

free sides of the U-shaped portion of the part 26a and the part 26b.

[0096] By way of example, the constraints can be located at the support axis of the lower wheels 51 sliding on the foot 12 of the rail.

[0097] The equipment illustrated in figure 2 also includes a blocking system 9 of the first coupling 5 to the rail, which blocks the device 5 itself to the rail when it is in proximity of a free end 2a, 2b of the rail.

[0098] In other positions of the device 5 on the rail the blocking system 9 enables a free relative movement.

[0099] The blocking system 9 as a whole is constituted by stop means 21 and the activation means 15 described below.

[0100] In particular the stop means 21 clearly visible in figure 4 and in figure 9 are suitable for selectively blocking the relative longitudinal sliding of the first coupling device 5 with respect to the rail 2.

[0101] In other words the stop means 21 are configurable between a rest condition (figure 4) in which they enable the sliding and a working condition (figure 9) in which the stop means prevent the sliding and are controlled by the activating means 15.

[0102] The stop means 21 comprise at least a pair of clamping bodies 22, 23 which bodies exhibit a curved active profile, destined in use to abut the web of the rail 18, such as to prevent the sliding motion between the rail and the first the coupling device 5 at least in the extraction direction E of the rail from the coupling device (figure 4).

[0103] Also the above-mentioned stop means also comprise respective control elements 24, 25 that are capable, by moving, of abutting the blocking bodies 22, 23 on the web of the rail.

[0104] The specific embodiment clearly visible in figure 4 shows the blocking bodies 22, 23 rigidly connected to said control elements 24, 25 and the entire structure of the stop means hinged to the first coupling device 5 and in particular, by the interposing of an appropriate block, to the upper portion 26a of the support structure 26.

[0105] In particular a rotary movement of the stop means about the respective axis of rotation nears the blocking bodies 22, 23 (or distances them depending on the rotation direction) from the web of the rail 18.

[0106] In the configuration of figure 4 the blocking bodies 22, 23 are kept away from the web 18 and therefore the first coupling device 5 slides freely on the rail 2.

[0107] Conversely, in the condition illustrated in figure 9 the blocking bodies 22, 23 are abutted to the web 18 and an extraction movement according to arrow E of figure 9 is prevented.

[0108] As mentioned the activating means 15 are active on the control elements 24, 25 of the stop means 21 in the inactive condition of the locking system such as to allow relative sliding between the rail 2 and the first coupling device 5, and are active in the active condition of the system locking means to prevent relative sliding.

[0109] Furthermore, the activation means 15 exhibit at least one and in general a pair of bodies 16, 17 mobile

at and along the rail 2 during the relative motion between the first coupling device 5 and the rail 2.

[0110] The mobile bodies 16, 17 are maintained in a first position of inactivity of the blocking means, from the rail and are configured, for example by gravity (or alternatively by means of an elastic element) to move into a working position of the blocking means at least when the first coupling device 5 reaches the free end of the rail 2b.

[0111] Looking at figure 2, it can be seen that the mobile body 16 is defined by a wheel predisposed to roll on the upper surface of the foot 12 of the rail 2.

[0112] The wheel 16 is pivoted and free to move in rotation at an arm 52 in turn hinged to the first coupling device about an axis 54 offset with respect to the coupling axis to the mobile body 16. When the first coupling device 5 reaches the terminal end 2b of the rail 2 (figure 7) the mobile body 16 descends from the base 12 of the rail and there is a contemporary relative rotation of the whole arm 52 about the rotation axis 54.

[0113] In particular, this movement is guaranteed by the force of gravity and by the weight of the arm and the wheel.

[0114] A specular and symmetrical structure is present on the other side of the rail mounted on the first coupling device 5.

[0115] The above-mentioned arm 52 has a respective seating 55, in general slotted, which receives the control element 24.

[0116] The displacement from the position of inactivity in the working position of the movable body 16 corresponds to a rotation of the arm 52 about the axis 54 and this rotation consequently moves the seating 55 inside which the control element 24 is engaged.

[0117] The command element 24 is thus moved, generating a rotation of the stop means 21 about the respective hinge axis vertical to the structure 26.

[0118] In particular, a downwards rotation of the arm 52 (i.e. the descent of the wheel 16 from the base 12 of the rail 2) entails a displacement of the stop means 21, and in particular of the blocking bodies 22, 23 from the rest condition to the working condition, or from a condition in which there is relative sliding movement to a blocking position (compare figures 4 and 9).

[0119] Obviously the structure and movements described above are absolutely symmetrical with reference to the left and right of the situation in figures 4 and 9.

[0120] Observing figures 10-12, provided purely as an indication of a further possible embodiment, it can be seen that the first coupling 5 exhibits a seating 8, at least partially complementarily-shaped, of a cross section of the rail 2, but having a different conformation to what is illustrated in figure 3.

[0121] The seating 8 of the embodiment enables the said relative sliding between the first coupling device 5 and the rail 2 at least from one end 2a to the other end 2b.

[0122] The seating 8 is delimited in cross-section by at least a first and a second portion 10, 11, opposite and facing one another in such a way as to be able to receive

respectively a base 12 of the rail and a head 13 of the rail, which will therefore abut on the first portion 10 and on the second portion 11 parallel to one another.

[0123] In general, the seating 8 of the first coupling device 5 is a through-seating (with a closed perimeter so as to define a resistant section) defined by a rigid box-like structure (in the embodiment illustrated in figure 12 with trapezoidal inclined sides 42, 43) which has a depth (in the sense of the development of the rail to which it is coupled) sufficient to maintain optimum sliding guidance during the movement steps.

[0124] In still other terms, the seating 8 of the first coupling device 5 is also in this case a through-seating defining a space that will allow the complete through-passage of a rail.

[0125] Where appropriate and should it be necessary, the first and the second portion 10, 11 may be each provided with one or more sliding rollers 41 in order to facilitate the guiding and sliding operations while guaranteeing a lower degree of friction.

[0126] In fact, the constraint achieved between the coupling device 5 and the rail 2 is, in all the embodiments, a prismatic constraint with sliding along an axis of development 14 of the rail, as the first coupling device 5 cannot distance from the development axis 14 of the rail 2 itself, nor can it rotate with respect to the axis of development (if not due to the play and tolerance necessary to prevent jamming during handling).

[0127] Obviously in this further embodiment the first coupling device 5 will also be equipped with a blocking system 9 which must be active in order to block the first device 5 to the rail 2 only when the first coupling device 5 is in proximity of a free end 2a, 2b of the rail (figure 11).

[0128] In all other positions of relative coupling the system 9 is not active and therefore allows the above-mentioned sliding (figure 10).

[0129] In this regard the further configurations of the blocking system may be of various types. In its simplest configuration (not shown), once the first coupling device 5 has reached the end 2b of the rail a manual intervention is required to block the coupling device 5 constituted for example by two or more joinable opposite jaws, for example by means of screws, clamps or another manually-activated block.

[0130] Obviously, the above solution requires intervention by personnel and is therefore not the most advantageous one.

[0131] In fact, in general, the blocking system 9 shown in figures 10-12 also includes activation means 15 capable of enabling the above-mentioned activation of the blocking system at the free end 2b of the rail, while maintaining the blocking system 9 itself inactive during the sliding along the central portions of the rail 2.

[0132] In particular, the activation means 15 enable activation of the blocking system 9 automatically on reaching the free end 2b of the rail 2 (figure 11).

[0133] In the specific embodiment the activation means 15 comprise a pair of bodies 16, 17 (e.g. defined

by a predetermined number of rollers) mobile at and along the web 18 of the rail itself during the relative movement steps between the first device coupling 5 and the rail 2.

[0134] In particular, the mobile bodies 16, 17 are maintained spaced apart by the thickness of the web 18 (figure 10) and in this configuration allow free relative sliding movement, i.e. they maintain the blocking system 9 inactive at a predetermined distance "d" from the portion of the rail (in the figures the web 18) where they will then be active in blocking.

[0135] The activating means 15, if constrained to the walls 10, 11, 42, 43 of the box-shaped body defining the abovementioned seat 8, will also include a corresponding pair of control elements 19, 20 which in the specific case will be elastic elements each active on a mobile body 16, 17 with the aim of generating nearing thrust forces between the mobile bodies 16, 17.

[0136] If as shown in the further embodiment, the mobile bodies 16, 17 were directly engaged to the blocking system 9, the elastic elements thereof might be used to cause the nearing of the bodies 16, 17.

[0137] As long as the mobile bodies 16, 17 are abutted to the web 18, the forces generated by the elastic elements 19, 20 (or by the blocking system 9) are not able to near the mobile bodies 16, 17 further.

[0138] However, when the first coupling device 5 reaches the end 2b of the rail, the mobile bodies 16, 17 reach the end zone of the web, and then disengage therefrom.

[0139] Consequently, the elastic elements 19, 20 (or the blocking system 9) may intervene by nearing the mobile bodies 16, 17 between them, in the direction of the arrows 44 of figure 11.

[0140] The neared position of the mobile bodies 16, 17 (in reciprocal contact, for example) corresponds to the active condition of the blocking system 9, which at this point intervenes by slidingly blocking the first coupling device 5 to the rear end 2b of the rail.

[0141] In this regard the blocking system 9 comprises the above-mentioned stop means 21 for selectively blocking the relative longitudinal sliding of the first coupling device 5 with respect to the rail 2.

[0142] The stop means 21, as mentioned above, are configurable between a rest condition where sliding is enabled (figure 10) and a working condition (figure 11) where sliding is prevented. The stop means 21 are controlled by the activation means 15 described above.

[0143] In detail, the stop means 21 comprise at least a pair of blocking bodies 22, 23 such as for example a pair of rollers destined, in use conditions, to abut the web 18 of the rail, preventing a sliding mode between the rail 2 and the first coupling device 5 at least in an extraction direction E of the end 2b of the rail 2 from the coupling device 5.

[0144] The stop means 21 also comprise at least one or two respective elastic elements 24, 25 that can abut the blocking bodies 22, 23 for example to the web 18 of

the rail 2 to be blocked (figure 11). The activation means 15 in fact oppose the action of the elastic element or elements 24, 25 of the stop means 21 in the inactive condition of the blocking system (i.e. when the mobile bodies 16, 17 are spaced from each other) and therefore allow the relative sliding of the rail 2 with respect to the first coupling device 5.

[0145] The mobile bodies 16, 17 reach the end of their sliding along the web 18 and are then approached by the respective elastic elements 19, 20; the activating means 15 enable the respective elastic elements 24, 25 of the stop means to intervene on the blocking bodies 22, 23 which, in turn, abut on the web 18 of the rail (figure 11) relatively blocking the first coupling device 5 and the rail 2.

[0146] Note also as the first coupling device 5 in accordance with the further embodiment includes a support structure 26 destined to define the abovementioned seating 8.

[0147] The support structure 26 of figure 12 will be defined by at least two parts 26a, 26b distanceable from each other (for example, they might be hinged or constrained by screws) to enable the opening of the seating 8 and the disengagement of a rail contained in the seating.

[0148] This operation should generally be performed every time the equipment is to be removed from an unloaded rail.

[0149] Turning now to consider the second coupling device 6, note that the second coupling device 6 comprises blocking means 30 for generating a stop force on the web 18 of the adjacent rail 3.

[0150] In particular, the coupling device 6 is configured to block at an end 3a of the further rail 3.

[0151] In general the second coupling device 6 cannot enable relative sliding between the adjacent rail 3 and the equipment itself (if not during the step of initial insertion of the web 18 in the seating), generating only a solid constraint between equipment and rail once assembled.

[0152] In certain specific embodiments the second coupling device can comprise a first and a second wing 27, 28 interfaced and coupled together in such a way as to be spaced longitudinally defining a cavity 29 between them having an opening of such dimensions as to be able to receive a web 18 of the adjacent rail 3 (figures 4, 5, 13, 14a, 14b, 14c).

[0153] The blocking means 30 are associated with at least one of the wings 27, 28 and in general to both in order to generate the blocking force on the web 18 itself.

[0154] From the functional point of view the blocking means 30 enable an insertion of the web 18 in the cavity 29 in a coupling direction 33 and an insertion direction I, and generate the blocking force in situations of extraction movement of the web 18 in an extraction direction E opposite the insertion direction in the same coupling direction 33.

[0155] In that regard, the blocking means 30 can comprise at least one and in particular at least two curved-profile blocking bodies 31, 32 which will enable insertion

of the web 18 in the cavity in the above-mentioned coupling direction in the insertion direction I and generate a blocking force in an extraction movement situation of the web 18 in the extraction direction and opposite the insertion direction of I.

[0156] In particular figure 5 illustrates the preferred embodiment of the second blocking device 6.

[0157] As can be observed, the curved-profile blocking bodies 31, 32 each have two curved surfaces, one upper and one lower, and contact with the web 18 of the rail 3.

[0158] Once the initial portion 3a of the rail has been inserted and the curved-profile bodies 31, 32 have been brought into contact with the respective web, it is substantially impossible to extract the rail, unless by intervening manually on the pins which emerge from the curved-profile bodies such as to bring them into an inactive condition (i.e. distance the curved-profile bodies 31, 32 of the web 18) and manually extract the second coupling device 6 from the rail 3.

[0159] As an alternative, to enable unblocking an axis of rotation can be defined between a wing and the other wing, blocking this degree of freedom in use with, for example an extractable locking pin in a release situation of the rail to open the two wings in reciprocal rotation.

[0160] In the embodiment shown in figure 13, the wheels 31, 32 are mounted such as to projectingly emerge internally of the cavity 29 and each exhibits a hinging 34 to the respective wing 27, 28 that is offset (by a distance "e" with respect to the centre of symmetry 35 of the wheel).

[0161] The offset positioning of the axis of rotation in a position close to the area of insertion of the rail with respect to the centre of symmetry means that during extraction the off-centre position blocks the relative sliding movement between the equipment and the rail.

[0162] Note that the embodiment described above may in principle also be used to define the blocking device 9 previously described and illustrated in figures 2, 7 and also 10-12.

[0163] In an alternative embodiment the coupling device can comprise the same respective guide seatings 36, 37 having inclined walls to the inserting axis of the cavity 29.

[0164] In this case the wheels 31, 32 are mobile by sliding in said seatings 36, 37 in the inclined direction.

[0165] In particular two further guides may be present (for example, grooves 45) suitable for defining the minimum and maximum run of the wheels along the guide seatings 36, 37 inside the cavity 29.

[0166] Elastic elements 38, 39 are present, active between the wings 27, 28 of the second coupling device and the respective wheel 31, 32, such as to position them in a condition of maximum extraction.

[0167] The insertion of the rail 3 in the cavity 29 opposes the elastic resistance of the element 38, 39 and pushes the wheels 31, 32 in a condition of lesser extraction.

[0168] A movement of the rail in the opposite direction

is opposed by the aforementioned rollers 31, 32 which cannot move along the inclined guides.

[0169] Obviously other simpler of different configurations of the second coupling device are also possible.

5 **[0170]** In other words, reciprocal clamping systems can be used during the coupling step to the front portion 3a of the rail 3.

[0171] Turning now to describe the connecting element 7; the connecting element 7 is configurable in a rest position shown in figure 1a in which is inclined with respect to the first and second coupling device 5 and to the direction of longitudinal development 14 of the rails; and in a working position during the extraction step in which the connecting element 7 is aligned with the first and second coupling devices 5, 6 along the overall development direction of the of the apparatus 1. In the example of figure 1A the angle of inclination is such as to maintain the ends of the rails aligned; obviously the connecting devices 5 and 6 could be aligned and the connecting element have an axis of development perpendicular to that of the rails with the latter slightly longitudinally staggered.

[0172] The connecting element 7 will generally be hinged to the first and second coupling device 5, 6 in such a way that it can rotate relatively during the extraction step, realigning the rails subsequently extracted as can be seen by comparing figures 1A, 1B, 1C .

[0173] In order to avoid excessive rotations (or further rotations) of the connecting element once it reaches the aligned working position, a stop structure 40 can be provided, active exclusively in the aligned configuration which operates in particular automatically when the aligned configuration is reached.

[0174] In an exemplary embodiment shown in figures from 2 to 9, the connecting element is constituted by an upper plate and a bottom plate hinged at the same axes of rotation both to the first coupling device 5 and the second coupling device 6.

[0175] Once the first rail 2 has been completely extracted from the transport truck, the first coupling device 5 constrains to the rear end 2b thereof and starts to drag the connecting element and therefore the second coupling device 6 which in turn is rigidly constrained to the next rail 3. During this step the connecting element 7 begins to rotate such as to bring the rails 2 and 3 into alignment along the axis of development, i.e. from the configuration of figure 2 to that of figure 7.

[0176] On reaching the configuration of figure 7, an abutment structure 56 of the connecting element 7 defined by a central vertical plate abuttingly receives a stop wing 57 borne by the support structure 26 of the first coupling device which can prevent additional rotations in the same rotation direction which can cause misalignment or oscillations around the alignment position. Correspondingly, the second coupling device 6 is provided with an abutment portion 58 (see figure 9) which is aligned in the same configuration as the connecting element 7 and abuts the above-mentioned abutment struc-

ture 56 at a lateral surface thereof, preventing further rotations of the second coupling device 6 which can lead to misalignments or oscillations around the aligned configuration.

[0177] The stop structure 40 can alternatively be constituted by a blocking pin and an elastic pusher which, in the aligned configuration, will engage a respective seating to eliminate the freedom to rotate (structure not shown).

[0178] Obviously the pin may be mounted on the connecting element or the respective first or second coupling device and the respective seating on the element opposite.

[0179] In this way, on reaching the aligned configuration the pin and the seating are also aligned (axially) and the elastic element can intervene to guarantee insertion of the pin in the seating and eliminate the rotating liberty with respect to both the first coupling device and the second coupling device, in this way maintaining the aligned configuration.

[0180] Using a pin and a corresponding pusher for each flank of the connecting element it will be possible to enable a relative rotation of the two devices 5, 6 in a clockwise or anti-clockwise direction depending on requirements.

[0181] Returning to figure 1a, in particular the last two illustrated rails, it can be observed that the equipment can also be mounted at the opposite end of the rails, i.e. the first rail to bring the second coupling device mounted on the rear end and the first sliding coupling device can be mounted on the immediately adjacent rail without there being substantial variations in functioning of the equipment.

[0182] Then as shown in figure 17, should the axis of rotation defined between the connecting element 7 and each of the devices 5, 6 be arranged perpendicular with respect to the configuration of figure 2, this would enable the connection of two rails contained in different planes of the truck and the two devices 5, 6 can rotate relatively in a vertical plane; in this way automatic and connected unloading is enabled, with the rails 6, 7 and 12, 13 connected, as in figure 18.

[0183] The embodiments described above can provide important advantages.

[0184] First, the equipment can be mounted during the loading step of the transport truck and does not require the intervention of operators during the rail unloading steps.

[0185] In fact, the coupling device is automatically activated on reaching the end of the rail, blocking and dragging it by means of the connecting element and the second blocking device and the rail until all the rails are unloaded.

[0186] The system is exclusively mechanical and is conceptually simple and substantially cheaper in terms of labour time than the corresponding operations carried out up to today for unloading rails.

Claims

1. Equipment (1) for connecting rails (2, 3) and movement of the rails (2, 3), in particular during unloading from a transport truck (4), comprising:

a first coupling device (5) configured such as to engage a portion of a rail (2);

a second coupling device (6) configured such as to engage a portion of a further rail (3);

and

at least a connecting element (7) suitable for constraining the first coupling device (5) to the second coupling device (6),

characterised in that at least the first coupling device (5) exhibits a guide system (50) comprising for example a seating (8) at least partially complementarily shaped to a transversal section of the rail (2), the guide system (50) being configured such as to enable a sliding of the first coupling device (5) with respect to the rail (2) from an end (2a) to another end (2b) thereof, and **in that** it further comprises a blocking system (9) of the first coupling device (5) to the rail (2), the system (9) being active such as to block the first coupling device (5) to the rail (2) at least when the first coupling device (5) is in proximity of a free end (2b) of the rail (2), the system (9) enabling sliding of the first coupling device (5) on the rail (2) into the other relative coupling positions.

2. The equipment of any one of the preceding claims, wherein the first coupling device (5) is configured for a prismatic constraint to the rail (2) with a sliding according to a development axis (14) of the rail, in particular the guide system (50) comprising a predetermined number of rotating coupling elements (51) such as wheels, small wheels, rollers, castors, suitable for abutting respective portions of the rail such as to determine a sliding coupling between the first coupling device (5) and the rail (2), in particular the guide system (50) comprising, on at least one and optionally on both flanks of the rail, two rotating coupling elements (51) destined to abut a foot (12) of the rail (2) and two rotating coupling elements (51) destined to abut a head (13) of the rail (2).

3. The equipment of any one of the preceding claims, wherein the blocking system (9) comprises activating means (15) for enabling activation of the blocking system at the free end (2b) of the rail (2) and for maintaining the blocking system (9) inactive during the sliding of the first coupling device (5) along the rail (2), the activating means (15) enabling activation of the blocking system (9) automatically on reaching the free end (2b) of the rail (2).

4. The equipment of the preceding claim, wherein the activating means (15) comprise at least a body (16, 17), for example a roller, mobile at and along the rail (2) during relative motion between the first coupling device (5) and the rail (2), the mobile body (16, 17) being maintained in a first inactive position of the blocking means by the rail (2), the activating means (15) being configured, for example by force of gravity and/or by means of an elastic element, such as to displace into a working position of the blocking means at least when the first coupling element (5) reaches the free end (2b) of the rail (2), the inactive position of the mobile body (16, 17) corresponding to the inactive condition of the blocking system (9), the working position of the mobile body (16, 17) corresponding to the active condition of the blocking system (9).

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5. The equipment of any one of the preceding claims, wherein the blocking system (9) comprises stop means (21) for selectively blocking relative longitudinal sliding of the first coupling device (5) with respect to the rail (2), the stop means (21) being configurable between a rest condition in which the stop means (21) enable sliding and a working condition in which the stop means (21) prevent sliding, in particular the stop means (21) being commanded by the activating means (15).

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6. The equipment of claims 3 and 5, wherein the stop means (21) comprise at least a pair of locking bodies (22, 23) such as bodies with a curved active profile or rollers, destined, in use conditions, to abut a web (18) of the rail (2) such as to prevent a sliding motion between the rail (2) and the first coupling device (5), at least in an extraction direction (E) of the rail (2) from the coupling device (5), and comprise respective command elements (24, 25) for abutting the locking bodies (22, 23) to the web (18) of the rail (2), the activating means (15) being active on the command elements (24, 25) of the stop means (21) in the inactive condition of the blocking system in order to enable relative sliding between the rail (2) and the first coupling device (5) and optionally being active in the active condition of the blocking system such as to prevent relative sliding.

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7. The equipment of any one of the preceding claims, wherein the second coupling device (6) comprises blocking means (30) for generating a blocking force on the web (18) of the rail (2), in particular the second coupling device (6) being configured such as to selectively block the equipment to an end (3a) of the further rail (3).

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8. The equipment of the preceding claim, wherein the second coupling device (6) comprises a first and a second wing (27, 28) that are interfaced, coupled to one another and longitudinally spaced such as to define a cavity (29) between them which is suitable for receiving a web (18) of the rail, the blocking means (30) being associated to at least one of the wings (27, 28) such as to generate the blocking force on the web (18), the blocking means (30) enabling an insertion of the web (18) into the cavity (29) according to a coupling direction (33) and an insertion direction (I) and generating the blocking force in a situation of extraction movement of the web (18) in an extraction direction (E) that is opposite the insertion direction (I) along the coupling direction (33).

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9. The equipment of any one of the preceding claims, wherein the connecting element (7) is configurable between an inclined rest position with respect to the first and the second coupling device (5, 6) and a working position in which it is aligned to the first and the second coupling device (5, 6) along a development direction of the equipment, the connecting element (7) being for example hinged to the first and/or the second coupling device (5, 6).

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10. A method for connecting rails and movement of rails, especially during unloading from a transport truck, comprising steps of:

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 - constraining a first coupling device (5) to a portion of a rail (2);
 - constraining a second coupling device (6) to a portion of a further rail (3), the first and second coupling devices (5, 6) being constrained to one another by means of a connecting element (7); and
 - extracting the rail (2) from the transport truck (4), the first coupling device (5) sliding along the rail (2) up to an end (2b) thereof and blocking the relative sliding at the end (2b), a further extraction of the rail (2) causing transmission of an extraction force, by means of the connecting element (7), to the second coupling device (6) and to the further rail (3), the further rail (3) also being drawn in extraction.

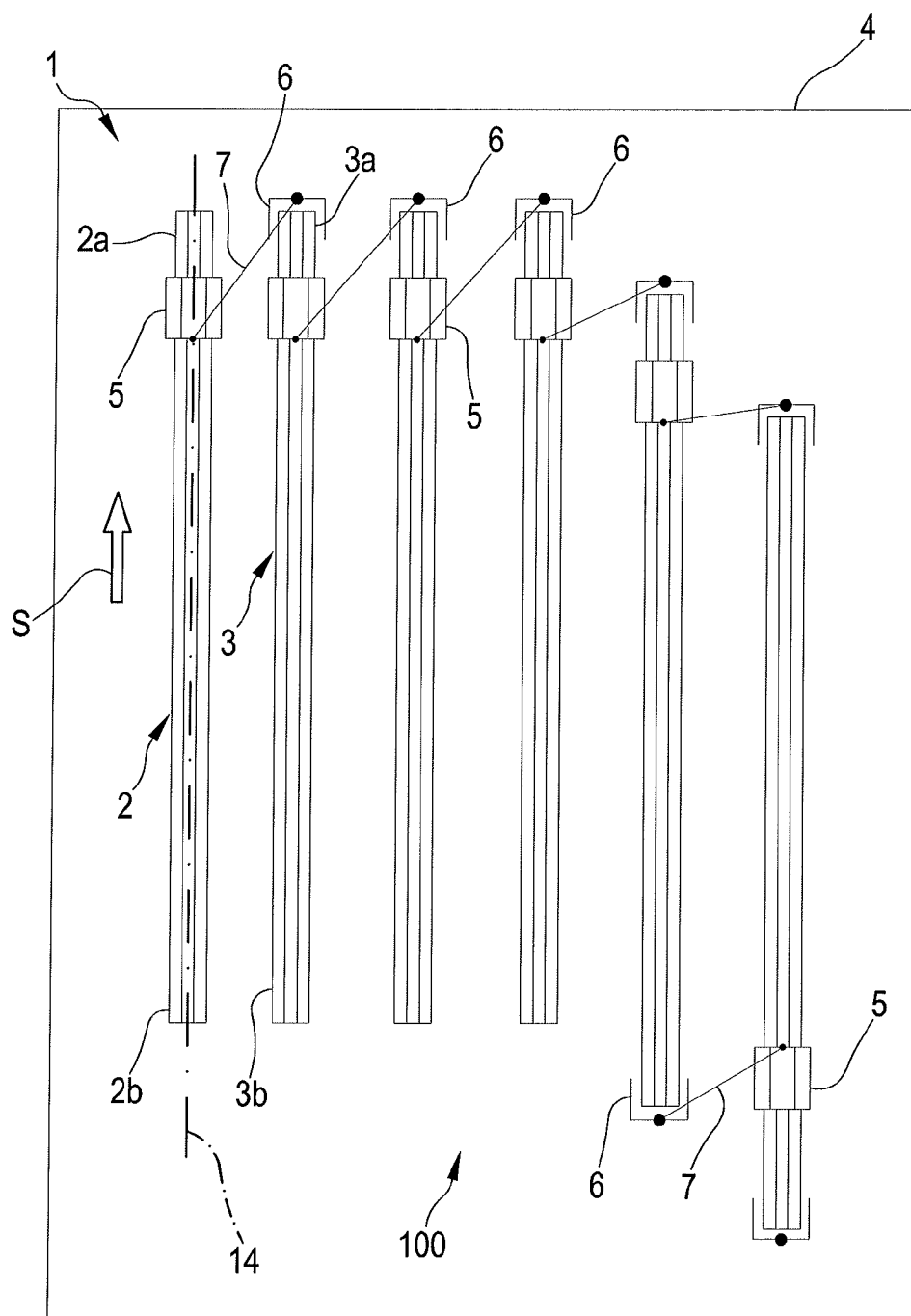


FIG.1A

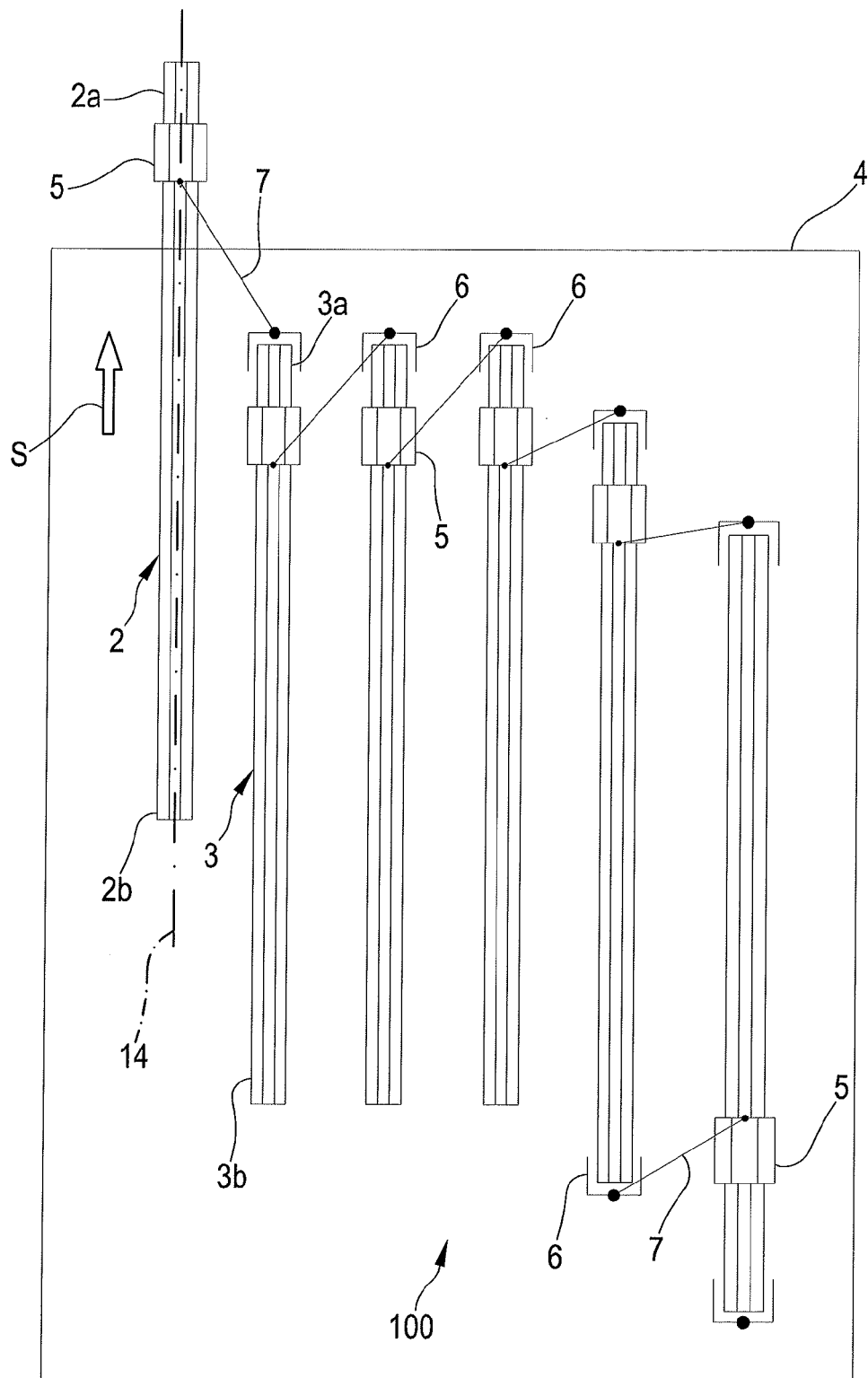


FIG.1B

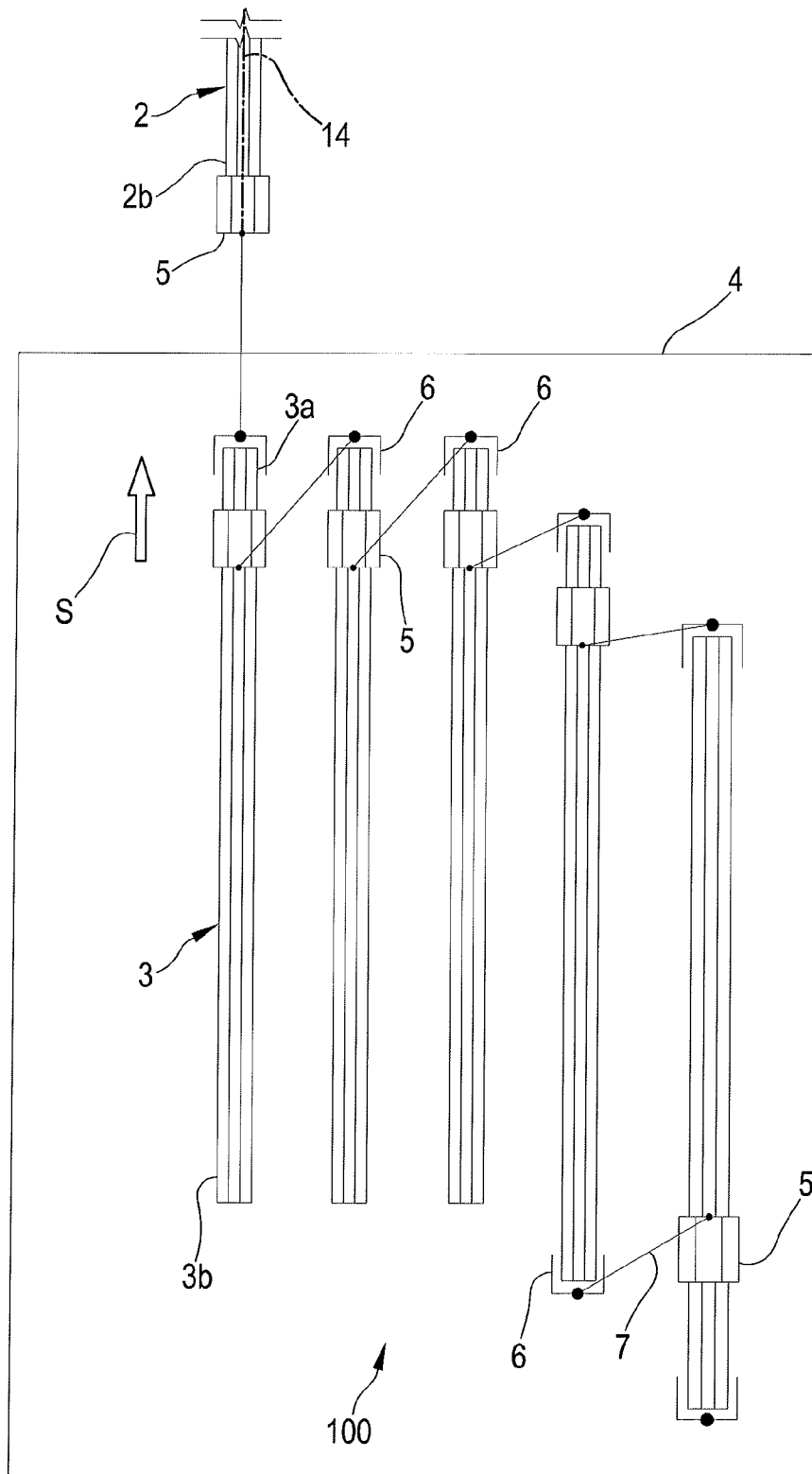
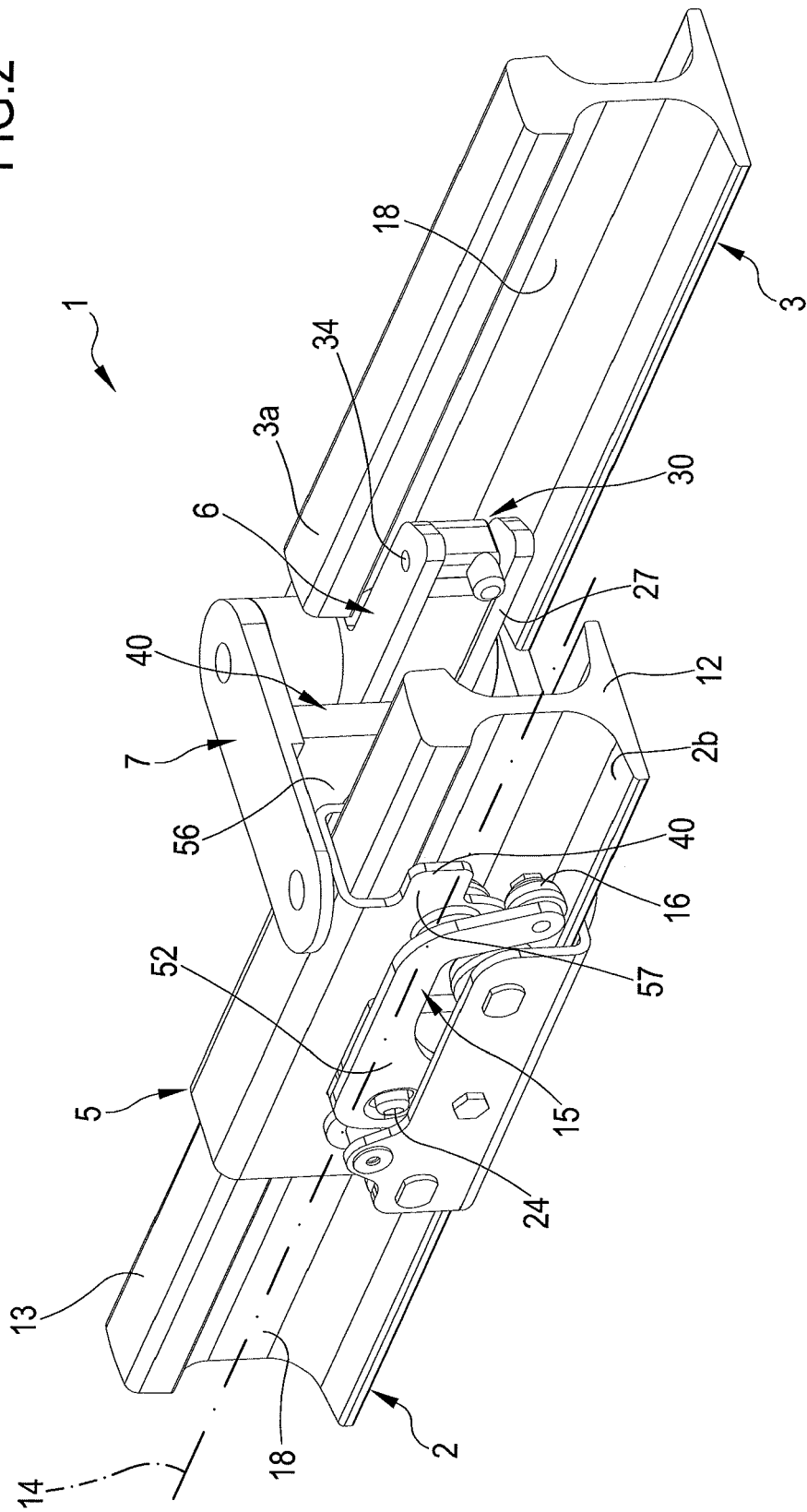


FIG.1C

FIG. 2



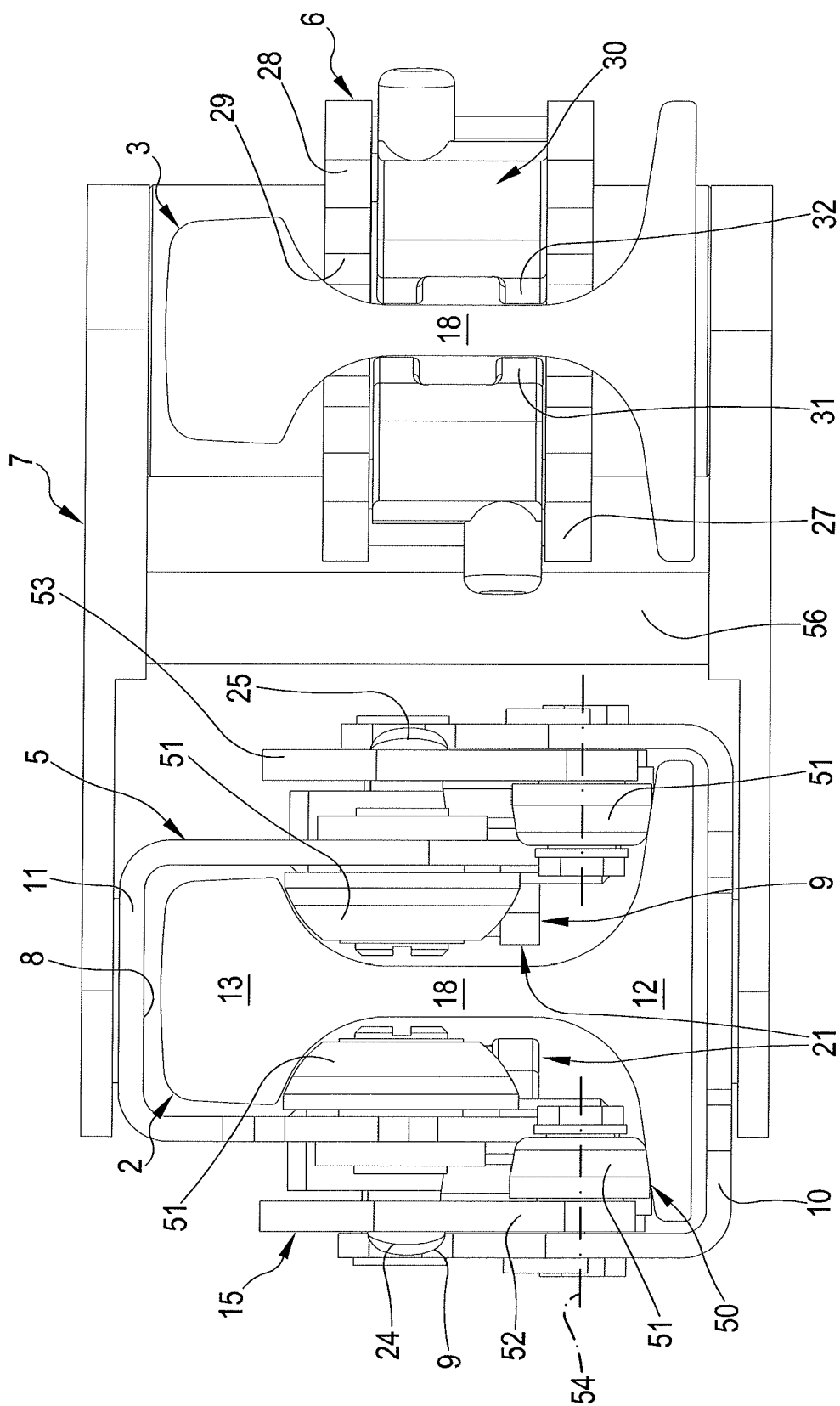


FIG.3

FIG.4

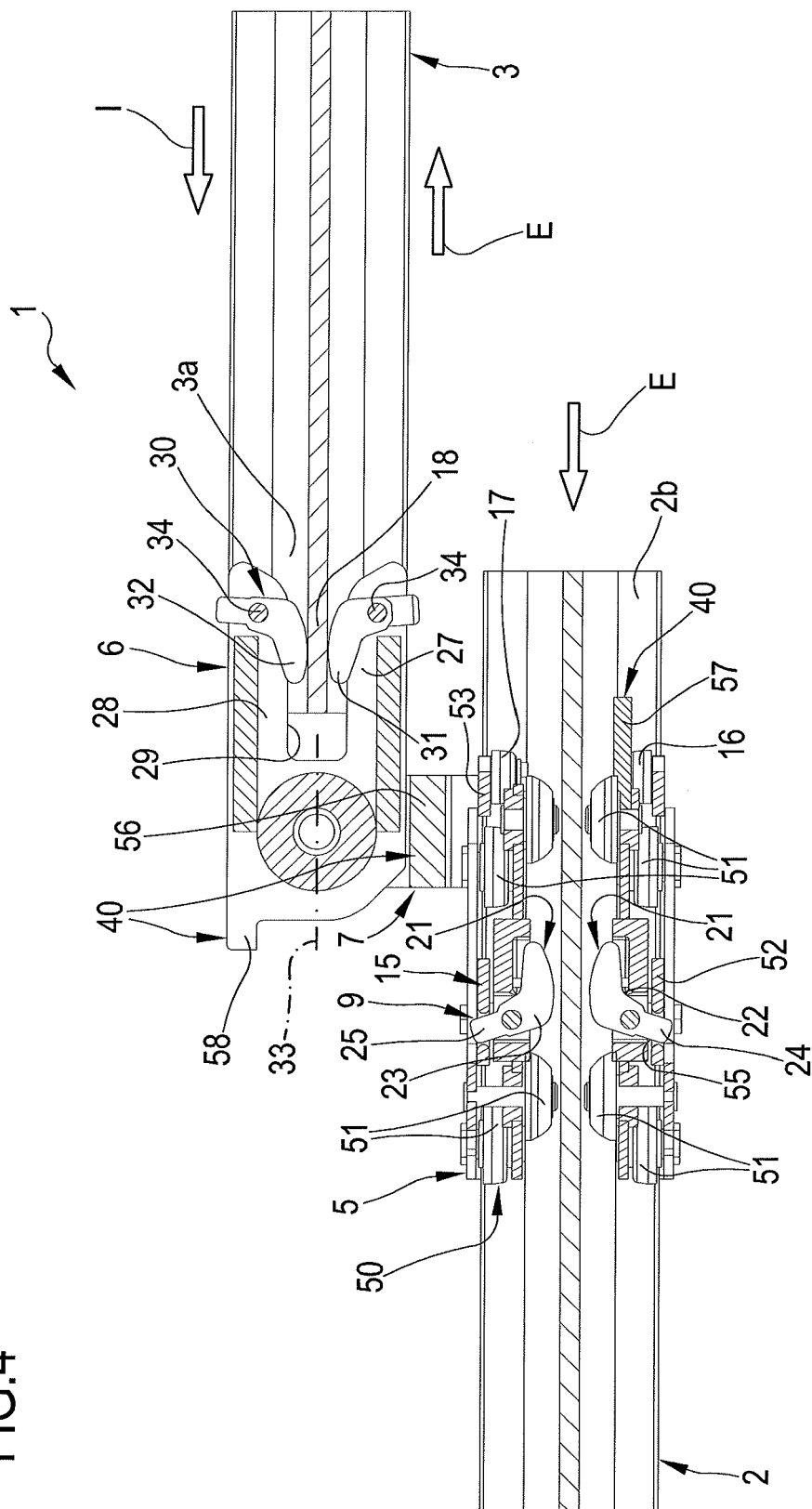
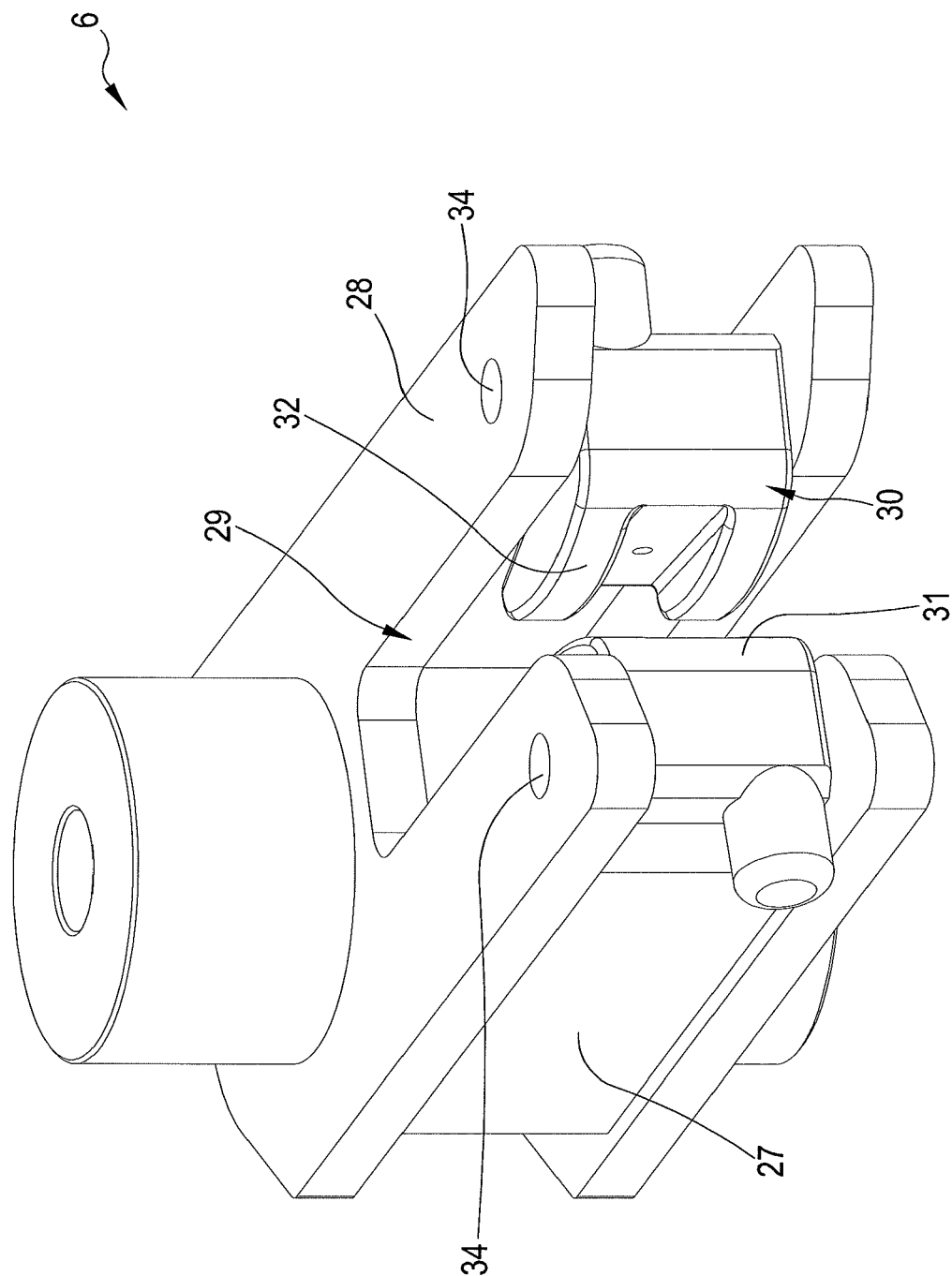
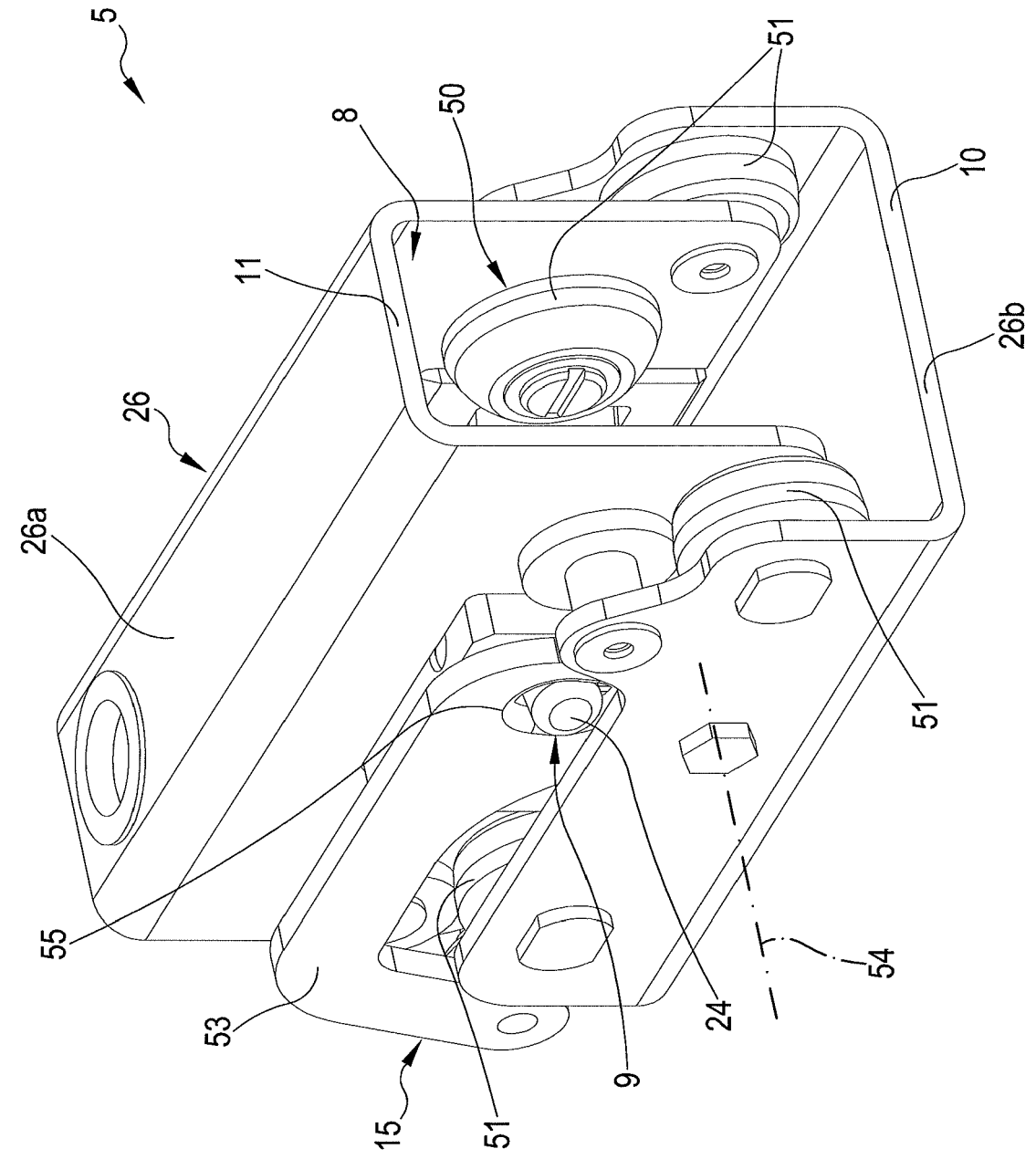


FIG.5



**FIG. 6**

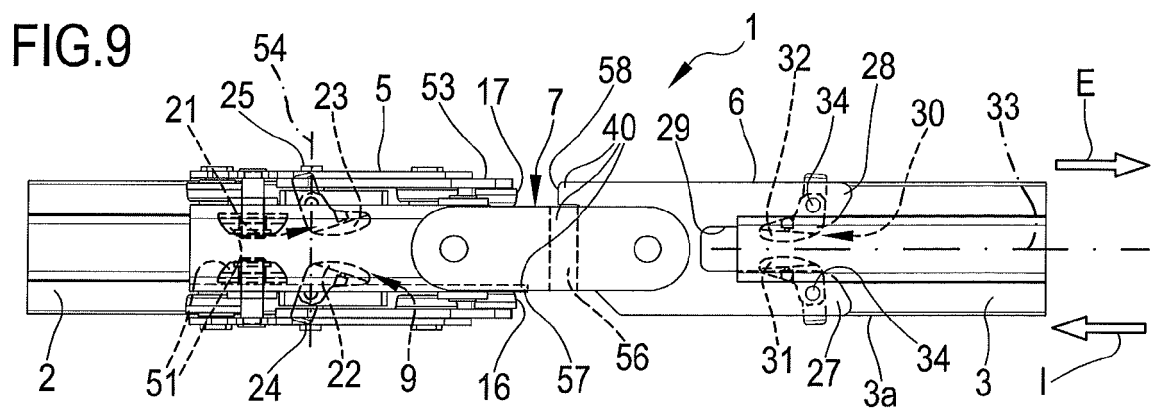
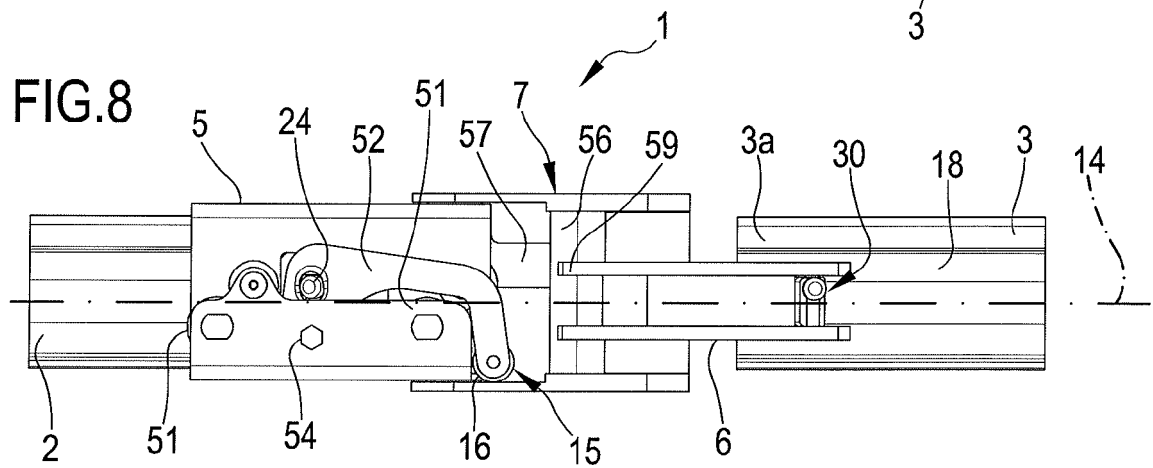
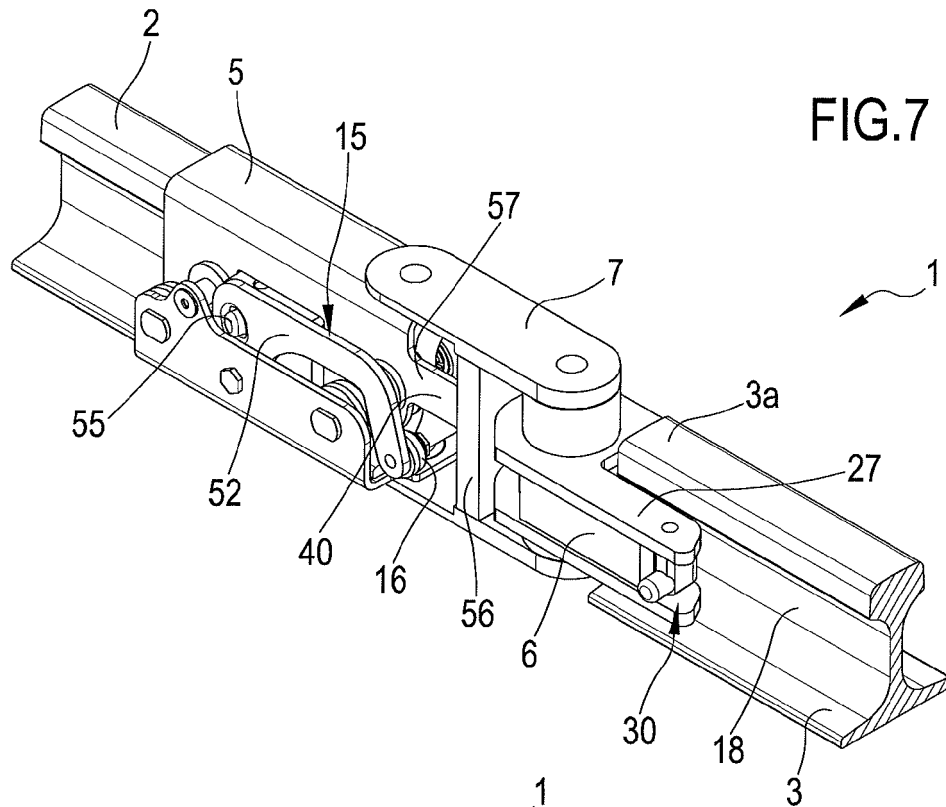


FIG.10

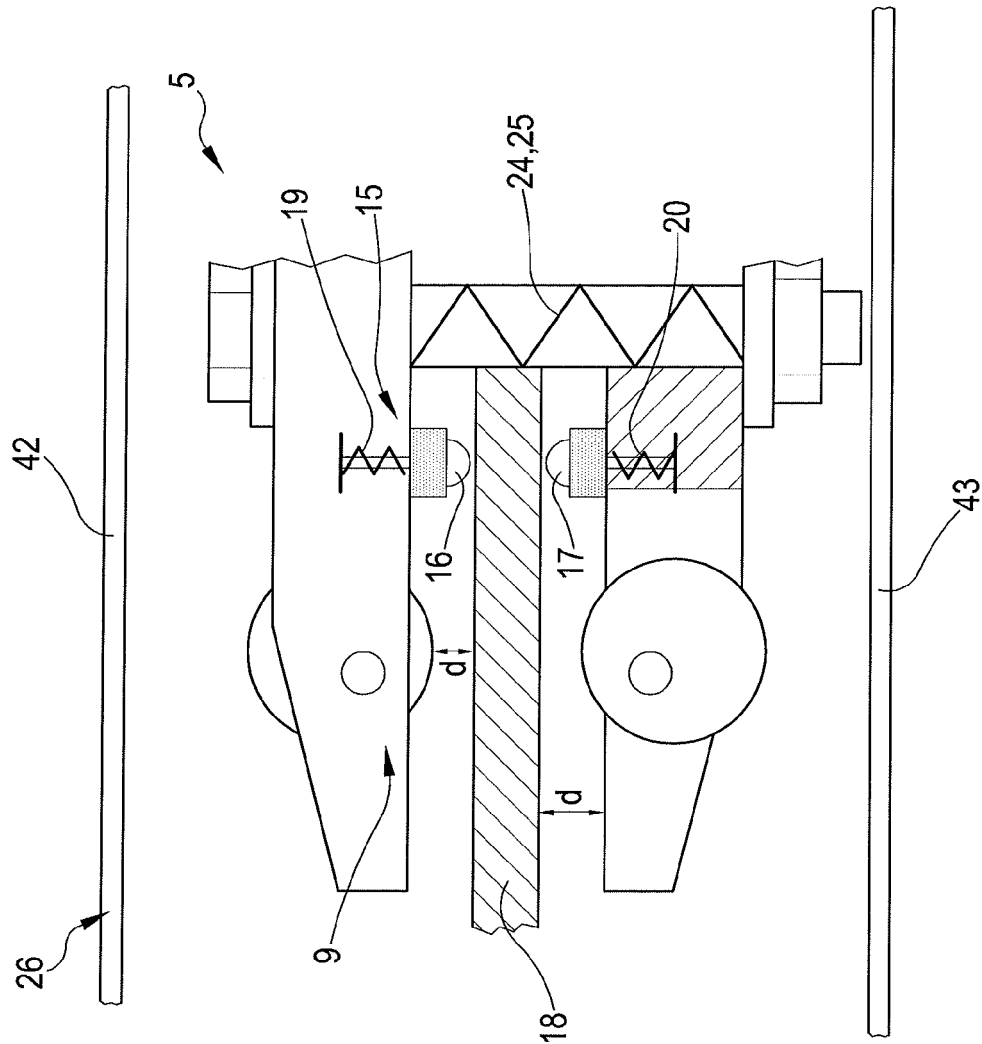
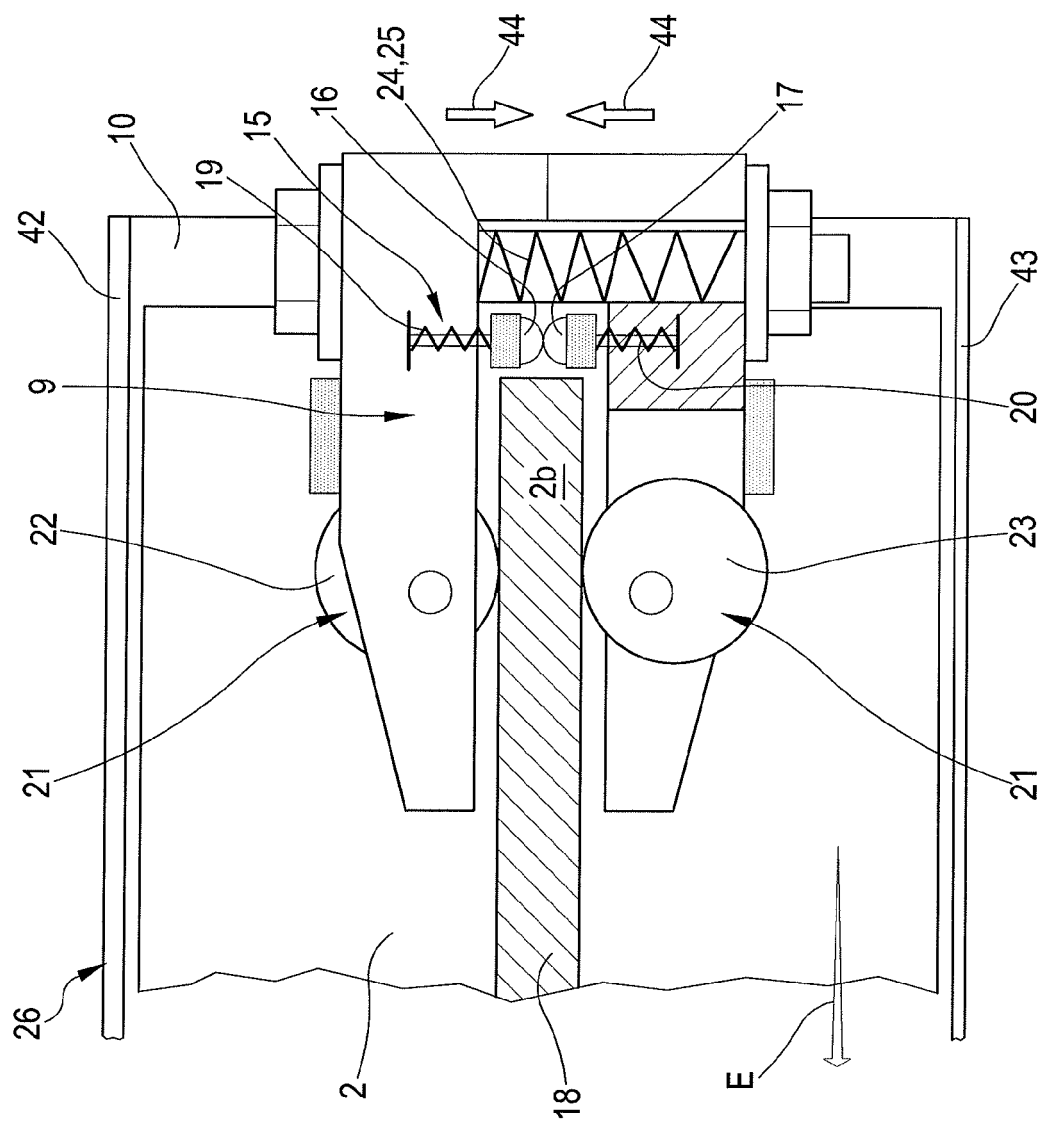


FIG.11



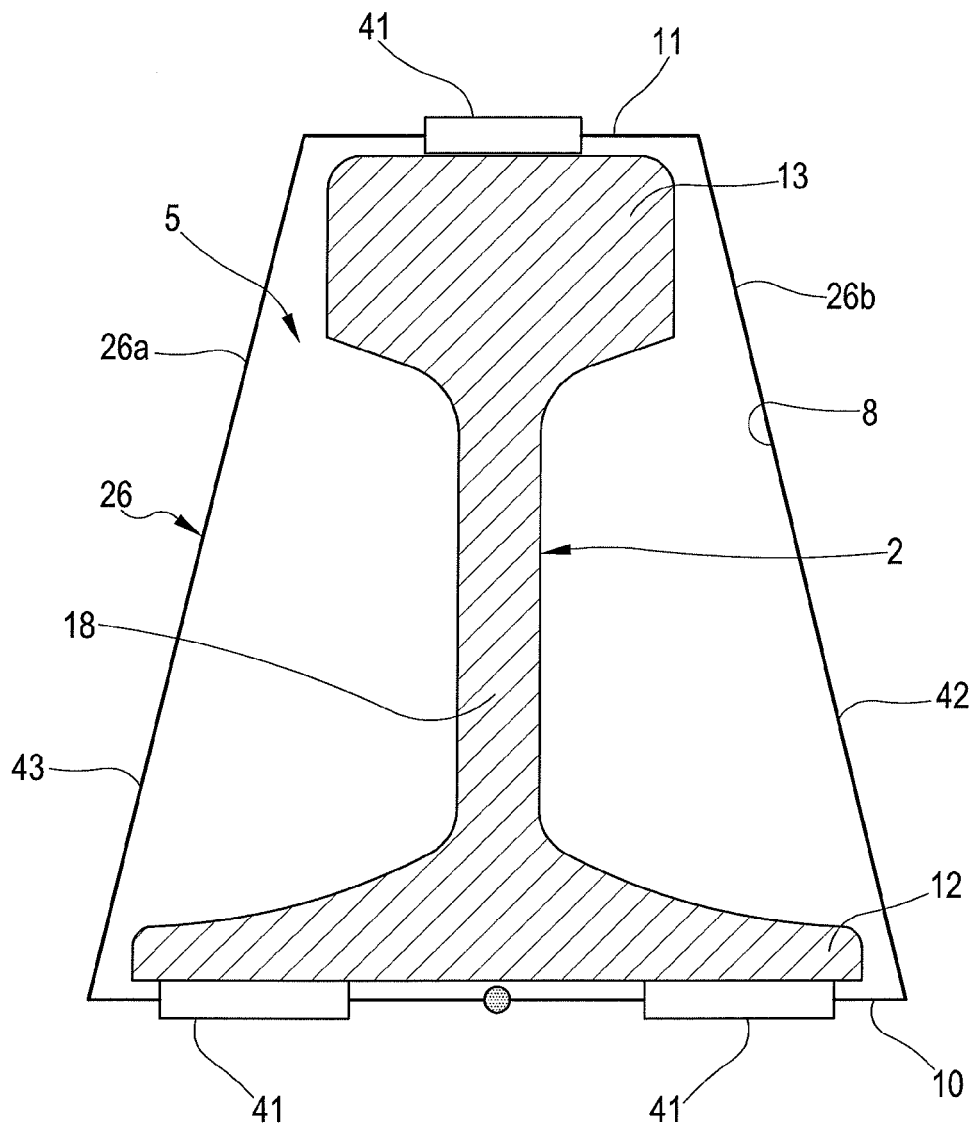


FIG.12

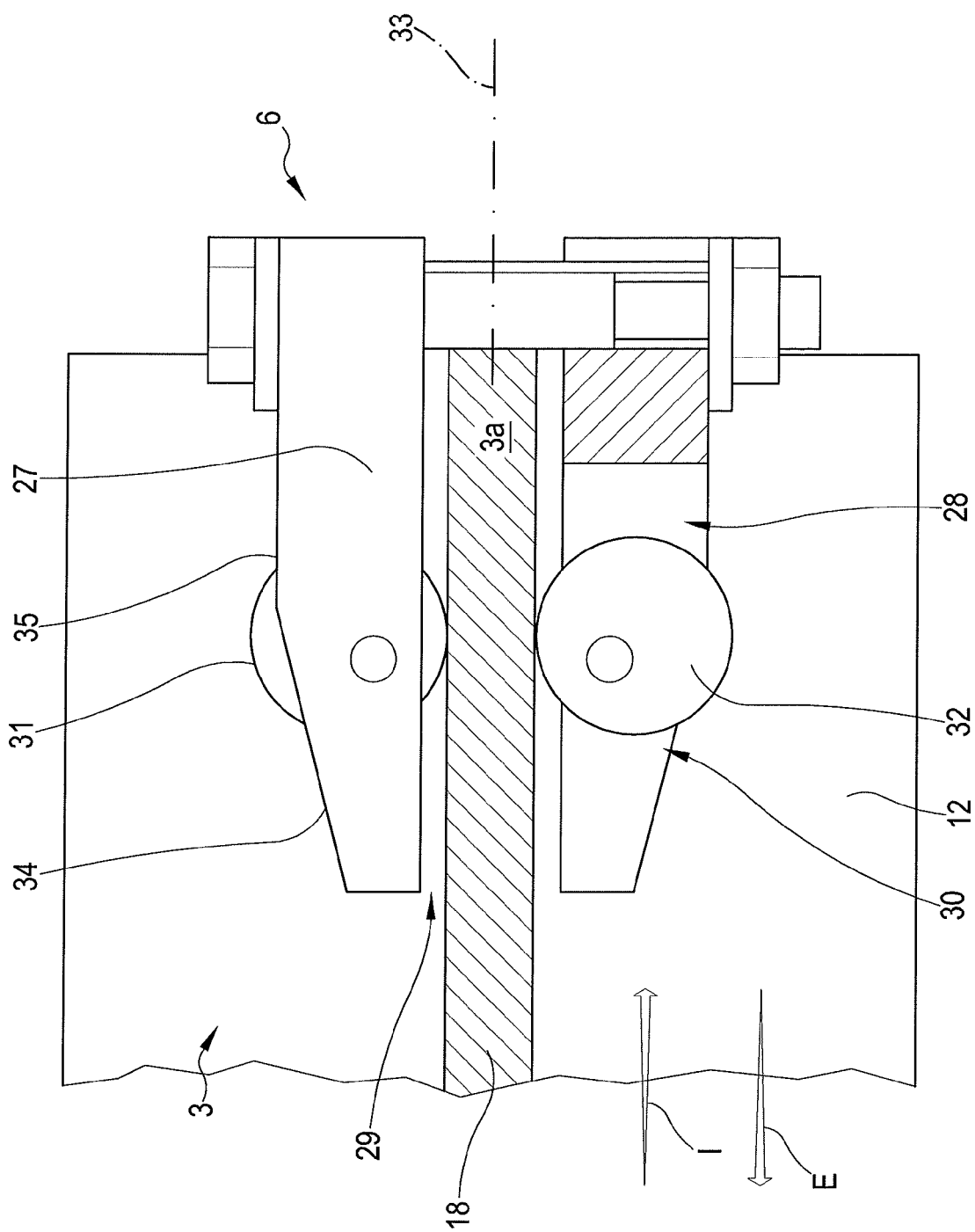


FIG.13

FIG.14

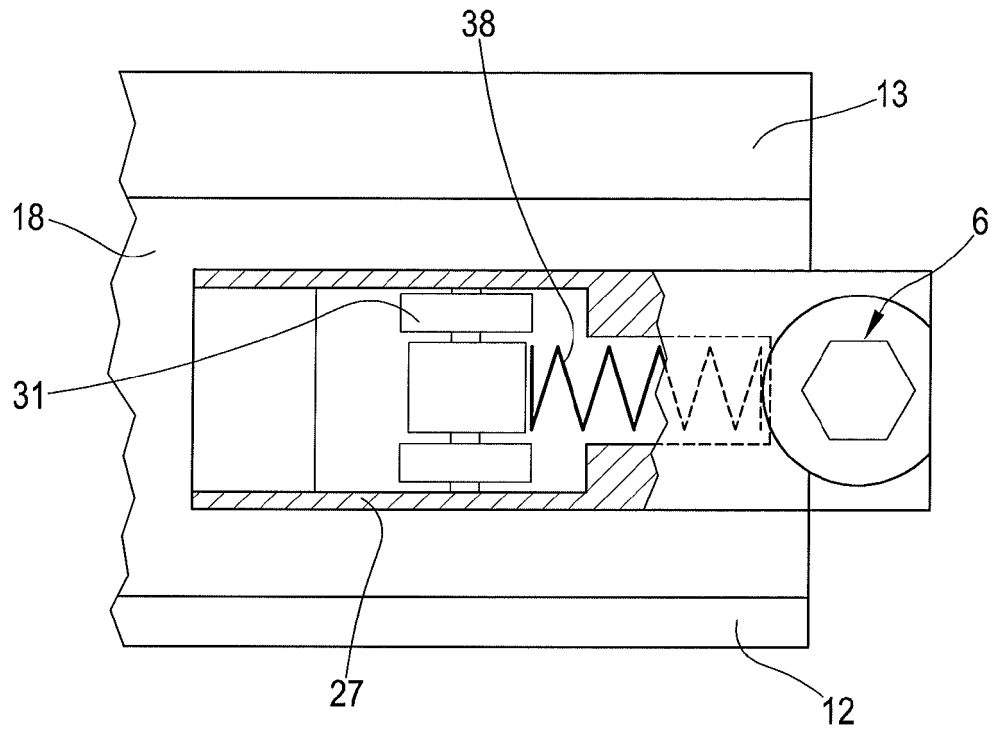
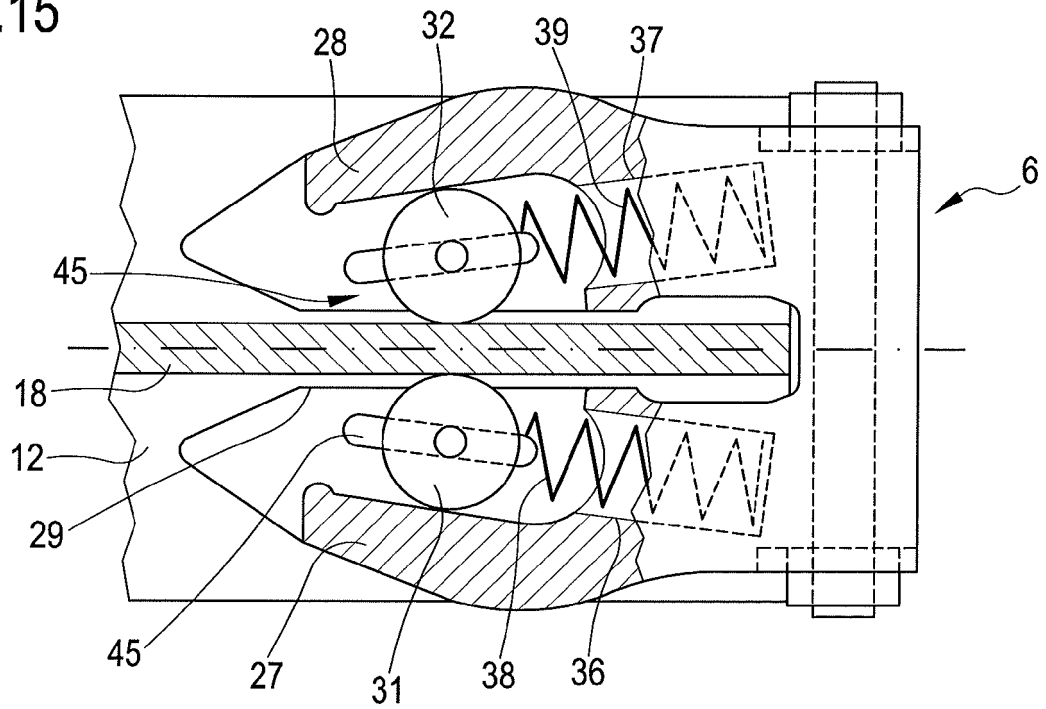


FIG.15



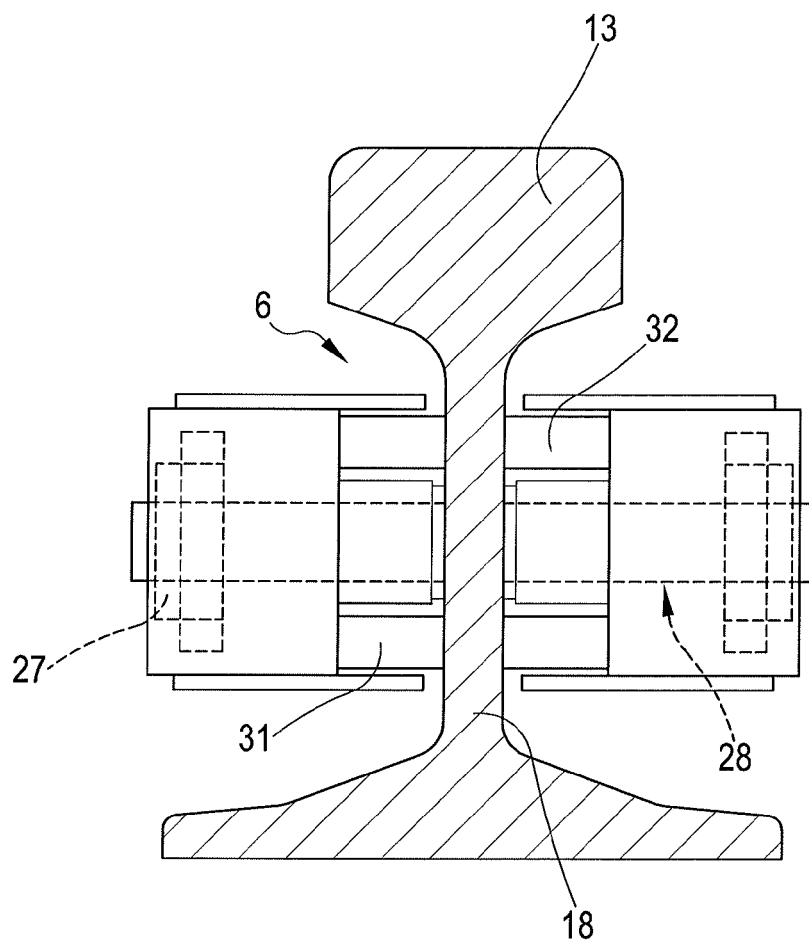


FIG.16

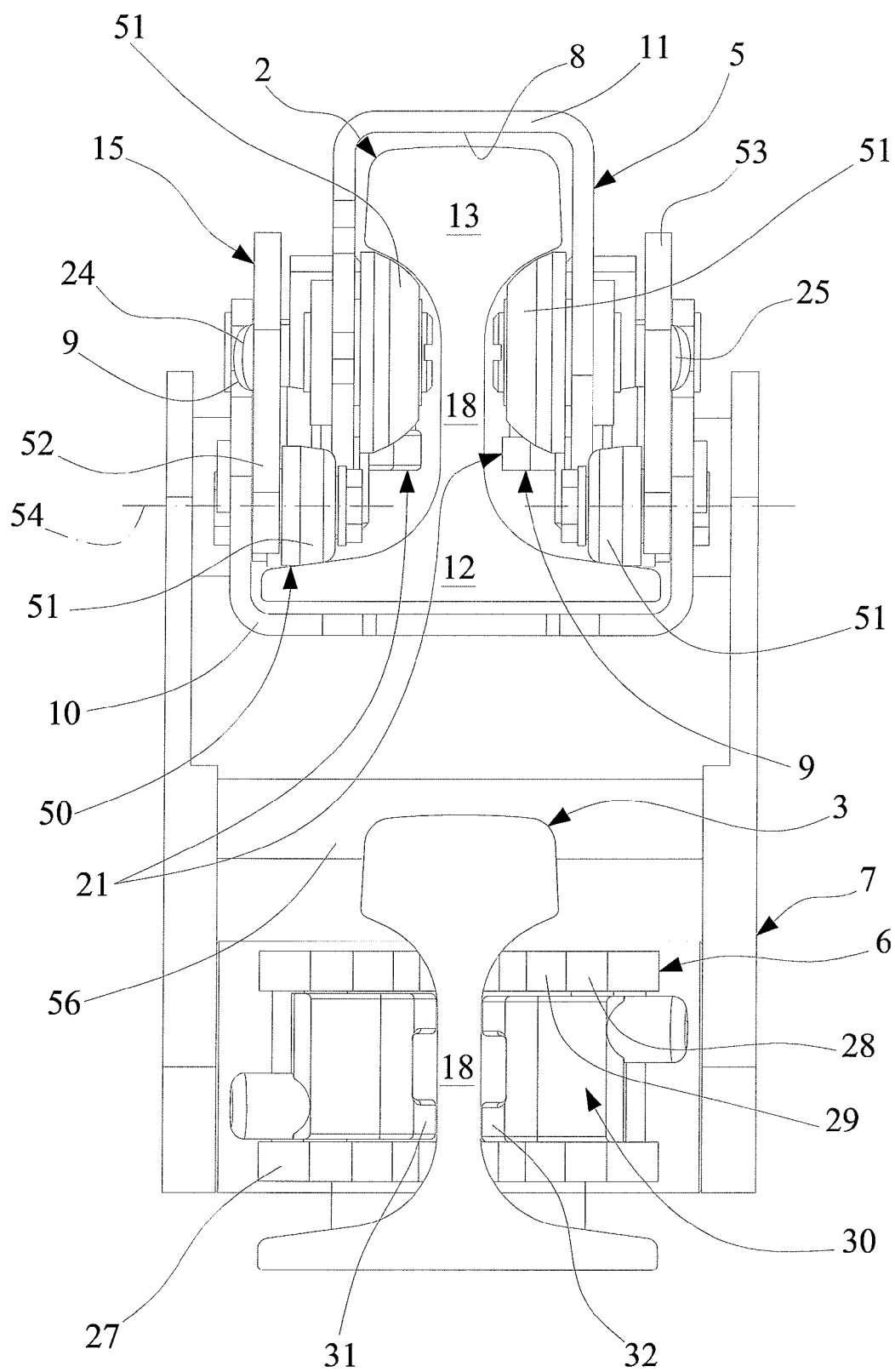


Fig.17

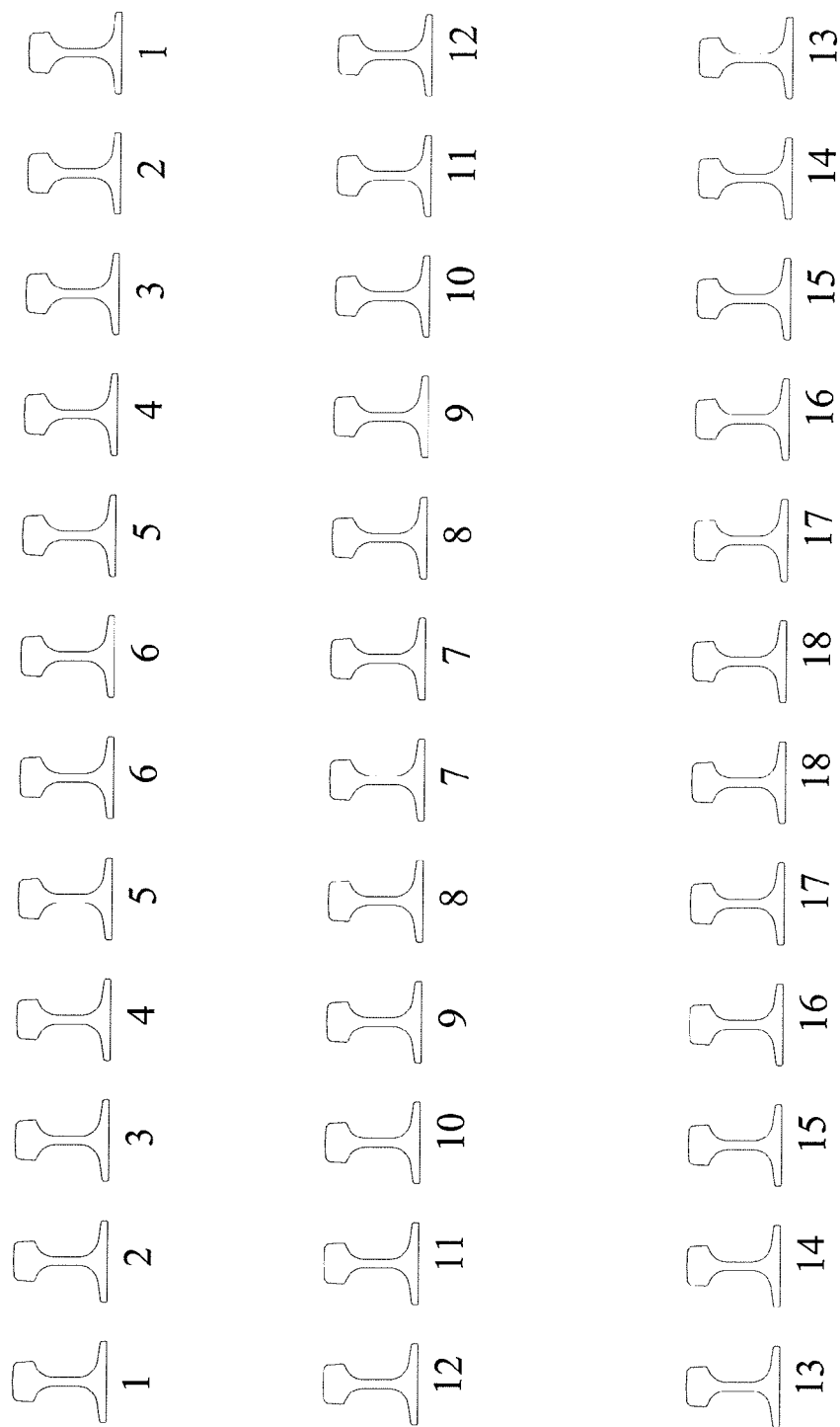


Fig.18



EUROPEAN SEARCH REPORT

Application Number
EP 12 16 0597

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A,D	EP 1 057 933 B1 (ROBEL BAHNBAUMASCHINEN GMBH [DE]) 16 November 2005 (2005-11-16) * column 2, line 21 - column 3, line 32; figures 1-3 *	1,10	INV. E01B11/02 E01B29/16 E01B29/20
A	US 5 575 416 A (OELLERER FRIEDRICH [AT] ET AL) 19 November 1996 (1996-11-19) * abstract; figures 1-4 *	1,10	
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