(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 4 549 655 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
07.05.2025 Bulletin 2025/19

(21) Application number: **24199248.6**

(22) Date of filing: **09.09.2024**

(51) International Patent Classification (IPC):
E01B 29/02 *(2006.01)*

(52) Cooperative Patent Classification (CPC):
E01B 29/02

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC ME MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA
Designated Validation States:
GE KH MA MD TN

(30) Priority: **30.10.2023 IT 202300022794**

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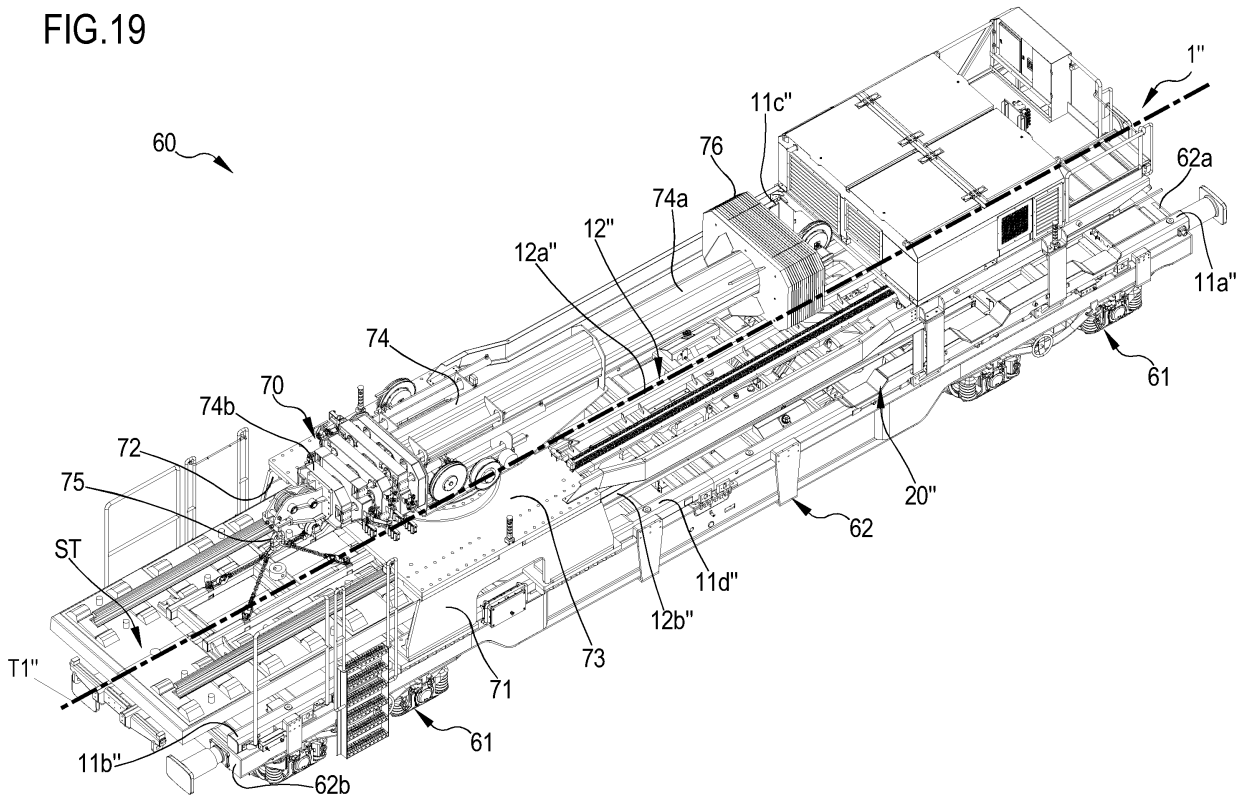
(54) HANDLING SYSTEM FOR SUPPORT COMPONENTS, PROCESS OF UNLOADING SUPPORT COMPONENTS BY MEANS OF SUCH HANDLING SYSTEM AND RAILWAY WAGON

(57) Handling system (1") for support components (ST) for engaging a rail of a railway line; the handling system (1") comprises a frame (11") extending along a longitudinal trajectory (T1"), which has a first and a second zone (Z1", Z2"). The handling system comprises: a guide (12") extending along the longitudinal trajectory (T1"), a carriage (13") movable along the guide (12"), an unloading device (70) configured to engage a support component from the carriage located at the second zone and unload it into an external zone outside the frame (11").

FIG.19



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Description

FIELD OF THE INVENTION

[0001] It is an object of the present invention to provide a handling system of support components suitable for receiving engaged at least one rail of a railway line, as well as a railway wagon and a railway vehicle comprising said handling system. The invention may find application in the railway filed for the maintenance of railway infrastructure, for example for the construction and/or renewal of railway lines.

STATE OF THE ART

[0002] Railway tracks are laid on wooden or concrete sleepers, which in turn are laid on a crushed stone base, also known as ballast, configured to distribute the load, provide stability to the tracks and drain water. Conventional structures, however, require constant maintenance, which includes working on the ballast and/or replacing sleepers. With respect to the replacement of sleepers, Patent Application No. EP 3 892 775 A1 describes a railway wagon equipped with a plurality of carriages for transporting new sleepers, as well as three conveyor belts configured to move the sleepers between the various belts and the carriages so as to be able to regulate the exit of the old sleepers and the sending of the new sleepers to the laying system. The movement of the sleepers is handled by a suspended crane. Further known from patent application No. US 2021/054576 A1 and No. US 3 283 926 A are systems capable of moving single railway spans comprising a plurality of sleepers constrained to pairs of rails. In particular, patent application No. US 2021/054576 A1 shows a complex wagon comprising a reticular frame carrying three independent suspended cranes; the cranes are configured to slide on top of the frame and work independently of each other to pick up and move single railway spans above the wagon.

[0003] The patent application No. US 3 283 926 A shows a head wagon carrying a large frame that extends, front and rear, outside the wagon to pick up individual railway spans from a rear wagon and unload them outside the wagon. The frame has a fixed structure along which a suspended crane configured for picking up and unloading spans is movable. The Applicant noted, however, that the above-mentioned systems are highly complex and bulky, as well as unsafe. As an improvement on traditional railway lines without ballast, so-called slab-track railway lines, were introduced,: the tracks are directly anchored to slabs made of reinforced concrete, also known as slab-track. The rigid structure of the slabs eliminates the need for ballast, offering potential advantages in terms of durability, maintenance and stability. Due to their nature, *slab-tracks* are generally preferred in contexts such as high-speed railway lines, tunnels, bridges and urban areas, where constant maintenance may be complex and high stability is required.

[0004] The installation and construction process of slab railways involves an initial phase of preparing the ground and the subsequent positioning of the slabs. This is followed by the anchoring of the rails directly to the slabs using fastening systems such as screws, bolts, brackets or other anchoring mechanisms. An important step in the installation process is the transport of the slabs to the installation site. The reinforced concrete slabs are transported, usually four at a time, from a storage area to a pick-up and laying area by means of wheeled vehicles (e.g., trucks) and/or tracked vehicles travelling on a side dock at the side of the slab-laying area. The slabs are then laid on the ground by means of special cranes placed on the dock or on tracks at the side of the slab-laying area.

[0005] Although the known solutions allow the laying of reinforced concrete slabs on the ground, the Applicant found that these solutions are not free from limitations and inconveniences, and therefore can be improved in several aspects. As a matter of fact, the known solutions require the presence of an auxiliary track and/or a dock for crane handling alongside the slab-laying area, a condition that considerably limits the applicability of the process.

SCOPE OF THE INVENTION

[0006] The aim of the present invention is to solve at least one of the drawbacks and/or limitations of the previous solutions. It is a first object of the present invention to provide a handling system, as well as a wagon and a vehicle comprising said handling system, capable of quickly and safely moving a plurality of support components of a railway line, for example concrete slabs for engaging rails. It is further an object of the present invention to provide a handling system, as well as a wagon and a vehicle comprising said handling system, having a high capacity, as well as capable of safely transporting many support components of a railway line, for example reinforced concrete slabs for engaging rails. It is further an object of the present invention to provide a handling system, as well as a wagon and a vehicle comprising said handling system, having a simple and compact structure, in particular which can be realised at low cost. It is an object of the present invention to provide a rail wagon and a vehicle comprising said handling system which is flexible in use and capable of travelling on at least one rail of a railway line in an efficient and safe manner. These purposes and others are obtained by a handling system, as well as a railway wagon and a railway vehicle comprising said handling system in accordance with one or more of the attached claims.

SUMMARY

[0007] In a 1st aspect a handling system (1; 1'; 1") for support components (ST) which are configured to re-

ceive in engaged at least one rail of a railway line is provided, wherein the handling system comprises at least one frame (11, 11'; 11") extending between a rear portion (11a; 11a'; 11a") and a front portion (11b; 11b'; 11b") along a longitudinal trajectory (T1; T1'; T1"), wherein said frame (11) presents:

at least one first zone (Z1; Z1'; Z1") defined between the rear portion and a middle portion of the same frame, wherein the middle portion is placed substantially in the middle between the rear and front portions of the frame,
at least one second zone (Z2; Z2'; Z2") defined between the front portion of the frame and said middle portion.

[0008] In a 2nd aspect according to the preceding aspect, the handling system comprises at least one guide (12; 12'; 12") extending for at least a portion of the extension trajectory of the frame substantially parallel to the longitudinal trajectory of the frame. In a 3rd aspect according to any one of the preceding aspects, the handling system (1; 1'; 1") comprises at least one carriage, optionally slidably engaged to the guide, configured to move between the first and second zones of the frame.

[0009] In a 4th aspect according to any one of the preceding aspects the handling system (1) comprises at least one movable to-and-fro carriage along the guide (12) between the first and second zones (Z1, Z2). In a 5th aspect according to any one of the preceding aspects the at least one carriage comprises a support surface configured to receive in support one or more support components. In a 6th aspect according to the preceding aspects the at least one carriage comprises a support surface configured to define a support surface for one or more support components, optionally directly arranged on said support surface. In a 7th aspect according to any one of the preceding aspects the at least one carriage comprises:

at least one first carriage (13; 13') movable along the guide, configured to move between the first and second zones of the frame,
at least one second carriage (14; 14') movable along the guide, configured to move between the second zone of the frame and a zone outside the frame.

[0010] In an 8th aspect according to any one of the preceding aspects, the handling system (1; 1'; 1") may be engaged with a railway wagon (60), optionally of the type comprising:

a plurality of axles (61), wherein each axle is constrained by at least one or more wheels configured to move along at least one rail,
a platform (62) supported by said plurality of axles.

[0011] In a 9th aspect according to any one of the preceding aspects, the frame (11; 11'; 11") is engageable to a platform (62) of a railway wagon.

[0012] In a 10th aspect according to any one of the preceding aspects, the first and second zones are consecutive to each other with respect to the longitudinal trajectory. In an 11th aspect according to any one of the preceding aspects the first and second zones are immediately consecutive to each other with respect to the longitudinal trajectory.

[0013] In a 12th aspect according to any one of the preceding aspects from 2nd to 11th the guide (12; 12'; 12") extends from the rear portion (11a; 11a'; 11a") to the front portion (11b; 11b'; 11b") along the longitudinal trajectory (T1; T1'; T1"). In a 13th aspect according to any one of the preceding aspects from 2nd to 12th, the guide extends along the entire extension of the frame. In a 14th aspect according to any one of the preceding aspects from the 2nd to the 13th, the guide is fixed to the frame, optionally joined in a single piece. In a 15th aspect according to any one of the preceding aspects from the 2nd to the 14th the at least one guide (12; 12'; 12") comprises at least one first tract (12a; 12a'; 12a") and at least one second tract (12b; 12b'; 12b") parallel to each other. In a 16th aspect according to the preceding aspect the first and second tracts of the guide are placed at a minimum distance from each other of between 700 mm and 1,500 mm, optionally between 800 mm and 1,400 mm. In a 17th aspect according to the preceding aspect, the minimum distance between said first and second guide tracts is measured orthogonally to the longitudinal trajectory of the frame.

[0014] In an 18th aspect according to any one of the preceding aspects, the longitudinal trajectory of the frame is rectilinear. In a 19th aspect according to any one of the preceding aspects, the frame has a first and a second lateral edges (11c, 11d; 11c', 11d'; 11c'; 11d') spaced apart from each other along a direction orthogonal to the longitudinal trajectory of the same frame. In a 20th aspect according to the preceding aspect the first and second lateral edges (11c, 11d; 11c', 11 d'; 11c"; 11d") define a lateral frame size. In a 21st aspect according to any one of the preceding two aspects, the first and second lateral edges (11c, 11d; 11 c', 11d'; 11c"; 11d") extend along the entire extension of the frame, optionally from the rear portion to the front portion. In a 22nd aspect according to any one of the three preceding aspects, the first and second lateral edges (11c, 11d; 11c', 11d'; 11c"; 11d") are placed at a minimum distance from each other, optionally measured orthogonally to the longitudinal trajectory of the frame. In a 23rd aspect according to the preceding aspect, the minimum distance between the first and second lateral edges (11c, 11d; 11c', 11d'; 11c"; 11d") is greater than 2,000 mm, optionally between 2,300 and 2,800 mm. In an aspect 24 according to any one of the preceding aspects 18th to 23rd the first and second lateral edges (11c, 11d; 11 c', 11d'; 11c"; 11d") are substantially parallel to each other. In a 25th aspect according to any one of the preceding aspects from the 18th to

the 24th the first and second lateral edges (11c, 11d; 11 c', 11d'; 11c' ; 11d") extend along directions parallel to the longitudinal trajectory. In a 26th aspect according to any one of the preceding aspects from 18th to 25th the guide (12; 12'; 12") is interposed between said first and second lateral edges (11c, 11d; 11c', 11d'; 11c"; 11d"). In a 27th aspect according to any one of the preceding aspects from 2nd to 26th, the guide is substantially positioned at a longitudinal centreline of the frame, optionally positioned midway between said first and second lateral edges. In a 28th aspect according to any one of the preceding aspects from the 18th to the 27th, the first and second tracts of the guide are opposed to each other with respect to an ideal frame centreline plane, parallel to the longitudinal trajectory and interposed between the first and second lateral edges of the frame. In a 29th aspect according to the preceding aspect said ideal centreline plane, in a condition of use of the handling system (1; 1'; 1"), extends vertically. In an aspect 29bis according to any one of aspects from 2nd to 29th, the guide (12) substantially lies on the same ideal lie plane as the frame. In an aspect 29ter according to any one of aspects from 2nd to 29bis the guide (12) lies on an ideal plane which, in use, is placed at an equal height above the ground with respect to a respective frame laying plane.

[0015] In a 30th aspect according to any one of the preceding aspects from 7th to 29th, the first carriage (13; 13'), optionally when placed in engaged to the guide (12; 12'), is placed within the lateral size of the frame (11; 11'). In an aspect 31st according to any one of the preceding aspects 7th to 30th the first carriage is configured to move along the guide between the first and second zones, parallel to the longitudinal trajectory of the frame. In a 32nd aspect according to any one of the preceding aspects from 7th to 31st, the first carriage (13; 13') has a support surface (13a; 13a') configured to receive at least one support component (ST), optionally a concrete slab. In a 33rd aspect according to any one of the preceding aspects from 7th to 32nd, the first carriage (13; 13') comprises a plurality of wheels (13b; 13b') engaged to the guide (12; 12') which are configured to allow the carriage to slide along said guide. In an aspect 34th according to the preceding aspect, the first carriage comprises a number of wheels equal to or greater than 4, optionally between 4 and 10, even more optionally between 6 and 10. In an aspect 35th according to any one of the preceding aspects from 7th to 34th, the first carriage has a longitudinal dimension substantially equal to a longitudinal dimension of at least one of the first and second zones. In an aspect 35bis according to any one of the preceding aspects the at least one carriage, optionally at least one of the first and second carriages, has a predetermined length measured along the longitudinal trajectory of the frame, optionally said length being measured in a condition of engagement of the at least one carriage with the guide. In an aspect 35ter according to any one of the preceding aspects, the first zone (Z1) of the frame defines a prefixed longitudinal dimension defined substantially by the distance present between the front portion and the middle portion of the same frame. In an aspect 35quater according to any one of the preceding aspects, the second zone (Z2) of the frame defines a prefixed longitudinal dimension defined substantially by the distance present between the rear portion and the middle portion of the same frame. In an aspect 35quinqies according to any one of aspects from 35th to 35quater the ratio between the longitudinal dimension of the first zone and the length of the at least one carriage (optionally of the first or second carriage) is between 0.6 and 1, optionally between 0.7 and 1. In an aspect 35sexies according to any one of aspects from 35th to 35quinqies the ratio of the longitudinal dimension of the second zone to the length of the at least one carriage (optionally of the first or second carriage) is between 0.6 and 1, optionally between 0.7 and 1. In an aspect 35septies according to any one of aspects from 35quater to 35sexies the longitudinal dimension of the first zone (Z1) is substantially equal to the longitudinal dimension of the second zone (Z2). In an aspect 36th according to any one of the preceding aspects 7th to 35septies the first carriage (13; 13') extends between a first and a second longitudinal end respectively facing the rear portion (11a; 11a') of the frame and the front portion (11b; 11b') of the frame. In a 37th aspect according to any one of the preceding aspects, the first end of the first carriage, when the first carriage is arranged on the first zone, is arranged at the rear portion. In a 38th aspect according to any one of the preceding aspects, the second end of the first carriage, when the first carriage is disposed on the first zone, is directed towards the middle portion of the frame, optionally disposed at the middle portion. In a 39th aspect according to any one of the preceding three aspects, the first end of the first carriage, when the first carriage is arranged on the second zone, is directed towards the middle portion of the frame, optionally arranged at the middle portion. In an aspect 40th according to any one of the four preceding aspects, the second end of the first carriage, when the first carriage is disposed on the second zone, is disposed at the front portion of the frame.

[0016] In an aspect 41st according to any one of the preceding aspects from 32nd to 40th the support surface (13a; 13a') of the first carriage (13; 13'), in use, is substantially horizontal. In an aspect 42nd according to any one of the preceding aspects from 32nd to 41st the support surface of the first carriage is configured to keep an equal distance from the frame (11; 11'), wherein said distance is measured orthogonally to the support surface (13a; 13a') of the first carriage. In an aspect 43rd according to any one of the preceding aspects from 32nd to 42nd the support surface (13a; 13a') of the first carriage (13; 13') lies substantially on an ideal plane.

[0017] In a 44th aspect according to any one of the preceding aspects from 7th to 43rd, the second carriage (14; 14'), optionally when placed in engaged guide (12: 12'), is placed within the lateral size of the frame (11; 11').

In an aspect 45th according to any one of the preceding aspects from 7th to 44th the second carriage is configured to move along the guide between the second zone and the zone outside the frame, substantially parallel to the longitudinal trajectory of the frame.

[0018] In an 46th aspect according to any one of the preceding aspects from the 7th the 45th, the second carriage (14; 14') has a support surface (14a; 14a') configured to receive at least one support component (ST), optionally a reinforced concrete slab. In an 47th aspect according to any one of the preceding aspects from 7th to 46th, the second carriage (14; 14') comprises a plurality of wheels (14b; 14b') engaged to the guide (12; 12') which are configured to allow the carriage to slide along said guide. In an aspect 48th according to any one of the preceding aspects from 7th to 48th, the second carriage comprises a number of wheels equal to or greater than 4, optionally between 4 and 10, even more optionally between 6 and 10. In an aspect 49th according to any one of the preceding aspects from 7th to 48th, the second carriage has a longitudinal dimension substantially equal to the longitudinal dimension of at least one of the first and second zones.

[0019] In an aspect 50th according to any one of the preceding aspects 7th to 49th, the second carriage extends between a first and a second longitudinal end respectively facing the rear portion of the frame and the front portion of the frame. In a 51st aspect according to the preceding aspect, the first end of the second carriage, when the second carriage is disposed on the second zone, is disposed at the middle portion of the frame. In a 52nd aspect according to any one of the preceding aspects, the second end of the second carriage, when the second carriage is disposed on the second zone, is directed towards the front portion of the frame, optionally disposed at the front portion.

[0020] In an aspect 53rd according to any one of the preceding aspects from 46th to 52nd the support surface of the second carriage, in use, is substantially horizontal. In a 54th aspect according to any one of the preceding aspects from 46th to 53rd the support surface (14a; 14a') of the second carriage (14; 14') is configured to keep an equal distance from the frame (11; 11'), wherein said distance is measured orthogonally to the support surface of the second carriage. In an aspect 55th according to any one of the preceding aspects 46th to 54th, the support surface of the second carriage substantially lies on an ideal plane. In a 56th aspect according to any one of the preceding aspects from 46th to 55th the support surface (14a; 14a') of the second carriage (14; 14') is substantially parallel to the support surface (13a; 13a') of the first carriage (13; 13'). In an aspect 57th according to any one of the preceding aspects from 46th to 56th, the support surface of the second carriage and the support surface of the first carriage lie substantially on a single plane. In a 58th aspect according to any one of the preceding aspects from 46th to 57th the support surface of the second carriage is placed at a distance from the frame substantially identical to a distance present between the support surface of the first carriage and said frame; optionally said distances being measured orthogonally to the support surfaces of said first and second carriages.

[0021] In an aspect 59th according to any one of the preceding aspects from 7th to 58th, the first and second carriages are constrained to each other. In an aspect 60th according to any one of the preceding aspects from 7th to 59th the first and second carriages are constrained in movement. In a 61st aspect according to any one of the preceding aspects from 7th to 60th, the second carriage (14; 14'), during movement of the first carriage (13; 13') from the first to the second zone, is configured to move from the second zone (Z2; Z2') to the outer zone of the frame (11; 11'). In an aspect 62nd according to any one of the preceding aspects from 7th to 61st, the second carriage (14; 14'), during movement of the first carriage (13; 13') from the second zone (Z2; Z2') to the first zone (Z1; Z1'), is configured to move from the outer zone to the second zone (Z2; Z2').

[0022] In an aspect 63rd according to any one of the preceding aspects from 7th to 62nd the first and second carriages are constrained to each other by means of a connecting element (15; 15'), optionally comprising an elongated body. In a 64th aspect according to any one of the preceding aspects, the connecting element (15; 15') is hinged, on one side, to the first carriage (optionally to the second end of the first carriage) and, on the other side, is hinged to the second carriage (optionally to the first end of the second carriage). In an aspect 65th according to any one of the preceding two aspects, the connecting element (15; 15') comprises at least one bar.

[0023] In a 66th aspect according to any one of the preceding aspects from 4th to 65th, the handling system (1; 1') comprises at least one actuator configured to allow movement by sliding of the at least one carriage. In a 67th aspect according to any one of the preceding aspects from 7th to 66th, the handling system (1; 1') comprises at least one actuator configured to allow sliding movement of the first and second trolleys along the guide. In a 68th aspect according to any one of the two preceding aspects, the actuator comprises at least one of: an electric motor, a hydrostatic motor. In an aspect 69th according to any one of the three preceding aspects the actuator is directly active only on one of said first and second carriages. In an aspect 69bis according to any one of the preceding aspects from 66th to 69th the actuator is configured to directly move only one of said first and second carriages along the guide, wherein the other of said second or first carriage is guided in movement by the at least one of said first or second carriage, optionally by means of the constrained first and second carriage generated by the connecting element (15). In an aspect 69ter according to any one of the preceding aspects from 66th to 69bis the actuator comprises:

at least one dragging element (17; 17') connected to the first carriage (13; 13') and configured to move

said first carriage along the guide,
at least one transmission organ (18; 18') engaged to the dragging element (17; 17') and movable by rotation around an axis to allow movement of the dragging element (17; 17') and consequently of the first carriage (13; 13'),
at least one motor, optionally a hydrostatic motor, active on the transmission organ (18) and configured to allow the rotation of this transmission organ.

[0024] In a 70th aspect according to any one of the preceding aspects the transmission organ comprises at least one of: a toothed wheel, a crown wheel, a friction wheel. In a 71st aspect according to any one of the two preceding aspects the dragging element comprises at least one of: a belt, a chain.

[0025] In an aspect 72nd according to any one of the three preceding aspects, the dragging element is constrained, on the one hand, to the frame and, on the other hand, is constrained only to the first carriage. In a 73rd aspect according to any one of the four preceding aspects, the actuator comprises a single motor active directly on the at least one transmission organ. In an aspect 74th according to any one of the five preceding aspects, the second carriage is movable along the guide only as a result of the movement of the first carriage imparted by said at least one actuator. In a 75th aspect according to any one of the preceding aspects the handling system (1; 1'; 1") comprises at least one lift engaged at the frame (11) and active at at least one of the first zone (Z1; Z1'; Z1") and the second zone (Z2; Z2'; Z2"). In a 76th aspect according to any one of the preceding aspects, the at least one lift is configured to lift one or more support components relative to the frame. In a 77th aspect according to any one of the preceding aspects the at least one lift, in use, is configured to vertically move the one or more support components. In an 78th aspect according to any one of the three preceding aspects the at least one lift is configured to move the one or more support components along a direction orthogonal to the support plane of said at least one of said first and second carriages. In a 79th aspect according to any one of the preceding aspects, the handling system (1) comprises:

a first lift (20) engaged at the frame (11) and active at the first zone (Z1),
a second lift (25) engaged at the frame (11) and active at the second zone (Z2).

[0026] In an 80th aspect according to any one of the preceding aspects, the first lift (20) is configured to move the one or more support components (ST) relative to the at least one carriage, optionally relative to at least one of the first carriage and the second carriage. In an 81st aspect according to any one of the two preceding aspects, the first lift (20) is movable between:

a raised position where the first lift (20) is configured to distance one or more support components (ST) from at least one carriage, optionally from at least one of said first and second carriages,
a lowered position where the first lift (20) is configured to allow one or more support components (ST) to rest on at least one of said first and second carriages.

[0027] In an 82nd aspect according to the preceding aspect, the first lift (20), during movement between the lowered position and the raised position, is configured to lift the one or more support components relative to the at least one carriage, optionally relative to the at least one of the first carriage (13) and the second carriage (14). In an 83rd aspect according to any one of the two preceding aspects, the first lift (20), during movement between the lowered position and the raised position, is configured to distance the one or more support components with respect to the frame (11). In an 84th aspect according to any one of the three preceding aspects, the first lift (20), in use, during movement between the lowered position and the raised position, is configured to vertically move the one or more support components away from the frame (11).

[0028] In an 85th aspect according to any one of the preceding aspects from 79th to 84th the first lift (20) comprises an upper surface (21) configured to receive in support the one or more support components (ST). In an 86th aspect according to the preceding aspect the upper surface (21) of the first lift (20), in use and in the lowered position of the first lift (20), is positioned below the support surface of the at least one carriage, optionally below the support surfaces of the first carriage (13) and the second carriage (14). In an 87th aspect according to any one of the two preceding aspects, the upper surface (21) of the first lift (20), in use and in the raised position of the first lift (20), is placed above the support surface of the at least one carriage, optionally above the support surfaces of the first carriage (13) and the second carriage (14).

[0029] In an 88th aspect according to any one of the preceding aspects from 79th to 87th the first lift (20) comprises at least one first and second arms (22, 23) respectively engaged at the first and second lateral edges of the frame. In an 89th aspect according to the preceding aspect the first and second arms of the first lift define the upper surface (21) of the first lift (20). In a 90th aspect according to any one of the preceding aspects, the guide (12) is interposed between the first and second arms of the first lift (20). In an aspect 91st according to any one of the three preceding aspects the first carriage (13), at least when arranged at the first zone (Z1), is interposed between the first and second arms of the first lift (20).

[0030] In an aspect 92nd according to any one of the preceding aspects from 79th to 91st, the handling system (1) comprises at least one actuator (24) engaged, on the one hand, to the frame (11) and, on the other hand, to the first lift (20), wherein said actuator (24) is configured to

move said first lift (20) from the lowered position to the raised position, and vice versa. In a 93rd aspect according to the preceding aspect, the actuator (24) active on the first lift (20) is configured to allow movement of the first and second arms (22, 23) of said first lift (20) relative to the frame (11). In a 94th aspect according to any one of the two preceding aspects the actuator (24) active on said first lift (20) comprises at least one of: a hydraulic cylinder, an electric motor.

[0031] In a 95th aspect according to any one of the preceding aspects from 79th to 94th, the second lift (25) is configured to move one or more support components (ST) relative to the at least one carriage, optionally relative to at least one of the first carriage and the second carriage. In a 96th aspect according to any one of the preceding aspects from 79th to 95th the second lift (25) is movable between:

a raised position where the second lift (25) is configured to distance one or more support components (ST) from at least one carriage, optionally from at least one of the first carriage and the second carriage,

a lowered position where the second lift (25) is configured to allow one or more support components (ST) to rest on the at least one carriage, optionally at least one of the first carriage and the second carriage.

[0032] In a 97th aspect according to the preceding aspect, the second lift (25), during movement between the lowered position and the raised position, is configured to lift the one or more support components relative to the at least one carriage, optionally relative to the at least one of the first carriage and the second carriage. In a 98th aspect according to any one of the two preceding aspects, the second carriage (25), during movement between the lowered position and the raised position, is configured to distance the one or more support components with respect to the frame (11). In a 99th aspect according to any one of the three preceding aspects, the second carriage (25), in use, during movement between the lowered position and the raised position, is configured to vertically move the one or more support components away from the frame (11).

[0033] In a 100th aspect according to any one of the preceding aspects from 74th to 99th, the second lift (25) comprises an upper surface (26) configured to receive in support the one or more support components (ST). In a 101st aspect according to the preceding aspect, the upper surface (26) of the second lift (25), in use and in the lowered position of the second lift (25), is positioned below the support surface (13a, 14a) of the first and second carriages (13, 14). In a 102nd aspect according to any one of the two preceding aspects, the upper surface (26) of the second lift (25), in use and in the raised position of the second lift (25), is positioned above the support surface (13a, 14a) of the first and second carriages (13, 14).

[0034] In a 103rd aspect according to any one of the preceding aspects from 74th to 102nd, the second lift (25) comprises at least one first and second arms (27, 28) respectively engaged at the first and second lateral edges (11c, 11d) of the frame (11). In a 104th aspect according to the preceding aspects, the first and second arms (27, 28) of the second lift define the upper surface (26) of the second lift (25) itself. In a 105th aspect according to any one of the two preceding aspects, the guide (12) is interposed between the first and second arms of the second lift (25). In a 106th aspect according to any one of the three preceding aspects the second carriage (14), at least when arranged at the second zone (Z2), is interposed between the first and second arms of the second lift (25).

[0035] In a 107th aspect according to any one of the preceding aspects from 74th to 106th the handling system (1) comprises at least one actuator (29) engaged, on the one hand, to the frame (11) and, on the other hand, to the second lift (25), wherein said actuator (29) is configured to move said second lift (25) from the lowered position to the raised position, and vice versa. In a 108th aspect according to the preceding aspect, the actuator (29) active on the second lift is configured to allow movement of the first and second arms of the second lift relative to the frame (11). In a 109th aspect according to any one of the two preceding aspects the actuator (29) active on the second lift (25) comprises at least one of: a hydraulic cylinder, an electric motor.

[0036] In an aspect 110th according to any one of the preceding aspects, the handling system (1) comprises at least one control unit. In a 111th aspect according to the preceding aspect, the control unit is connected to at least one actuator of the handling system (1). In a 112th aspect according to any one of the two preceding aspects the control unit is active in command on the first lift (20) and on the second lift (25). In a 113th aspect according to any one of the three preceding aspects the control unit is active in command on:

the actuator configured to move at least one carriage, optionally the first and second carriage along the guide (12),

the actuator (24) of the first lift (20),

the actuator (29) of the second lift (25).

[0037] In a 114th aspect according to any one of the four preceding aspects, the control unit is configured to perform an advancement procedure configured to allow movement of a plurality of support components (ST), wherein said advancement procedure performed by the control unit comprises the following steps:

arrange the first and second lifts (20, 25) in the lowered position,

when the first and second lifts (20, 25) are in the lowered position, command the movement of at least

one carriage along the guide (12) in such a way that at least one carriage may move from the first zone (Z1) to the second zone (Z2),
command the movement of the first and second lifts (20, 25) from the lowered to the raised position to allow one or more support components (ST) to be lifted from at least one carriage,
then, when the first and second lifts (20, 25) are in the raised position, command the movement of at least one carriage along the guide (12) so that this carriage may move from the second zone (Z2) to the first zone (Z1),
then, command again the movement of the first and second lifts (20, 25) from the raised position to the lowered position, optionally in such a way that one or more of the components supported by the second lift (25) may be loaded onto at least one carriage.

[0038] In a 115th aspect according to the preceding aspect, the advancement procedure performed by the control unit may comprises the following steps:

arrange the first and second lifts (20, 25) in the lowered position,
when the first and second lifts (20, 25) are in the lowered position, command the movement of the first and second carriages (13, 14) along the guide (12) in such a way that the first carriage (13) may move from the first zone (Z1) to the second zone (Z2) while the second carriage (14) may move from the second zone (Z2) to the outer zone of the frame, optionally during this movement the first and second carriages are each configured to support one or more support components (ST),
command the movement of the first and second lifts (20, 25) from the lowered to the raised position to allow one or more support components (ST) to be lifted from the first carriage (13),
then, when the first and second lifts (20, 25) are in the raised position, command the movement of the first and second carriages (13, 14) along the guide (12) so that the first carriage (13) may move from the second zone (Z2) to the first zone (Z1) while the second carriage (14) may move from the outer zone to the second zone (Z2) of the frame, optionally during this movement the second lift (25) is configured to support one or more components carried on the second zone by the first carriage (13),
then, command the movement of the first and second lifts (20, 25) from the raised position to the lowered position, optionally so that one or more of the components supported by the second lift (25) may be loaded onto the second carriage (14).

[0039] In a 116th aspect according to any one of the six preceding aspects, the handling system further comprises at least one first sensor connected the control unit and configured to output a signal representative of the position of the first and second carriages (13, 14) relative to the guide (12). In an aspect 117th according to any one of the seven preceding aspects, the handling system further comprises at least one second sensor connected to the control unit and configured to output a signal representative of the lowered or raised position of the first and second carriages. In an aspect 118th a process for moving support components (ST) by means of a handling system (1) in accordance with any one of the preceding aspects 1st to 117th is provided. In an 119th aspect according to the preceding aspect, the process comprises the following steps:

arrange the first carriage (13) at the first zone (Z1) and the second carriage at the second zone (Z2),
arrange on the first carriage (13) a first plurality of support components placed one above the other to define a first stack (P1) of support components,
arrange on the second carriage (14) a second plurality of support components placed one above the other to define a second stack (P2) of support components,
arrange the first and second lifts (20, 25) in the lowered position,
during the lowered position of the first and second lifts (20, 25), move the first and second carriages (13, 14) in relation to the frame (11) in such a way that the first carriage (13) moves from the first zone (Z1) to the second zone (Z2) while the second carriage (14) may move from the second zone (Z2) to the outer zone of the frame,
move at least the first and second lifts (20, 25) from the lowered to the raised position so that the second lift (25) may receive the first stack (P1) of support components,
during the raised position of the first and second lifts (20, 25), move the first and second carriages in relation to the frame in such a way that the first carriage (13) may move from the second zone (Z2) to the first zone (Z1) while the second carriage (14) may move from the outer zone to the second zone (Z2) of the frame, wherein during such movement of the first and second carriages (13, 14) the first stack (P1) of support components is supported by the second lift (25),
move at least the first and second lifts (20, 25) from the raised position to the lowered position so that the first stack (P1) of support components may be placed on the second carriage.

[0040] In a 120th aspect according to any one of the two preceding aspects, the process, following the positioning of the first stack (P1) of support components on the second carriage, involves the positioning of a further stack (FP) of support components on the first carriage (13).

[0041] In a 121st aspect according to any one of the three preceding aspects, the first stack (P1) of support

components comprises a number of support components equal to or greater than 2, optionally between 2 and 6. In a 122nd aspect according to any one of the four preceding aspects the second stack (P2) of support components comprises a number of support components equal to or greater than 2, optionally between 2 and 6. In a 123rd aspect according to any one of the five preceding aspects, each support component (ST) comprises at least one concrete slab configured to receive in engagement at least one rail of a railway line.

[0042] In a 124th aspect according to any one of the preceding aspects, the handling system (1') comprises a lift (20') engaged to the frame (11') and active at the first zone (Z1'). In a 125th aspect according to the preceding aspect, the lift (20') is configured to move one or more support components (ST) relative to the first carriage (13'). In a 126th aspect according to any one of the two preceding aspects, the lift (20') is movable between:

a raised position where the lift (20') is configured to distance one or more support components (ST) from at least one carriage, optionally from at least one of the first and second carriage,
a lowered position where the lift (20') is configured to allow one or more support components (ST) to rest on the at least one carriage, optionally at least one of the first and second carriage.

[0043] In a 127th aspect according to the preceding aspect, the lift (20'), during movement between the lowered position and the raised position, is configured to lift one or more support components relative to the first carriage (13'). In a 128th aspect according to any one of the two preceding aspects, the lift (20'), during movement between the lowered position and the raised position, is configured to distance one or more support components relative to the frame (11'). In a 129th aspect according to any one of the three preceding aspects, the lift (20'), in use, during movement between the lowered position and the raised position, is configured to vertically move the one or more support components away from the frame (11').

[0044] In a 130th aspect according to any one of the preceding aspects from 124th to 129th, the lift (20') comprises an upper surface (21') configured to receive in support one or more support components (ST). In a 131st aspect according to the preceding aspect, the upper surface (21') of the lift (20'), in use and in the lowered position of the lift (20'), is located below the support surface (13a') of the first carriage (13'). In a 132nd aspect according to any one of the two preceding aspects, the upper surface (21') of the lift (20'), in use and in the raised position of the lift (20'), is positioned above the support surface (13a') of the first carriage (13').

[0045] In a 133rd aspect according to any one of the preceding aspects from 124th to 132nd, the lift (20') comprises at least one first and second arms respectively engaged at the first and second lateral edges (11c', 11d') of the frame (11'). In a 134th aspect according to the preceding aspect, the first and second arms define the upper surface (21') of the first lift (20'). In a 135th aspect according to any one of the two preceding aspects, the guide (12') is interposed between the first and second lift arms (20'). In a 136th aspect according to any one of the three preceding aspects, the first carriage (13'), at least when arranged at the first zone (Z1'), is interposed between the first and second arms of the lift (20').

[0046] In a 137th aspect according to any one of the preceding aspects from 124th to 136th the handling system (1') comprises at least one actuator (24') engaged, on one side, to the frame (11') and, on the other side, to the lift (20'), wherein said actuator (24') is configured to move said lift (20') from the lowered position to the raised position, and vice versa. In a 138th aspect according to the preceding aspects, said actuator (24') active on said lift (20') is configured to allow movement of said first and second arms of said lift (20') relative to said frame (11'). In a 139th aspect according to any one of the two preceding aspects the actuator (24') active on said lift (20') comprises at least one of: a hydraulic cylinder, an electric motor.

[0047] In a 140th aspect according to any one of the preceding aspects, the handling system (1') comprises a de-stacker (30) engaged at the frame (11') and active at the second zone (Z2'). In an aspect 140bis according to the preceding aspect, the de-stacker (30) is arranged only at the second zone (Z2). In a 141st aspect according to any one of the two preceding aspects, the de-stacker (30) is configured to simultaneously lift a plurality of support components relative to the frame (11'). In a 142nd aspect according to any one of the three preceding aspects, the de-decollator (30), in use, is configured to vertically move the one or more support components. In an 143rd aspect according to any one of the four preceding aspects, the de-stacker (30) is configured to move the one or more support components (optionally only) along a direction orthogonal to the support plane of at least one of said first and second carriages (13', 14'). In a 144th aspect according to any one of the preceding aspects from 140th to 143rd, the de-stacker (30) is configured to move the one or more support components (ST) relative to said first and second carriages (13', 14'). In a 145th aspect according to any one of the preceding aspects from 140th to 144th the at least one part of the de-stacker (30) is movable from at least one of the following plurality of operating positions:

a lowered position wherein said at least one de-stacker (30) is arranged at said at least one carriage, optionally at said first or second carriage (13', 14'), wherein said at least one carriage is arranged at said second zone (Z2'), wherein said de-stacker (30) when arranged in the lowered position is configured to pick up one or more support components from said at least one carriage (optionally from said first or second carriage 13', 14') and/or unload one or more

support components onto said at least one carriage arranged in said second zone (Z2'),
an intermediate pick-up position where the de-stacker (30) is configured to contact one or more support components spaced by said at least one carriage placed in the second zone (Z2'),
at least one raised position where said de-stacker (30) is configured to distance one or more support components from said at least one carriage arranged in the second zone (Z2').

[0048] In an aspect 145bis according to the preceding aspect wherein at least a part of the de-stacker (30) is movable at least between:

the lowered position,
a first raised position where said de-stacker (30) is configured to lift all supporting components from said at least one carriage placed in the second zone (Z2'),
an intermediate pick-up position where the de-stacker (30) is configured to contact one or more support components spaced from said at least one carriage placed in the second zone (Z2'), optionally contacting one or more support components placed above the support component placed in direct contact with the at least one carriage placed in the second zone (Z2'),
at least a second raised position where said de-stacker (30) is configured to distance, with respect to the frame, the one or more support components spaced from said at least one carriage arranged in the second zone (Z2') with respect to, optionally distancing from the frame the one or more support components placed above the support component placed in direct contact with the at least one carriage arranged in the second zone (Z2').

[0049] In an aspect 145ter according to any one of the preceding aspects from 140th to 145bis the de-stacker (30) is placed to the side of the at least one carriage when disposed in the second zone. In an aspect 145quater according to any one of the preceding aspects from 140th to 145ter the de-stacker (30) is not arranged above the at least one carriage, optionally when arranged in the second zone (Z2').

[0050] In an aspect 145quinquies according to any one of the preceding aspects from 140th to 145quater the de-stacker is configured to move the one or more support components (optionally a plurality) only along a direction orthogonal to the longitudinal trajectory of the frame, optionally vertical, in use. In an aspect 145sexies according to any one of aspects 140th to 145quinquies the de-stacker is only movable along a direction orthogonal to the longitudinal trajectory of the frame, optionally in vertical use. In an aspect 145septies according to any one of the preceding aspects from 140th to 145sexies the de-stacker is not movable approaching and/or moving away from the first zone. In a 146th aspect according to any one of the preceding aspects, the de-stacker (30) comprises at least one lifting arm configured to lift (optionally directly contact and lift) one or more support components relative to the frame (11'). In a 147th aspect according to the preceding aspects said at least one lifting arm is movable at least between the operating positions of the de-stacker. In an 148th aspect according to any one of the two preceding aspects, the lifting arm is movable between the following operating positions: the lowered position, the intermediate picking position, the at least one lifting position, optionally the first and second lifting positions.

[0051] In a 149th aspect according to any one of the three preceding aspects the intermediate pick-up position is interposed between the lowered position and the at least one raised position. In a 150th aspect according to any one of the four preceding aspects the at least one lifting arm, in the lowered position presents a first distance from the frame (11') while when placed in the intermediate picking position presents a second distance from the frame (11') greater than the first distance. In a 151st aspect according to any one of aspects from 146th to 150th the at least one lifting arm, when placed in the at least one raised position, presents a third distance from the frame (11') greater than the second distance.

[0052] In an aspect 151bis according to any one of the preceding aspects from 146th to 151st the at least one lifting arm of the de-stacker, at least in the lowered position, is placed to the side of the at least one carriage when placed in the second zone (Z2').

[0053] In a 152nd aspect according to any one of the preceding aspects from 140th to 151st the de-stacker (30) comprises:

a first column (31) arranged at the first lateral edge (11c') of the frame (11'),
a second column (32) arranged at the second lateral edge (11d') of the frame (11').

[0054] In a 153rd aspect according to the preceding aspect the first and second columns (31, 32) are engaged at the frame (11'). In a 154th aspect according to any one of the two preceding aspects the first and second columns (31, 32) extend in height along respective extension directions parallel to each other starting from the frame. In a 155th aspect according to any one of the three preceding aspects the first and second columns (31, 32) extend along extension directions orthogonal to the support surface of the first and second carriages (13', 14').

[0055] In a 156th aspect according to any one of the preceding aspects from 151st to 155th the at least one carriage, optionally at least one of the first and second carriages (13', 14'), when disposed at the second zone (Z2'), is interposed between the first and second columns (31, 32) of the de-stacker (30). In a 157th aspect according to any one of the preceding aspects from 151st to 156th the guide (12') is at least partially interposed between the first and second columns (31, 32) of the de-stacker (30).

[0056] In a 158th aspect according to any one of the preceding aspects from 151st to 157th the de-stacker comprises one lifting arm for each of said first and second columns (31, 32). In a 159th aspect according to any one of the preceding aspects from 151st to 158th de-stacker comprises two lifting arms, one for each column.

[0057] In a 160th aspect according to any one of the preceding aspects from 151st to 159th the first column (31) comprises:

a first and second uprights (33, 35) spaced along a direction parallel to the extension trajectory (T1') of the frame (11'), wherein said first and second uprights are parallel to each other and extend along directions orthogonal to the support surface of at least one carriage,
a first lifting arm (37) engaged at said first and second uprights (33, 35), said first lifting arm (37) being sliding movable along said first and second uprights (33, 35) of the first column (31) between the plurality of operating positions.

[0058] In a 161st aspect according to the preceding aspect the first and second uprights (33, 35) of the first column are fixed relative to the frame (11'). In a 162nd aspect according to any one of the two preceding aspects only the first arm (37) of the first column (31) is movable relative to the frame (11'). In a 163rd aspect according to any one of the three preceding aspects the first lifting arm (37) comprises:

a connecting body (39) engaged for sliding to the first and second uprights (33, 35),
at least one support element (41) carried by the connection body (39) which is configured to receive one or more support components (ST).

[0059] In a 164th aspect according to the preceding aspect, the connecting body (39) comprises at least one of: a bar, a profile, a beam. In a 165th aspect according to any one of the two preceding aspects the connecting body (39) extends along a direction, in use, horizontal. In a 166th aspect according to any one of the three preceding aspects, the connecting body (39) extends along an extension direction, which is parallel to the support surface (13a', 14a') of the first and second carriages (13', 14'). In a 167th aspect according to any one of the four preceding aspects said at least one support element (41) is movable relative to the connecting body (39) at least between:

an extended position where said support element is configured to intercept and support one or more support elements (ST),
a retracted position.

[0060] In a 168th aspect according to the preceding aspect the support element (41), in the retracted position, is configured not to contact the support components (ST), optionally carried by the first and/or second carriage (13', 14'). In a 169th aspect according to any one of the two preceding aspects, the support element (41) is configured to contact the one or more support components (ST) only when arranged in the extended position. In a 170th aspect according to any one of the three preceding aspects the support element (41) is hinged to the connecting body (39). In a 171st aspect according to any one of the four preceding aspects the support element (41) is configured to rotate relative to the connecting body (39) between the extended position and the retracted position around an axis, in use, that is vertical. In a 172nd aspect according to any one of the five preceding aspects, the first lifting arm (37) comprises a plurality of support elements (41) spaced apart along a direction parallel to the extension trajectory (T1') of the frame (11'). In a 173rd aspect according to any one of the six preceding aspects, the first lifting arm comprises between 2 and 6 support elements, optionally between 2 and 5. In a 174th aspect according to any one of the seven preceding aspects, the support elements (41) of the first lifting arm (37) are equidistant from each other.

[0061] In a 175th aspect according to any one of the preceding aspects from 160th to 174th the first column (31) comprises at least one actuator (31a) configured to allow movement of the first lifting arm (37) relative to the frame (11'). In a 176th aspect according to the preceding aspect said at least one actuator (31a) comprises two hydraulic cylinders both active on the first lifting arm (37) at the first and second columns (33, 35) respectively.

[0062] In a 177th aspect according to any one of the preceding aspects 163rd to 176th the first column (31) comprises at least one actuator (43) active on the at least one support element (41), optionally on a plurality of support elements. In a 178th aspect according to the preceding aspect said actuator (43) active on the at least one support element is configured to move said at least one support element from the retracted position to the extended position, and vice versa. In a 179th aspect according to any one of the two preceding aspects said actuator active on said at least one support element (41) comprises at least one of: a hydraulic cylinder, a pneumatic actuator, an electric motor.

[0063] In a 180th aspect according to any one of the preceding aspects from 151st to 179th the second column (32) comprises:

a first and second uprights (34, 36) spaced apart along a direction parallel to the extension trajectory (T1') of the frame (11'), wherein said first and second uprights (34, 36) are parallel to each other and extend along directions orthogonal to the support surface of the at least one carriage,
a second lifting arm (38) engaged at said first and second uprights (34, 36), said second lifting arm (38) being sliding movable along said first and second uprights (34, 36) of said second column (32) be-

tween said plurality of operating positions.

[0064] In a 181st aspect according to the preceding aspect the first and second uprights (34, 36) of the second column are fixed relative to the frame (11'). In a 182nd aspect according to any one of the two preceding aspects only the second arm (38) of the second column (32) is movable relative to the frame (11'). In a 183rd aspect according to any one of the three preceding aspects the second lifting arm (38) comprises:

a connecting body (40) engaged for sliding to the first and second uprights (34, 36) of the second column (32),
at least one support element (42) carried by the connection body (40) of the second column (32) which is configured to receive one or more support components (ST).

[0065] In a 184th aspect according to the preceding aspect, the connecting body (40) of the second column (32) comprises at least one of: a bar, a profile, a beam. In a 185th aspect according to any one of the two preceding aspects, the connecting body (40) of the second column (32) extends along a direction, in use, vertical. In an 186th aspect according to any one of the three preceding aspects, the connecting body (39) of the second column (32) extends along an extension direction, which is parallel to the support surface (13a', 14a') of the first and second carriages (13', 14').

[0066] In a 187th aspect according to any one of the three preceding aspects said at least one support element (42) is movable with respect to the connecting body (40) of the second column (32) at least between:

an extended position where said support element (42) is configured to intercept and support one or more support components (ST),
a retracted position.

[0067] In a 188th aspect according to the preceding aspect the support element (42) of the second column, in the retracted position, is configured not to contact the support components (ST) optionally carried by the first and/or second carriage (13', 14'). In an 189th aspect according to any one of the two preceding aspects, the support element (42) of the second column (32) is configured to contact the one or more support components (ST) only when arranged in the extended position. In a 190th aspect according to any one of the preceding aspects from 183rd to 189th, the support element (42) of the second column (32) is hinged to the connecting body (40) of the second lifting arm. In a 191st aspect according to any one of the preceding aspects from 183rd to 190th the support element (42) of the second column (32) is configured to rotate with respect to the connecting body (40) of the second lifting arm (38) between the extended position and the retracted position around an axis, in use, that is vertical. In a 192nd aspect according to any one of the preceding aspects from 183rd to 191st, the second lifting arm (38) comprises a plurality of support elements (42) spaced apart along a direction parallel to the extension trajectory (T1') of the frame (11'). In a 193rd aspect according to any one of the preceding aspects from 183rd to 192nd the second lifting arm (38) comprises a number of support elements between 2 and 6, optionally between 2 and 5. In a 194th aspect according to any one of the preceding aspects from 183rd to 193rd, the support elements (42) of the second lifting arm (38) are equidistant from each other.

[0068] In a 195th aspect according to any one of the preceding aspects from 151st to 194th the second column (32) comprises at least one actuator (32a) configured to allow movement of the second lifting arm (38) relative to the frame (11'). In a 196th aspect according to any of the preceding aspects said at least one actuator (32a) of the second column (32) comprises two hydraulic cylinders both active on the second lifting arm (38) at the first and second uprights (34, 36) respectively.

[0069] In a 197th aspect according to any one of the preceding aspects from 183rd to 196th the second column (32) comprises at least one actuator (44) active on the at least one support element (42), optionally on a plurality of support elements. In a 198th aspect according to the preceding aspect said actuator active on the at least one support element (42) is configured to move said at least one support element from the retracted position to the extended position, and vice versa. In a 199th aspect according to any one of the two preceding aspects, said active actuator on said at least one support element (42) comprises at least one of: a hydraulic cylinder, a pneumatic actuator, an electric motor.

[0070] In a 200th aspect according to any one of the preceding aspects from 180th to 199th the first and second lifting arms (37, 38) are configured to move simultaneously. In a 201st aspect according to any one of the preceding aspects from 180th to 200th the first and second connecting bodies extend along respective directions to define an ideal lying plane. In a 202nd aspect according to the preceding aspect, the ideal lying plane in use is substantially horizontal. In a 203rd aspect according to any one of the preceding aspects from 180th to 202nd the first and second lifting arms are configured to move simultaneously to keep on a substantially horizontal plane each of the support components carried by said lifting arms. In a 204th aspect according to any one of the preceding aspects from 183rd to 203rd the support elements (41, 42) of the first and second lifting arms (37, 38) are configured to define a support plane for the one or more support components (ST), in use, substantially horizontal.

[0071] In a 205th aspect according to any one of the preceding aspects the handling system (1') comprises at least one control unit. In a 206th aspect according to the preceding aspects the control unit is connected to at least one actuator of the handling system (1'). In a 207th

aspect according to any one of the two preceding aspects the control unit is active in command on the lift (20') and on the de-stacker (30). In a 208th aspect according to any one of the three preceding aspects the control unit is active in command on:

the actuator configured to move the first and second carriage (13', 14') along the guide (12'),
the actuator (24') of the lift (20'),
the actuator (31a') configured to allow movement of the first arm (37),
the actuator (43) active on at least one support element (41) of the first column,
the actuator (32a') configured to allow movement of the second arm (38),
the actuator (44) active on at least one support element (42) of the second column.

[0072] In an 209th aspect according to any one of the four preceding aspects, the handling system control unit (1') is configured to perform a singularisation procedure, optionally configured to allow picking and moving a support component from a plurality of support components (ST) placed one above the other. In a 210th aspect according to the preceding aspect, the singularisation procedure performed by the control unit comprises the following steps:

arrange the lift in the lowered position, optionally in the lowered position the at least one carriage is configured to receive a plurality of support components (ST) placed one above the other to define a stack of supports,
when the lift (20') is in the lowered position, command the movement of at least one carriage along the guide (12') so that this carriage may move from the first zone (Z1') to the second zone (Z2'),
when the carriage is in the second zone (Z2'), arrange the at least one lifting arm of the de-stacker (30) in the lowered position,
then, command the movement of at least one lifting arm from the lowered position to at least one raised position, optionally to lift the entire stack of supporting components (ST),
then command the movement of at least one carriage along the guide (12') so that this carriage may move from the second zone (Z2') to the first zone (Z1'),
then, move the at least one lift arm to the lowered position, optionally to unload the stack of supporting components (ST) onto a further carriage (optionally the second carriage 14' or a different carriage from another handling system),
then, move the at least one lifting arm to the intermediate pick-up position, optionally to intercept the support components above the support component in direct contact with the additional carriage,
then, move the at least one lifting arm from the intermediate pick-up position back to the at least one raised position in such a way that the support components above the support component are in direct contact with the additional carriage,
then, command the movement of said at least one carriage along the guide (12') from the second zone (Z2') to the first zone (Z1').

[0073] In a 211th aspect according to any one of the two preceding aspects, the handling system (1') comprises said first and second carriages (13', 14), wherein the singularisation procedure comprises the following steps:

arrange the lift in the lowered position, optionally in the lowered position lift condition the first carriage (13') is configured to receive a plurality of support components (ST) placed one above the other to define a stack of support components,
when the lift (20') is in the lowered position, command the movement of the first and second carriages (13', 14') along the guide (12') in such a way that the first carriage (13') may move from the first zone (Z1') to the second zone (Z2') while the second carriage (14') may move from the second zone (Z2') to the outer zone of the frame,
when the first carriage (13') is in the second zone (Z2'), arrange the at least one lifting arm of the de-stacker (30) in the lowered position,
then, control the movement of at least one lifting arm from the lowered position to at least one raised position, optionally to lift the entire stack of supporting components (ST),
then, control the movement of the first and second carriages (13', 14') along the guide (12') so that the first carriage (13') may move from the second zone (Z2') to the first zone (Z1') while the second carriage (14') may move from the outer zone to the second zone (Z2') of the frame,
then, move the at least one lift arm to the lowered position, optionally to unload the stack of support components (ST) onto the second carriage (14'),
then, move the at least one lifting arm to the intermediate pick-up position, optionally to intercept the support components above the support component in direct contact with the second carriage (14'),
then, move the at least one lifting arm from the intermediate pick-up position back to the at least one raised position in order to lift the support components above the support component in direct contact with the second carriage (14'),
then, command the movement of the first and second carriages (13', 14') along the guide (12') in such a way that the first carriage (13') may move from the second zone (Z2') to the first zone (Z1') and the second carriage (14') may move from the outer zone to the second zone (Z2') of the frame optionally to move only one carriage component (optionally the carriage component in direct contact with the second

carriage 14') from the second zone (Z2') to the outer zone (11') of the frame (1').

[0074] In a 212nd aspect a process of singularising support components (ST) by means of a handling system (1') in accordance with any one of the preceding aspects is provided. In an aspect 212bis according to the preceding aspect, the singularisation process comprises the following steps:

arrange the first carriage (13') at the first zone (Z1') and the second carriage at the second zone (Z2'),
arrange on the first carriage (13') a plurality of support components (ST) placed one above the other to define a stack of support components,
arrange the lift (20') in the lowered position,
during the lowered position of the lift (20'), first move the first and second carriages (13', 14') in relation to the frame (11') in such a way that the first carriage (13') may move from the first zone (Z1') to the second zone (Z2') while the second carriage (14') may move from the second zone (Z2') to the outer zone of the frame,
when the first carriage (13') is in the second zone (Z2'), arrange the at least one lifting arm of the de-stacker (30) in the lowered position, optionally to allow the entire stack of support components on the first carriage (13') to be intercepted,
then, perform an initial movement of the at least one lift arm from the lowered position to at least one raised position in order to lift the entire stack of supporting components (ST),
then, perform a second movement of the first and second carriages (13', 14') along the guide (12') so that the first carriage (13') may move from the second zone (Z2') to the first zone (Z1') while the second carriage (14') may move from the outer zone to the second zone (Z2') of the frame, during this movement phase the stack of support components remains in the second zone (Z2'), supported by the de-stacker,
then, perform a second movement of at least one lift arm to the lowered position to unload the entire stack of support components (ST) onto the second carriage (14'),
then, perform a third movement of at least one lifting arm to the intermediate pick-up position to intercept the support components above the support component in direct contact with the second carriage (14'),
then, perform a fourth movement of the at least one lifting arm from the intermediate pick-up position to at least one raised position in such a way as to lift the support components above the support component in direct contact with the second carriage (14'), during this phase only one support component is supported by the second carriage (14'),
then, perform a third movement of the first and second carriages (13', 14') along the guide (12') so that the first carriage (13') may move from the second zone (Z2') to the first zone (Z1') while the second carriage (14') may move from the outer zone to the second zone (Z2') of the frame to move only one support component from the second zone (Z2') to the outer zone of the frame (11') of the handling system (1').

[0075] In a 213th aspect according to the preceding aspects, the movements of the at least one lifting arm comprises moving of the first and second lifting arms (37, 38) of the first and second columns. In a 214th aspect according to any one of the two preceding aspects the first carriage (13'), during the first movement of the first and second carriages, supports said first stack of support components. In an 215th aspect according to any one of the three preceding aspects, the at least one lifting arm comprises the first and second lifting arms carrying respective support components. In an 216th aspect according to any one of the four preceding aspects the first and second lifting arm supporting support components, during the first movement of the first and second carriages, are arranged in the retracted position. In a 217th aspect according to any one of the five preceding aspects, the step of arranging the at least one lifting arm of the de-stacker (30) in the lowered position comprises positioning the first and second lifting arms in the lowered position, during said positioning step the support elements carried by the first and second lifting arms are in the retracted position. In a 218th aspect according to any one of the six preceding aspects the first movement of the at least one lifting arm comprises moving the first and second lifting arms from the lowered position to the at least one raised position, optionally during said first movement the support components carried by the first and second lifting arms are in the extended position and support the entire stack of support components. In a 219th aspect according to any one of the seven preceding aspects the second movement of the at least one lifting arm comprises moving the first and second lifting arms from the at least one raised position to the lowered position, optionally during said second movement the support components carried by the first and second lifting arms are in the extended position. In a 220th aspect according to any one of the eight preceding aspects, the support elements carried by the first and second lifting arms, during the transition from the second to the third movement of the at least one lifting arm, are in the retracted position to avoid contact with the support elements. In a 221st aspect according to any one of the nine preceding aspects, the fourth movement of the at least one lifting arm comprises moving the first and second lifting arms from the intermediate pick-up position to the at least one raised position, optionally during said fourth movement the support components carried by the first and second lifting arms are in the extended position. In a 222nd aspect according to any one of the ten preceding aspects, the first support component stack com-

prises a number of support components equal to or greater than 2, optionally between 2 and 6. In a 223rd aspect according to any one of the eleven preceding aspects each support component (ST) comprises at least one concrete slab configured to receive in engagement at least one rail of a railway line.

[0076] In a 224th aspect according to any one of the preceding aspects from 4th to 223rd the at least one carriage of the handling system (1") comprises a single carriage (13") movable for sliding along the guide (12") between the first and second zones (Z1", Z2") of the frame (11").

[0077] In a 225th aspect according to any one of the preceding aspects from 4th to 224th, the carriage (13"), optionally when engaged to the guide (12"), is placed within the lateral size of the frame (11"). In a 226th aspect according to any one of the preceding aspects from 4th to 225th the carriage (13") is configured to move along the guide (12") between the first and second zones, parallel to the longitudinal trajectory (T1") of the frame (11"). In a 227th aspect according to any one of the preceding aspects from 4th to 226th, the carriage (13") has a support surface (13a") configured to receive at least one support component (ST), optionally a reinforced concrete slab. In a 228th aspect according to any one of the preceding aspects from 4th to 227th, the carriage (13") comprises a plurality of wheels (13b") engaged to the guide (12") which are configured to allow the carriage to slide along said guide. In a 229th aspect according to the preceding aspect, the carriage (13") comprises a number of wheels equal to or greater than 4, optionally between 4 and 10, even more optionally between 6 and 10. In a 230th aspect according to any one of the preceding aspects from 4th to 229th, the carriage (13") has a longitudinal dimension substantially equal to the longitudinal dimension of at least one of the first and second zones (Z1", Z2").

[0078] In a 231st aspect according to any one of the preceding aspects from 4th to 230th, the carriage (13") extends between a first and a second longitudinal end respectively facing the rear portion (11a") and the front portion (11b") of the frame. In a 232nd aspect according to the preceding aspect the first end of the carriage, when the carriage (13") is arranged on the first zone (Z1"), is arranged at the rear portion (11a"). In a 233rd aspect according to any one of the preceding two aspects, the second end of the carriage (13"), when the carriage is disposed on the first zone, is optionally and optionally disposed at the middle portion of the frame (11a"). In a 234th aspect according to any one of the three preceding aspects, the first end of the carriage (13"), when the carriage is arranged on the second zone, is facing the middle portion of the frame, optionally and disposed at the middle portion. In a 235th aspect in any one of the four preceding aspects, the second end of the carriage (13"), when the carriage is disposed on the second zone, is disposed at the front portion of the frame.

[0079] In a 236th aspect according to any one of the preceding aspects from 227th to 235th, the support surface (13a") of the carriage (13"), in use, is substantially horizontal. In a 237th aspect according to any one of the preceding aspects from 227th to 236th, the support surface of the carriage (13a") is configured to maintain an equal distance from the frame (11"), wherein said distance is measured orthogonally to the support surface (13a") of the carriage (13"). In a 238th aspect according to any one of the preceding aspects from 227th to 237th the support surface (13a") of the carriage (13") lies substantially on an ideal plane.

[0080] In a 239th aspect according to any one of the preceding aspects, the handling system (1") comprises a lift (20") engaged at the frame (11") and active at the first zone (Z1"), optionally only active at the first zone. In a 240th aspect according to the preceding aspect, the lift (20") is configured to move one or more support components (ST) relative to the single carriage (13") slidably engaged to the guide (12"). In an aspect 241 according to any one of the preceding two aspects, the lift (20") is movable between:

a raised position where the lift (20") is configured to distance one or more support components (ST) from the carriage (13"),
a lowered position where the lift (20") is configured to allow one or more support components (ST) to rest on the carriage (13").

[0081] In a 242nd aspect according to the preceding aspect, the lift (20"), during movement between the lowered position and the raised position, is configured to lift one or more support components relative to the carriage (13"). In a 243rd aspect according to any one of the two preceding aspects, the lift (20"), during movement between the lowered position and the raised position, is configured to distance one or more support components relative to the frame (11"). In a 244th aspect according to any one of the three preceding aspects, the lift (20"), in use, during movement between the lowered position and the raised position, is configured to vertically move the one or more support components away from the frame (11").

[0082] In a 245th aspect according to any one of the preceding aspects from 239th to 244th, the lift (20") comprises an upper surface (21") configured to receive in support one or more support components (ST). In a 246th aspect according to the preceding aspect, the upper surface (21") of the lift (20"), in use and in the lowered position of the lift (20"), is located below the support surface (13a") of the single carriage (13"). In a 247th aspect according to any one of the two preceding aspects, the upper surface (21") of the lift (20"), in use and in the raised position of the lift (20"), is placed above the support surface (13a") of the single carriage (13").

[0083] In a 248th aspect according to any one of the preceding aspects from 239th to 247th the lift (20") comprises at least one first and second arms respectively

engaged at the first and second lateral edges (11c", 11d") of the frame (11"). In a 249th aspect according to the preceding aspects, the first and second lift arms (20") define the upper surface (21") of the lift (20"). In a 250th aspect according to any one of the two preceding aspects, the guide (12") is interposed between the first and second lift arms (20"). In a 251st aspect according to any one of the three preceding aspects, the carriage (13"), at least when arranged at the first zone (Z1"), is interposed between the first and second arms of the lift (20").

[0084] In a 252nd aspect according to any one of the preceding aspects from 239th to 251st the handling system (1") comprises at least one actuator engaged, on one side, to the frame (11") and, on the other side, to the lift (20"), wherein said actuator is configured to move said lift (20") from the lowered position to the raised position, and vice versa. In a 253rd aspect according to any one of the two preceding aspects, the active actuator on the lift (20") is configured to allow movement of the first and second arms of said lift (20") relative to the frame (11"). In a 254th aspect according to any one of the three preceding aspects the active actuator on said lift (20") comprises at least one of: a hydraulic cylinder, an electric motor.

[0085] In a 255th aspect according to any one of the preceding aspects, the handling system (1") comprises at least one unloading device (70) engaged to the frame (11"), optionally active, at the second zone (Z2"), optionally only at the second zone. In a 256th aspect according to the preceding aspects the unloading device (70) is configured to engage the at least one support component located on the at least one carriage (13"), optionally from the single carriage (13"), located at the second zone (Z2") and unload it to an external zone outside the frame (11"). In a 257th aspect according to any one of the two preceding aspects, the unloading device (70) is placed at least partially above the second zone (Z2"). In a 258th aspect according to any one of the three preceding aspects, the unloading device (70) is engaged at at least one of the first lateral edge (11c") and the second lateral edge (11d"). In a 259th aspect according to any one of the four preceding aspects, the unloading device (70) is directly engaged at the first lateral edge (11c") and the second lateral edge (11d"). In an aspect 259bis according to any one of the preceding aspects from 255th to 259th the unloading device (70) comprises:

a base (73) fixed to the frame,
at least one unloading arm (74) of an extendible type constrained to the base (73), said unloading arm being configured to engage at least one support component located at the base (73) and move said support component
outside the frame (11").

[0086] In a 260th aspect according to any one of the six preceding aspects, the unloading device (70) comprises:

a first shoulder (71) fixed to the first lateral edge (11c") of the frame (11"), at the second zone (Z2"), optionally the first shoulder (71) extends from a base end fixed to the first lateral edge (11c") of the frame to an opposing top end,
a second shoulder (72) fixed to the second lateral edge (11d") of the frame (11"), at the second zone (Z2"), optionally the second shoulder (72) extends from a base end fixed to the second lateral edge (11d") of the frame to an opposing top end,

wherein the base (73) fixed to the first and second shoulders (71, 72) at their respective top ends. In a 261st aspect according to the preceding aspect, the guide (12") is interposed between the first and second shoulders (71, 72). In a 262nd aspect according to any one of the aspects 259bis to 261st the base (73) is placed, in use, above the guide (12"). In a 263rd aspect according to any one of aspects from 259bis to 262nd the single carriage (13"), in use and when placed at the second zone (Z2"), is placed below the base (73). In a 264th aspect according to any one of the preceding aspects from 259bis to 263rd the unloading device (70) comprises:

the unloading arm (74) which extends between a first and a second end portion (74a, 74b),
at least one gripping device (75) engaged at the second end portion (74b) of the unloading arm.

[0087] In a 265th aspect according to the preceding aspect, the first end portion (74a) of the unloading arm (74) faces the rear portion (11a") of the frame (11") while the second end portion (74b) faces the front portion (11b") of the frame. In a 266th aspect according to any one of the two preceding aspects, the unloading arm is of the extendable type. In a 267th aspect according to any one of the three preceding aspects at least the second end portion (74b) of the unloading arm (74) is movable relative to the base, optionally together with the gripping device. In a 268th aspect according to any one of the four preceding aspects, the second end portion (74b) of the unloading arm (74) is movable at least between:

a pick-up position where the second end portion (74b) is placed, in use, above the second zone (Z2"),
an unloading position where the second end portion (74b) is placed, in use, outside the frame.

[0088] In a 269th aspect according to the preceding aspect, the second end portion (74b), in use and in the pick-up position, is configured to allow the gripping device (75) to pick up at least one support component (ST) from the single carriage (13") placed in the second zone (Z2"). In a 270th aspect according to any one of the two preceding aspects, the second end portion (74b), in use and in the unloading position, is configured to allow the gripping device to unload the one or more support com-

ponents outside the frame (11").

[0089] In a 271st aspect according to any one of the preceding aspects from 264th to 270th the first end portion (74a) of the unloading arm (74) carries a counterweight (76). In a 272nd aspect according to the preceding aspect the counterweight (76) is arranged, in use, at the first zone (Z1") of the frame (11").

[0090] In a 273rd aspect according to any one of the preceding aspects from 260th to 272nd, the base (73) is arranged at a minimum distance from the frame (11a") of more than 400 mm, optionally between 500 and 1200 mm. In a 274th aspect according to any one of the preceding aspects from 260th to 273rd, the base (73) is arranged at a minimum distance from the support surface (13a") of the single carriage (13") of more than 350 mm, optionally between 400 and 1000 mm.

[0091] In a 275th aspect according to any one of the preceding aspects from 264th to 274th, the gripping device (75) is movable in approach and departure with respect to the frame, optionally along a direction orthogonal to the support surface (13a") of the single carriage (13"). In a 276th aspect according to any one of the preceding aspects from 264th to 275th, the gripping device (75) comprises at least one hook (75a) movable in approach and departure with respect to the frame (11') optionally along a direction orthogonal to the support surface (13a") of the single carriage (13").

[0092] In a 277th aspect according to any one of the preceding aspects from 264th to 276th, the unloading device (70) comprises at least one active actuator on the unloading arm (74) and configured to move said unloading arm (74) relative to the base, optionally between the pick-up position and the unloading position. In a 278th aspect according to the preceding aspect, the active actuator on the unloading arm comprises at least one of: a hydraulic cylinder, a hydraulic motor, an electric motor, a winch (optionally comprising a hydraulic or electric motor, a hydraulic or electric gearbox, a rope or chain, optionally one or more pulleys and a drum).

[0093] In a 279th aspect according to any one of the preceding aspects from 264th to 278th the unloading device (70) comprises at least one active actuator on the gripping device (75) and configured to move said gripping device (75) in approaching and moving away from the frame (11"). In a 280th aspect according to the preceding aspect, the active actuator on the gripping device comprises at least one of: an electric motor, a hydraulic cylinder, a hydraulic motor, an electric actuator, a pneumatic actuator.

[0094] In a 281st aspect according to any one of the preceding aspects the handling system (1") comprises at least one control unit. In a 282nd aspect according to the preceding aspect the control unit is connected to at least one actuator of the handling system (1"). In a 283rd aspect according to any one of the two preceding aspects the control unit is active in command on the lift (20") and the unloading device (70). In a 284th aspect according to any one of the three preceding aspects the control unit is active in command on:

- the actuator configured to move the carriage (13") along the guide (12"),
- the lift actuator (20"),
- the active actuator on the unloading arm (74),
- the active actuator on the gripping device (75).

[0095] In a 285th aspect according to any one of the preceding aspects from 281st to 284th, the handling system control unit (1") is configured to perform an unloading procedure, optionally configured to allow the removal of at least one support component from the carriage (13") and the unloading of said support component from the handling system (1"). In a 286th aspect according to the preceding aspect, the unloading procedure performed by the control unit comprises the following steps:

- arrange the lift (20") in the lowered position, optionally in the lowered position the carriage (13") is configured to receive at least one support component (ST),
- when the lift (20") is in the lowered position, command the movement of the carriage (13") along the guide (12") so that the carriage (13") may move from the first zone (Z1") to the second zone (Z2"),
- when the carriage (13") is in the second zone (Z2"), arrange the second end portion (74b) of the unloading arm (74) above the carriage (13"),
- then, control the approach of the gripping device (75) to the carriage (13") to allow the support component (ST) to be engaged to the gripping device,
- then, command the movement of the second end portion (74b) of the unloading arm (74) outside the frame (11"),
- then, command the movement of the gripping device (75) away from the unloading arm to allow the support component (ST) to be unloaded onto the ground.

[0096] In a 287th aspect according to the preceding aspect the unloading procedure performed by the control unit further comprises a step of commanding the movement of the carriage (13") along the guide (12") in such a way that the carriage (13") may move from the second zone (Z2") to the first zone (Z1"), optionally during said carriage movement step (13") the control unit is configured to command the movement of the lift (20") from the lowered position to the raised position.

[0097] In a 288th aspect a process for unloading support components (ST) by means of a handling system (1") in accordance with any one of the preceding aspects is provided. In a 289th aspect according to any one of the preceding aspects from 286th to 288th the process comprises the following steps:

- arrange the carriage (13") at the first zone (Z1"),

arrange at least one support component (ST) on the carriage (13"),
perform an initial movement of the carriage (13") relative to the frame (11") so that the carriage (13") moves from the first zone (Z1") to the second zone (Z2"),
when the carriage (13") is in the second zone (Z2"), place the second end portion (74b) of the unloading arm above the carriage (13"),
then, arrange the gripping device (75) close to the support component (ST) and hook said support component (ST) onto the gripping device (75),
lift the support component (ST) away from the carriage (13") by moving the gripping device (75) away from the frame (11"),
then, move the second end portion (74b) of the unloading arm (74) away from the base in such a way that the support component engaged by the gripping device is outside the frame (11"),
unload the support component on the ground by moving the gripping device (75) in relation to the unloading arm (74).

[0098] In a 290th aspect according to any one of the preceding aspects from 286th to 289th aspects, the process, prior to the step of placing the support component (ST) on the carriage, involves:

the lift arrangement (20") in the raised position,
the arrangement of at least one support component (ST) on the lift (20"),
moving the lift (20") from the raised position to the lowered position in such a way that the lift (20") may place the at least one support component (ST) on the carriage (13").

[0099] In a 291st aspect according to any one of the preceding aspects 286th to 290th the process, following the step of picking-up the support component (ST) from the carriage (13"), comprises a second movement of the carriage (13") from the second zone (Z2") to the first zone (Z1), optionally such that the carriage (13") may receive another support component (ST). In a 292nd aspect according to any one of the preceding aspects from 286th to 291st each support component (ST) comprises at least one concrete slab configured to receive in engagement at least one rail of a railway line.

[0100] In a 293rd aspect a railway wagon (60) is provided, wherein the railway wagon comprises:

a plurality of axles (61), wherein each axle is constrained by at least one or more wheels configured to move along at least one rail,
at least one platform (62) supported by said plurality of axles,
at least one handling system (1; 1'; 1") in accordance with any one of the preceding aspects.

[0101] In a 294th aspect according to the preceding aspect, the handling system (1; 1'; 1") is engaged to the platform (62) from opposite sides to the axles (61). In a 295th aspect according to any one of the preceding aspects, the handling system (1; 1'; 1") is configured to allow handling of support components (ST) with respect to the platform (62). In a 296th aspect according to any one of the preceding aspects from 293rd to 295th the platform (62) extends longitudinally along an extension direction between a first and a second end (62a, 62b). In a 297th aspect according to the preceding aspects, the extension direction of the platform (62) is substantially parallel to the longitudinal trajectory (T1; T1; T1") of the frame (11; 11'; 11").

[0102] In a 298th aspect according to any one of the preceding aspects from 293rd to 297th, the rear portion of the frame is positioned at the first end (62a) of the platform (62) while the front portion of the frame is positioned at the second end (62b) of the platform (62). In a 299th aspect according to any one of the preceding aspects 293rd to 298th, the frame extends along the entire longitudinal extension of the platform (62).

[0103] In a 300th aspect according to any one of the preceding aspects from 293rd to 299th, the platform (62) has a respective first and second lateral edge (62c, 62d) spaced apart from each other along a direction orthogonal to the direction of extension of said platform. In a 301st aspect according to the preceding aspect, the first and second lateral edges (62c, 62d) define a lateral size of said platform (62). In a 302nd aspect according to the preceding aspect, the first lateral edge of the frame is positioned at the first edge of the platform (62). In a 303rd aspect according to any one of the two preceding aspects, the second frame edge is placed at the second edge (62d) of the platform (62). In a 304th aspect according to any one of the three preceding aspects, the first and second lateral edges (62c, 62d) define a lateral size of the platform (62). In a 305th aspect according to any one of the four preceding aspects, the first and second lateral edges (62c, 62d) of the platform are placed at a minimum distance from each other, optionally measured orthogonally to the direction of extension of said platform. In a 306th aspect according to any one of the five preceding aspects, the minimum distance between the first and second lateral edges (62c, 62d) of the platform is greater than 2,000 mm, optionally between 2,300 and 2,800 mm. In a 307th aspect according to any one of the six preceding aspects, the lateral size of the platform (62) is substantially equal to the lateral size of the frame of the handling system (1; 1'; 1").

[0104] In a 308th aspect according to any one of the preceding aspects from 293rd to 307th, the railway wagon comprises at least one handling system (1) in accordance with any one of the preceding aspects from 1st to 117th, to define a railway wagon for transporting a plurality of support components (ST). In a 309th aspect according to any one of the preceding aspects, the railway wagon comprises at least one handling system (1') in

accordance with any one of the preceding aspects from 1st to 78th, 124th to 211th, to define a railway wagon for singularising a plurality of support components (ST). In a 310th aspect according to any one of the preceding aspects from 7th to 309th, the second carriage (14; 14'), during movement with respect to the frame (11; 1'1), is configured to protrude from the platform (62), optionally from the lateral of the second end (62b) of said platform (62).

[0105] In a 311th aspect according to any one of the preceding aspects from 293rd to 310th, the railway wagon comprises at least one handling system (1") according to any one of the following aspects from 1st to 78th, from 224th to 287th, to define a railway wagon for unloading support components (ST).

[0106] In a 312th aspect a railway vehicle comprising at least one railway wagon (60) according to any one of the preceding aspects from 293rd to 311st is provided. In a 313rd aspect according to the preceding aspect, the railway vehicle comprises at least one locomotive configured to allow the at least one railway wagon (60) to be moved along rails. In a 314th aspect according to any one of the two preceding aspects, the railway vehicle comprises:

at least one first railway wagon in accordance with the 308th aspect to define a railway wagon for transporting a plurality of supporting components (ST),
at least one second railway wagon in accordance with the 309th aspect to define a railway wagon for the singularisation of support components (ST),
at least one third railway wagon in accordance with the 311th aspect to define a railway wagon for unloading support components (ST).

[0107] In a 315th aspect according to the preceding aspect the first and second rail wagons are engaged with each other. In a 316th aspect according to any one of the preceding aspects from 312th to 315th the second end of the first rail car is facing the first end of the second rail car. In a 317th aspect according to any one of the preceding aspects from 312th to 316th the first and second railway wagons are engaged with each other by means of an articulated joint. In a 318th aspect according to any one of the preceding aspects from 312 to 317 the second and third railcars are engaged with each other. In a 319th aspect according to any one of the preceding aspects from 312nd to 318th the second end of the second rail car is facing the first end of the third rail car. In a 320th aspect according to any one of the preceding aspects from 312nd to 319th the second and third rail wagons are engaged by means of an articulated joint.

[0108] In a 321at aspect according to any one of the preceding aspects from 312nd to 320th the second rail car is interposed between the first and third rail cars. In a 322nd aspect according to any one of the preceding aspects from 312th to 321st the first, second and third rail wagons are placed consecutively to each other along a forward direction of said vehicle.

[0109] In a 323rd aspect according to any one of the preceding aspects from 312nd to 322nd the second carriage (14) of the handling system (1) of the first railway wagon is configured to move from the second zone (Z2) of the handling system (1) of the first railway wagon (1) to the first zone (Z1) of the handling system (1') of the second railway wagon. In a 324th aspect according to any one of the preceding aspects from 312th to 323rd the second carriage (14) of the handling system (1) of the first railway wagon is configured to move from the second zone (Z2) of the handling system (1) of the first railway wagon to the first zone (Z1') of the handling system (1') of the second railway wagon:

during the movement of the first carriage (13) of the handling system (1) of the first railway wagon from the first to the second zone (Z1, Z2) of the handling system (1) carried by the first railway wagon,
when moving the first carriage (13) of the handling system (1') of the second railway wagon from the first to the second zone (Z1', Z2') of the handling system (1') carried by the second railway wagon.

[0110] In a 325th aspect according to any one of the preceding aspects from 312th to 324th, the vehicle comprises at least one connecting guide connecting the guide (12) of the handling system (1) carried by the first railway wagon with the guide (12') of the handling system (1') carried by the second railway wagon railway carriage to allow the second carriage of the handling system (1) carried by the first railway carriage to move from the second zone (Z2) of the handling system of the first railway carriage to the first zone (Z1') of the handling system (1') carried by the second railway carriage. In a 326th aspect according to the preceding aspect, the connecting guide represents an extension of the guides (12, 12') of the handling systems (1, 1') respectively carried by the first and second railway wagon, capable of allowing the second carriage (14) of the handling system carried by the first railway wagon to slide.

[0111] In a 327th aspect according to any one of the preceding aspects from 312th to 326th the second carriage (14) of the handling system (1) of the first railway wagon is configured to move from the second zone (Z2) of the handling system (1) of the first railway wagon (1) to the first zone (Z1) of the handling system (1') of the second railway wagon. In a 328th aspect according to any one of the preceding aspects from 312th to 327th the second carriage (14') of the handling system (1) of the second railway wagon is configured to move from the second zone (Z2) of the handling system (1) of the second railway wagon to the first zone (Z1") of the handling system (1") of the third railway wagon:

during the movement of the first carriage (13') of the handling system (1') carried by the second railway wagon from the first to the second zone (Z1', Z2') of

the handling system (1') carried by the second railway wagon,
when moving the carriage (13") of the handling system (1") of the third railway wagon from the first to the second zone (Z1", Z2") of the handling system (1") carried by the third railway wagon.

[0112] In a 329th aspect according to any one of the preceding aspects from 312th to 328th, the vehicle comprises at least one connecting guide connecting the guide (12') of the handling system (1') carried by the second rail car with the guide (12") of the handling system (1") carried by the third rail car to enable the second carriage (14') of the handling system (1") carried by the second railway wagon to move from the second zone (Z2") of the handling system (1") carried by the first railway wagon to the first zone (Z1") of the handling system (1") carried by the third railway wagon. In a 330th aspect according to the preceding aspect, the connecting rail represents an extension of the guides (12', 12") of the handling systems (1', 1") carried by the second and third rail carriages respectively, which is suitable for the sliding of the second carriage (14') of the handling system (1') carried by the second rail carriage.

[0113] In a 331st aspect according to any one of the preceding aspects from 312th to 330th, the rail vehicle comprises at least one control unit. In a 332nd aspect according to the preceding aspects the control unit is connected to and active in command on at least one actuator of the handling systems (1, 1', 1") respectively carried by the first, second and third rail car.

[0114] In a 333rd aspect, a use of the handling system in accordance with any one of the preceding aspects for moving support components (ST) for the construction and/or renewal of railway lines is provided. In a 334th aspect according to f the preceding aspects, the handling system may be used for moving a plurality of slab-tracks between railway wagons.

BRIEF DESCRIPTION OF THE DRAWINGS

[0115] Certain forms of construction and aspects of the invention will be described below with reference to the accompanying drawings, which are provided for illustrative purposes only and are therefore not limiting wherein:

- Figure 1 is a perspective view of a railway wagon carrying a first design variant of a handling system in accordance with the present invention;
- Figure 2 is an exploded view of the handling system in Figure 1;
- Figure 3 is a detail view of a connecting element of two carriages of a handling system in accordance with the present invention;
- Figures 4 and 5 are further detailed views of a handling system according to the present invention, having a lift arranged in two different operating positions;
- Figures 6 to 9 show, in side view, a handling sequence of a plurality of support components by means of a handling system in accordance with the present invention;
- Figure 10 is a perspective view of a railway wagon carrying a second design variant of a handling system in accordance with the present invention;
- Figure 11 is a detail of a de-stacker from the handling system in Figure 10;
- Figures 12 to 18 show, in side view, a handling sequence of a plurality of support components by means of a handling system in accordance with figure 10;
- Figure 16A is a side view detail of the de-stacker of the figure 10 handling system;
- Figure 19 is a perspective view of a railway wagon carrying a third design variant of a handling system in accordance with the present invention;
- Figure 20 is a side view of the railway wagon in figure 19;
- Figures 21 to 25 show, in side view, a sequence of handling at least one support component by means of the railway wagon in figure 19.

DEFINITIONS AND CONVENTIONS

[0116] In the present detailed description, corresponding parts illustrated in the various figures are indicated by the same numerical references. The figures may illustrate the subject matter of the invention by means of representations that are not to scale; therefore, parts and components illustrated in the figures may relate only to schematic representations.

[0117] The terms *'horizontal'* or *'vertical'* refer to a condition of use of the handling system, wagon or vehicle, during a handling and/or laying procedure.

[0118] The term *'support component'* means a basic body or an assembly of basic bodies capable of receiving at least one rail of a railway line to support it. The support component ST comprises a reinforced concrete slab, also called a slab-track, which may have one or more seats capable of accommodating at least one rail. The support component ST may also be defined by said reinforced concrete slab on which a tract of a rail is already engaged. The support component may also comprise one or more sleepers, e.g. of wood or concrete, which accommodate at least one tract of rail.

[0119] At least one of the handling system, the rail wagon and the rail vehicle may comprise/use at least one control unit which is responsible for controlling the operating conditions implemented by them and/or for controlling the phases of the movement process of the supporting components. The control unit may be a single unit or may consist of a plurality of separate control units depending on the design choices and operational requirements.

[0120] By *'control unit'* is meant a component of electronic type, which may comprise at least one of: a digital

processor (CPU), an analogue type circuit, or a combination of one or more digital processors with one or more analogue type circuits. The control unit may be "configured" or "programmed" to perform certain steps: this may be achieved in practice by any means that allows the control unit to be configured or programmed. For example, in the case of a control unit comprises one or more CPUs and one or more memories, one or more programs may be stored in appropriate memory banks attached to the CPU(s); the program(s) contain instructions which, when executed by the CPU(s), program or configure the control unit to perform the operations described in relation to the control unit. Alternatively, if the control unit is or comprises analogue type circuitry, then the circuitry of the control unit may be designed to include circuitry configured, in use, to process electrical signals to perform the steps related to the control unit.

[0121] Parts of the process described herein may be implemented by means of a data processing unit, or control unit, technically substitutable for one or more computers designed to execute a portion of a software programme or firmware loaded onto a storage medium. Such software programme may be written in any known programming language. If there are two or more computers, they may be interconnected by means of a data connection such that their computing power is shared in any manner whatsoever; the same computers may thus be installed in even geographically different locations, thereby creating a distributed computing environment through the aforementioned data connection.

[0122] The data processing unit, or control unit, may be a *general purpose* processor configured to perform one or more parts of the process identified in the present disclosure through the software or firmware programme, or be an ASIC or dedicated processor or FPGA, specifically programmed to perform at least part of the operations of the process described herein.

[0123] The memory medium may be non-transitory and may be internal or external to the processor, or control unit, or data processing unit, and may - specifically - be a memory geographically located remote from the computer. The memory medium may also be physically divided into several portions, or in the form of a *cloud,* and the software or firmware programme may be physically comprised of portions stored on geographically divided portions of memory. *Actuator'* refers to any device capable of causing a movement on a body, e.g. upon command from the control unit (reception by the actuator of a command sent by the control unit). The actuator may be electric (e.g. an electric motor), pneumatic, mechanical (e.g. a spring), hydraulic or other types.

DETAILED DESCRIPTION

[0124] It is an object of the present invention to form a handling system for support components ST. In the accompanying figures, three different variants of the handling system are shown which, in all its variants, may be engaged with a movable railway wagon along a rail or track. As will be better described below, the handling system, in all its variants, may be used to move one or more support components ST, optionally either during a stationary condition wherein the railway wagon is stationary on a railway line or during a condition of moving the railway wagon.

Handling system 1

[0125] Figures 1 to 9 show a first implementation variant of the handling system 1. This handling system comprises a frame 11 extending lengthwise between a rear portion 11a and a front portion 11b along a longitudinal trajectory T1, optionally rectilinear; the frame 11 has:

a first zone Z1 defined between the rear portion of the frame and a middle portion of the same frame located substantially halfway between the rear and front portions of the frame,
a second zone Z2 defined between the front portion of the frame and said middle portion.

[0126] In fact, the first and second zones Z1, Z2 are placed consecutively to each other with respect to the longitudinal trajectory T1; the two zones share the middle portion.

[0127] As can be seen from the joined figures, the frame 11 also has a first and second lateral edges 11c, 11d spaced along a direction orthogonal to the longitudinal trajectory T1 of the same frame. As a matter of fact, the first and second lateral edges 11c, 11d define a lateral size of the frame 11.

[0128] The first and second lateral edges may extend along the entire extension of the frame and join the rear portion 11a with the front portion 11b. The first and second lateral edges 11c, 11d are substantially parallel to each other and extend along directions parallel to the longitudinal trajectory T1. The first and second lateral edges 11c, 11d are placed at a minimum distance from each other, which may be greater than 2,000 mm, optionally between 2,300 and 2,800 mm; this distance is measured orthogonally to the longitudinal trajectory T1 of the frame.

[0129] The frame 11 defines the part of the handling system 1 that enables said handling system to be connected to a railway wagon. Frame 11, in use, substantially lies on an ideal substantially orthogonal plane.

[0130] As can be seen from the joined figures, the handling system 1 further comprises at least one guide 12 extending for at least part of the extension trajectory of the frame 11, substantially parallel to the longitudinal trajectory T1. In particular, the guide 12 may extend from the rear portion 11a to the front portion 11b or over the entire extension of the frame 11. In detail, the guide 12 extends along a predetermined rectilinear direction and substantially connects said first and second zones Z1, Z2

of the frame 11.

[0131] In greater detail, the guide 12 is fixed to the frame and interposed between the first and second lateral edges 11c, 11d, i.e. substantially placed in correspondence with a longitudinal centreline area of the frame 11, optionally placed midway between the first and second lateral edges 11c, 11d. In fact, the guide 12 substantially lies on an ideal frame midplane, optionally defined by the first and second lateral edges 11c, 11d. In other words, the guide 12 lies on an ideal plane which, in use, is placed at the same height above the ground as a respective frame laying plane.

[0132] The guide 12 may be engaged to the frame 11 or, as shown in a non-limiting way in the accompanying figures, be joined by piece to said frame 11: frame 11 and guide 12 may thus define a single piece, for example of metal material. The guide 12 may comprise a single piece or it may comprise at least one first tract 12a and at least one second tract 12b (see, for example, Figure 1) parallel to each other, placed at a minimum distance from each other of between 700 mm and 1,500 mm, optionally between 800 mm and 1,400 mm; said minimum distance being measured orthogonally to the longitudinal trajectory of the frame 11.

[0133] Wherein the guide 12 comprises first and second tracts 12a, 12b, said tracts may be opposite to each other with respect to an ideal centreline plane of the frame 11, parallel to the longitudinal trajectory T1 and interposed between the first and second lateral edges 11c, 11d of the frame 11: said ideal centreline plane, in the condition of use of the handling system 1, extends vertically.

[0134] The guide 12 may essentially be defined as a kind of rail or track that allows at least one carriage to slide, as will be better described below.

[0135] The handling system 1 comprises at least one carriage slidably engaged to the guide 12 and configured to move back and forth between the first and second zones Z1, Z2 of the frame. In detail, the carriage defines a support surface configured to receive and support one or more support components ST and move them between the first and second zones Z1, Z2 of the frame 11. In the accompanying figures, a handling system 1 comprising a first and a second carriage 13, 14 has been illustrated in a non-limiting way; obviously, the possibility of realising a handling system 1 comprising only one carriage is not excluded.

[0136] The first carriage 13 is slidably engaged to the guide 12 and placed within the lateral size of the frame 11; in further detail, the first carriage 13 is configured to move along the guide 12 between the first and second zones Z1, Z2, parallel to the longitudinal trajectory T1 of the frame 11. In still further detail, the first carriage 13 may comprise a support surface 13a (Figures 1-3) configured to receive at least one support component ST; said support surface extends substantially along a plane, in horizontal use. The bedding plane of the support surface 13a of the first carriage 13 is parallel to the longitudinal trajectory T1. The support surface 13a of the first carriage 13 is configured to maintain an equal distance from the frame 11; this distance is measured orthogonally to the support surface 13a of the first carriage. In fact, the support surface 13a of the first carriage 13, in use, is spaced from the frame 11 in such a way that the support component resting on said first carriage may slide over the frame without interfering with the latter. The support surface 13a is therefore placed at a fixed height, spaced away from the frame 11.

[0137] The first carriage 13 further comprises a plurality of wheels 13b (see, for example, figure 2) engaged at the guide 12: the wheels 13b are configured to allow the carriage 13 to slide along said guide 12. In detail, the first carriage 13 comprises a number of wheels 13b equal to or greater than 4, optionally between 4 and 10, even more optionally between 6 and 10.

[0138] Dimensionally, the first carriage 13 has a longitudinal dimension substantially equal to the longitudinal dimension of at least one of the first and second zones Z1, Z2. In fact, the first carriage 13 extends between a first and a second longitudinal end respectively facing the rear portion 11a of the frame 11 and the front portion 11b of the frame 11. The first end of the first carriage 13, when the first carriage is disposed on the first zone Z1, is disposed at the rear portion 11a; the second end of the first carriage 13, when the first carriage is disposed on the first zone Z1, is directed towards the middle portion of the frame. On the other hand, when the first carriage 13 is disposed at the second zone Z2, the first end of said first carriage 13 is directed towards the middle portion of the frame while the second end is disposed at the front portion of the frame 11.

[0139] As mentioned above, the handling system 1 may further comprise a second carriage 14 also engaged for sliding to the guide 12 and placed within the lateral size of the frame 11; in detail, the second carriage 14 is configured to move along the guide 12 between the second zone Z2 and a zone outside the frame, parallel to the longitudinal trajectory T1 of the frame 11. In particular, said external zone is a zone located outside the size defined by the frame, located at the front portion. In other words, the second carriage 14 is not movable in correspondence with the first zone Z1: the second carriage 14 is only movable between the second zone Z2 and the outer zone of the frame 11. In fact, as will be better described below, the second carriage exits from the front portion of the frame 11 to reach a further handling system, for example carried by an adjacent railway wagon.

[0140] The second carriage 14 may comprise a respective support surface 14a (Figures 1-3) configured to receive at least one support component ST; said support surface 14a extends substantially along a plane, in horizontal use. The bedding plane of the second carriage support surface 14a is parallel to the longitudinal trajectory T1. The support surface 14a of the second carriage 14 is configured to maintain an equal distance from the frame 11; this distance is measured orthogonally to the

support surface 14a of the second carriage. In fact, the support surface 14a of the second carriage 14, in use, is spaced from the frame 11 in such a way that the support component resting on said second carriage may slide over the frame without interfering with the latter. The support surface 14a is therefore placed at a fixed height, spaced away from the frame 11.

[0141] The support surface 14a of the second carriage 14 is placed at a distance from the frame substantially equal to the distance present between the frame and the support surface 13a of the first carriage 13. In fact, the first and second carriages 13, 14 are configured to support a plurality of support components (e.g. slab-track), said support components, in use, being arranged at an equal height with respect to the frame.

[0142] The second carriage 14 further comprises a plurality of wheels 14b (see for example Figure 2) engaged at the guide 12: the wheels 14b are configured to allow the carriage 14 to slide along said guide 12. In detail, the second carriage 14 comprises a number of wheels 14b equal to or greater than 4, optionally between 4 and 10, even more optionally between 6 and 10.

[0143] Dimensionally, the second carriage 14 has a longitudinal dimension substantially equal to the longitudinal dimension of at least one of the first and second zones Z1, Z2. In fact, the second carriage 14 extends between a first and a second longitudinal end respectively facing the rear portion 11a of the frame 11 and the front portion 11b of the frame 11. The first end of the first carriage 13, when the second carriage is disposed on the second zone Z2, is disposed at the middle portion of the frame while the second end of the second carriage 14 is disposed at the front portion. As can be seen for example in figure 1, the handling system 1 comprises a connecting element 15 which connects the first and second carriages 13, 14 in the movement. In fact, the second carriage 14, during the movement of the first carriage 13 from the first to the second zone, is configured to move from the second zone Z2 to the outer zone of the frame 11. In other words, the linking element 15 is configured to allow synchronised movement of the first and second carriages such that a movement of the first carriage 13 may define an optionally identical movement (i.e. a movement with equal speed and of equal displacement) of the second carriage 14. The connecting element 15 may, in a non-limiting way, comprise a bar hinged, on one side, to the second end of the first carriage 13 and, on the other side, hinged to the first end of the second carriage 14 as shown in figure 3.

[0144] The at least one carriage, optionally said first and second carriages, is moved by means of an actuator. In detail, the actuator is active on at least one of said first and second carriages 13, 14; the movement of at least one of said at least one of said carriages 13, 14, due to the presence of the connecting element 15, enables the movement of the other of said carriages 13, 14. In the accompanying figures, an actuator active only on the first carriage 13 has been shown (see, for example, figure 2); of course, the possibility of providing an actuator active only on the second carriage 14 or on both carriages is not excluded. The actuator may comprise at least one of: an electric motor, a hydrostatic motor. In detail, the actuator may comprise:

- at least one dragging element 17 connected to the first carriage 13 and configured to move said first carriage in sliding along the guide 12,
- at least one transmission organ 18 engaged to the dragging element 17 and movable by rotation about an axis to allow movement of the dragging element 17 and consequently of the first carriage 13,
- at least one hydrostatic motor active on the transmission organ 18 and configured to allow the rotation of said transmission organ.

[0145] In fact, the transmission organ 18 is constrained directly to the frame 11 in such a way that this organ may rotate freely around its own axis; the transmission organ comprises at least one of: a toothed wheel, a crown wheel, a friction wheel. A rotating organ 18 comprising one or more crown wheels is illustrated in a non-limiting way in the accompanying figures. The driving element 17, on the other hand, is constrained, on the one hand, to the frame 11 and, on the other hand, is constrained only to at least one carriage, optionally to the first carriage 13. In particular, the trailing element comprises at least one chain configured to cooperate with the crown wheel to allow trailing 17 of the at least one carriage.

[0146] The hydrostatic motor (alternatively, an electric motor or similar can be used) is configured to allow the rotation of the transmission organ, the rotation of which enables the activation of the dragging element 17 which, thanks to the constraint between frame 11 and carriage, allows said carriage to be dragged along guide 12.

[0147] As shown in Figures 1, 2, 5-9, the handling system 1 in accordance with the first variant comprises a first and second lift 20, 25 configured to lift one or more support components from the at least one carriage. In fact, each of said first and second lifters 20, 25 is configured to lift the one or more support components ST relative to the frame according to a direction orthogonal to the support plane of the at least one of said first and second carriages, optionally along a direction, in use, vertical.

[0148] In particular, the first lift 20 is engaged at the frame 11 and active at the first zone Z1. In detail, the first lift 20 is configured to move one or more support components ST with respect to the at least one carriage, optionally with respect to at least one of the first carriage 13 and the second carriage 14; the first lift 20 is movable between:

- a raised position where the first lift 20 is configured to distance one or more ST support components from at least one carriage, optionally from at least one of said first and second carriages,

a lowered position where the first lift 20 is configured to allow one or more ST support components to rest on at least one carriage, optionally by at least one of said first and second carriages.

[0149] In fact, the first lift 20, during movement between the lowered position and the raised position, is configured to lift the one or more support components with respect to the at least one carriage, optionally with respect to the at least one of the first carriage 13 and the second carriage 14, thereby enabling said support components to be moved away with respect to the frame 11 and thus free said at least one carriage; the first lift 20, during movement between the raised position and the lowered position is instead configured to move closer with respect to the frame 11 and to dispose itself, in use, below the at least one carriage so that any support components carried by the first lift 20 may be unloaded on the at least one carriage, optionally on at least one of said first and second carriages 13, 14.

[0150] In greater detail and as visible from the accompanying figures, the first lift 20 comprises an upper surface 21 configured to receive in support one or more support components ST; the upper surface 21 of the first lift 20, in use and in the lowered position of the first lift 20, is placed below the support surface of the at least one carriage, optionally below the support surfaces of the first carriage 13 and the second carriage 14. In the raised position of the first lift, the upper surface 21 is instead placed above the support surface of the at least one carriage, optionally of the first and second carriages. The upper surface 21 lies on an ideal plane, parallel to the support surface of the first and second carriages: the upper surface 21, in use, is substantially horizontal.

[0151] The first lift 20 may comprise at least one first and a second carriage 22, 23 (figure 2) respectively engaged at the first and second lateral edges 11c, 11d of the frame 11 and defining the upper surface; the guide 12 is interposed between the first and second carriage arms of the first lift 20: the at least one carriage, optionally the first carriage 13, at least when arranged at the first zone Z1, is interposed between the first and second carriage arms of the first lift 20.

[0152] As can be seen in Figures 4, 5, 8 and 9, the handling system 1 comprises at least one actuator 24 engaged, on one side, to the frame 11 and, on the other side, to the first lift 20; said actuator 24 is configured to move the first lift 20 from the lowered position to the raised position, and vice versa. In particular, the actuator 24 is active directly on the first and second arms 22, 23 to allow the relative movement of the latter with respect to the frame 11. The actuator 24 active on said first lift 20 may comprise at least one of: a hydraulic cylinder, an electric motor. In Figures 4 and 5, the actuator 24 comprises, in a non-limiting way, two hydraulic cylinders, active on the first arm 22; the actuator 24 may comprise two further hydraulic cylinders active on the second arm (condition not illustrated in the joined figures). As mentioned above, the handling system 1 further comprises a second lift 25 also engaged at the frame 11 and active at the second zone Z2. In detail, the second lift 20 is configured to move one or more support components ST relative to the at least one carriage, optionally to at least one of the first carriage 13 and the second carriage 14; the second lift 25 is movable between:

a raised position where the second lift 25 is configured to distance one or more ST support components from at least one carriage, optionally from at least one of said first and second carriages,
a lowered position where the second lift 25 is configured to allow one or more ST support components to rest on at least one of said first and second carriages.

[0153] In fact, the second lift 25, during movement between the lowered position and the raised position, is configured to lift the one or more support components with respect to the at least one carriage, optionally with respect to the at least one of the first carriage 13 and the second carriage 14, thereby enabling said support components to be moved away with respect to the frame 11 and thus free said at least one carriage; the second lift 25, during movement between the raised position and the lowered position is instead configured to move closer with respect to the frame 11 and to dispose itself, in use, substantially below the at least one carriage so that any support components carried by the first lift 20 may be unloaded on the at least one carriage, optionally on at least one of said first and second carriages 13, 14.

[0154] In greater detail and as visible from the accompanying figures, the second lift 25 comprises an upper surface 26 configured to receive in support one or more support components ST; the upper surface 26 of the second lift 25, in use and in the lowered position of the second lift 25, is placed below the support surface of the at least one carriage, optionally below the support surfaces of the first carriage 13 and the second carriage 14. In the raised position of the first lift, the upper surface 26 is instead placed above the support surface of the at least one carriage, optionally of the first and second carriages. The upper surface 26 lies on an ideal plane, parallel to the support surface of the first and second carriages: the upper surface 26 of the second lift, in use, is substantially horizontal.

[0155] In particular, the bedding plane of the upper surface 26 of the second lift 25 is parallel to the bedding plane of the upper surface 21 of the first lift 20. Identically, said upper surfaces 21, 26, in the lowered positions of the first and second lifts respectively, are placed substantially on a same bedding plane; in other words, said upper surfaces 21, 26, in the lowered positions of the first and second lifts respectively, are configured to be arranged at a same distance from the frame 11 and are therefore placed, in use, at substantially the same height. Identically, said upper surfaces 21, 26, in the raised positions of

the first and second lifts respectively, are placed substantially on the same lying plane; in other words, said upper surfaces 21, 26, also in the raised positions of the first and second lifts respectively, are configured to be arranged at an identical distance from the frame 11 and are therefore placed, in use, at substantially the same height.

[0156] The second lift 25 may comprise at least one first and second carriage 27, 28 (Figure 1) respectively engaged at the first and second lateral edges 11c, 11d of the frame 11 and defining the upper surface 26; the guide 12 is interposed between the first and second carriage 27, 28 of the second lift 25: the at least one carriage, optionally the first carriage 13 and/or second carriage 14 when arranged at the second zone Z2, is interposed between the first and second carriage 27, 28 of the second lift 25.

[0157] As visible, for example, in Figures 8 and 9, the handling system 1 comprises at least one actuator 29 engaged, on one side, to the frame 11 and, on the other side, to the second lift 25; said actuator 29 is configured to move the second lift 25 from the lowered position to the raised position, and vice versa. In particular, the actuator 29 is active directly on the first and second arms 27, 28 to allow the relative movement of the latter with respect to the frame 11. The actuator 29 active on said second lift 25 may comprise at least one of: a hydraulic cylinder, an electric motor. In Figures 4 and 5, the actuator 29 comprises, in a non-limiting way, two hydraulic cylinders, active on the first arm 27; the actuator 24 may comprise two further hydraulic cylinders active on the second arm (condition not illustrated in the joined figures).

[0158] The use of the first and second lifts 20, 25 in combination with the at least one carriage, allows the handling system 1 to move, in advancement along the longitudinal trajectory T1 of the frame 11, a plurality of support components ST; in particular, the combined action of the lifters 20, 25, in combination with the movement of the at least one carriage (optionally of the first and second carriages), allows to advance along the frame of the handling system, stacks of support components ST from the first zone Z1 to the second zone Z2 of the frame 11, as schematically illustrated in Figures 6 to 9.

[0159] The synchronisation of movement of the at least one carriage with the movement of the first and second lift may be controlled by an attendant by manual activation of the various actuators. Alternatively, the procedure may be carried out in semi-automatic or automatic mode; the handling system 1 may be equipped with at least one control unit connected to at least one actuator of the handling system 1.

[0160] In detail, the control unit may be connected and activated in command on:

- the actuator configured to move at least one carriage, optionally the first and second carriages 13, 14,
- the actuator 24 of the first lift 20,
- the actuator 29 of the second lift 25.

[0161] In detail, the control unit is configured to perform an advancement procedure configured to allow the movement of a plurality of ST support components, wherein said advancement procedure performed by the control unit comprises the following steps

- arrange the first and second lifts 20, 25 in the lowered position,
- when the first and second lifts 20, 25 are in the lowered position, command the movement of at least one carriage along the guide (12) in such a way that at least one carriage may move from the first zone Z1 to the second zone Z2,
- command the movement of the first and second lifts 20, 25 from the lowered position to the raised position to allow one or more ST support components to be lifted with respect to at least one carriage,
- then, when the first and second lifts 20, 25 are in the raised position, command the movement of at least one carriage along guide 12 so that this carriage may move from the second zone Z2 to the first zone Z1,
- then, command again the movement of the first and second lifts 20, 25 from the raised position to the lowered position, optionally in such a way that one or more of the components supported by the second lift 25 may be loaded onto at least one carriage.

[0162] Synchronising the movement of at least one carriage (optionally first and second carriage) with the first and second lift allows a stack of support components initially loaded at the first Z1 zone to be moved to the second zone, thus leaving space to load a new stack of support components on the first Z1 zone.

[0163] In case the handling system 1 comprises the first and second carriage, the advancement procedure performed by the control unit may comprise the following steps:

- arrange the first and second lifts 20, 25 in the lowered position,
- when the first and second lifts 20, 25 are in the lowered position, command the movement of the first and second carriages 13, 14 along the guide 12 in such a way that the first carriage 13 may move from the first zone Z1 to the second zone Z2 while the second carriage 14 may move from the second zone Z2 to the outer zone of the frame, optionally during said movement the first and second carriages are configured to each support one or more support components ST,
- command the movement of the first and second lifts 20, 25 from the lowered to the raised position to allow one or more ST support components to be lifted relative to the first carriage 13,
- then, when the first and second lifts 20, 25 are in the raised position, command the movement of the first

and second carriages 13, 14 along the guide 12 in such a way that the first carriage 13 may move from the second zone Z2 to the first zone Z1 while the second carriage 14 may move from the outer zone to the second zone Z2 of the frame, optionally during this movement the second lift 25 is configured to support one or more components carried on the second zone by the first carriage 13,
then, command again the movement of the first and second lifts 20, 25 from the raised position to the lowered position, optionally in such a way that one or more of the components supported by the second lift 25 may be loaded onto the second carriage 14.

[0164] The handling system 1 may comprises:

at least one first sensor connected to the control unit and configured to emit a signal representative of the position of the first and second carriage 13, 14 in relation to guide 12,
at least one second sensor connected to the control unit and configured to emit a signal representative of the lowered or raised position of the first and second carriage.

[0165] The control unit may then receive these signals from the sensors so that it can monitor the movement of at least one carriage and lifts 20, 25 and consequently manage the synchronisation.

Handling system 1'

[0166] A second embodiment variant of the 1' handling system is shown in Figures 10 to 18. This 1' handling system comprises:

a frame 11' essentially identical to frame 11 described above in relation to the first variant of handling system 1,
a guide 12' essentially identical to guide 12 described above in relation to the first variant of handling system 1. In fact, as visible from the joined figures, the frame 11' has the front portion 11b', the rear portion 11a', the first and second lateral edges 11c', 11d', the first and second zones Z1', Z2'. The elements and sub-parts of the frame 11' of the handling system 1', identical to those of the frame 11 of the handling system 1 in accordance with the first variant, have been identified with the same numerical references with the addition of the superscript" ' ". Therefore, the description of the elements 11a', 11b', 11c' 11d', Z1', Z2', of the frame 11' will not be duplicated since they are substantially identical in shape, position, structure, size and relation with respect to other elements with respect to the elements 11a, 11b, 11c, 11d, Z1, Z2 of the frame 11 described above.

[0167] Identically, the guide 12' is identical in shape, position, structure, size and relationship to other elements with respect to the guide 12 of the handling system 1 described above. In the joined figures, the guide 12' of the handling system 1', in accordance with the second variant, may in fact comprise the tracts 12a', 12b'. Therefore, the description of the guide 12' will not be duplicated.

[0168] The handling system 1', in accordance with the second embodiment variant, may also comprise at least one carriage slidably engaged to the guide 12' and configured to move back and forth between the first and second zones Z1', Z2' of the frame 11'. In detail, the carriage defines a support surface configured to receive and support one or more components and move them between the first and second zones Z1', Z2' of the frame 11'. In the accompanying figures, a handling system 1' comprising a first and a second carriage 13', 14' has been illustrated in a non-limiting way.

[0169] In fact, the handling system 1', according to the second variant, shares the same carriage configuration - or first and second carriages 13, 14 - as the handling system 1 according to the second variant. The first and second carriages 13', 14' are identical in shape, position, structure, size and relationship with respect to other elements with respect to the first and second carriages 13, 14 of the handling system 1 described above. Therefore, the description of the first and second carriages 13', 14', as well as of the elements related to these carriages (e.g., the actuator for moving the carriages as well as the connecting element 15') will also not be duplicated.

[0170] Identically, the handling system 1' in accordance with the second implementation variant comprises a lift 20' substantially identical in shape, size, position, structure and operation to the first lift 20 of the handling system 1 in accordance with the first variant. The elements and sub-parts of the lift 20' of the handling system 1', identical to those of the first lift 20 of the handling system 1 in accordance with the first variant, have been identified with the same numerical references with the addition of the superscript "' ". In the joined figures, the lift 20' of the handling system 1' in accordance with the second variant may in fact comprise the upper surface 21', the first and second arms 22', 23', the actuator 24'. Therefore, the description of the lift 20' will not be duplicated.

[0171] In contrast to the handling system 1 described above, the handling system 1' according to the second variant comprises only one lift 20' (see for example Figures 10, 12-16). The lift 20' is configured to lift one or more support components from at least one carriage. Further, the single lift 20' at least partially movable between the lowered position and the raised position to move (raise and lower) the one or more support components ST relative to the frame 11' according to a direction orthogonal to the support surface of the at least one of said first and second carriages, optionally along a direction, in use, vertical.

[0172] As can be seen from Figures 10-16, 17 and 18,

the handling system 1' in accordance with the second variant may comprise a de-stacker 30 engaged at the frame 11' and active (optionally only) at the second zone Z2'. The de-stacker 30 is configured to lift the one or more support components relative to the frame 11' along a direction orthogonal to the support surface of said at least one carriage, optionally relative to the support surface of said at least one of said first and second carriages 13', 14'. In fact, the de-stacker 30 is configured to move the one or more support components ST along a direction, in use, vertical to load and/or unload the at least one support component onto/from said at least one carriage, optionally onto/from at least one of said first and second carriages 13', 14'.

[0173] In fact, the de-stacker 30 essentially acts as a second lift, placed immediately after the lift 20'. As will be better described later, however, the de-stacker 30 allows the selection of the number of support components to be handled with respect to at least one carriage.

[0174] As can be seen from the accompanying figures, at least one part of the decanter 30 is movable between the following plurality of operating positions:

- a lowered position (see, for example, Figure 13) where said at least one de-stacker 30 is disposed at said at least one carriage, optionally at said first or second carriage 13', 14', wherein said at least one carriage is disposed at said second zone Z2', when disposed in the lowered position is configured to pick up one or more support components from said at least one carriage, optionally from said first or second carriage 13', 14' when disposed in said second zone Z2' and/or unload one or more support components onto said at least one carriage disposed in said second zone Z2',
- an intermediate pick-up position (see, for example, figure 17) where de-stacker 30 is configured to contact one or more support components spaced by said at least one carriage arranged in the second Z2' zone,
- at least one raised position (see, for example, Figures 14 and 18) where said de-stacker 30 is configured to distance one or more support components from said at least one carriage arranged in the second zone Z2'.

[0175] In fact, the de-stacker 30 when in the lowered position is configured to pick up all of the support components from the at least one carriage or to unload all of the support components previously lifted by the de-stacker 30 itself onto said at least one carriage. When, on the other hand, the de-stacker 30 is in the intermediate pick-up position (a position interposed between the lowered position and the raised position), said de-stacker 30 is configured to arrange itself at least partially above one or more support components in order to pick up only a portion of said support components, spaced out from said at least one carriage; For example, Figure 17 shows a de-stacker 30 placed in an intermediate pick-up position enabling the de-stacker 30 itself to leave on the at least one carriage only one support component ST (support component directly in contact with the carriage) and to lift three further support components placed above the support component in direct contact with the carriage. In detail, at least one part of the de-stacker 30 is movable between:

- the lowered position,
- a first raised position where said de-stacker 30 is configured to lift all supporting components from said at least one carriage placed in the second zone Z2', the intermediate pick-up position,
- a second raised position where said de-stacker 30 is configured to distance, with respect to the frame, the one or more support components spaced apart from said at least one carriage disposed in the second zone Z2' with respect to, optionally distancing from the frame the one or more support components located above the support component placed in direct contact with the at least one carriage disposed in the second zone Z2'.

[0176] The de-slider 30 is placed to the side of the at least one carriage when placed in the second zone; as can be seen from the accompanying figures, the de-slider 30 essentially defines a lateral lift (lateral to the guide and the at least one carriage) which is not placed above the at least one carriage, optionally when placed in the second zone Z2). Structurally, the de-stacker 30 comprises at least one lifting arm configured to lift one or more support components relative to the frame 11' by means of the movement of said arm in the operating position described above. The at least one lifting arm, in the lowered position presents, is placed to the side of the at least one carriage when placed in the second zone Z2'; still in the lowered position, the lifting arm presents a first distance from the frame 11' while when placed in the intermediate pick-up position presents a second distance from the frame 11' greater than the first distance; the at least one lifting arm, when placed in the raised position, presents a third distance from the frame 11' greater than the second distance.

[0177] The de-stacker 30 may comprise a single lifting arm carried by a support engaged to the frame 11', for example to at least one of the first and second lateral edges 11c', 11d'. Alternatively, as shown in the accompanying figures, the de-stacker 30 may comprise two lifting arms opposed to each other and configured to receive, simultaneously, the same stack of support components. In greater detail, the de-stacker 30 may comprise:

- a first column 31 arranged at the first lateral edge 11c' of frame 11',
- a second column 32 arranged at the second lateral edge 11d' of frame 11'.

[0178] The first and second columns 31, 32 are engaged to the frame 11' to substantially define a support frame engageable to the frame 11' of the handling system 1' (see for example Figure 11). The first and second columns 31, 32 extend in height along respective extension directions parallel to each other and orthogonal to the support surface of the first and second carriages 13', 14': the first and/or second carriages 13', 14', when arranged at the second zone Z2', are interposed between the first and second columns 31, 32.

[0179] The de-stacker 30 may therefore comprise a lifting arm for each of said first and second columns 31, 32. In particular, as can be seen for example from Figure 11, the first column 31 may comprise:

- a first and second uprights 33, 35 spaced along a direction parallel to the extension trajectory T1' of the frame 11', wherein said first and second uprights are parallel to each other and extend along directions orthogonal to the support surface of the first and second carriages 13', 14',
- a first lifting arm 37 slidably engaged along said first and second uprights 33, 35 between the plurality of operating positions.

[0180] The first and second uprights 33, 35 of the first column are fixed with respect to the frame 11', in particular they emerge from the first lateral edge without the possibility of moving with respect to said edge; the first lift arm 37 of the first column 31 is instead movable with respect to the frame 11' along said first and second uprights which essentially act as sliding guides for said lift arm 37. In greater detail, the first lifting arm 37 comprises a connecting body 39, for example defined by a bar made of a metal material, slidably engaged to the first and second uprights 33, 35; the connecting body 39 extends along a direction parallel to the support surface 13a', 14a' of the first and second carriages 13', 14', i.e., in use, horizontal.

[0181] The lifting arm may further comprise at least one support element 41 carried by the connecting body 39 which is configured to receive one or more support components ST. In fact, the at least one support element 41 defines a protrusion suitable for receiving in support the one or more support components ST. The at least one support element 41 is movable relative to the at least one connecting body 39 between:

- an extended position where said support element is configured to intercept and support one or more ST support components,
- a retracted position.

[0182] In detail, the support element 41, in the retracted position, is configured not to contact the ST support components carried by the first and/or second carriage 13', 14': the support element 41 is configured to contact one or more ST support components only when arranged in the extended position.

[0183] The support element 41 is hinged to the link body 39: the support element 41 is configured to rotate relative to the link body 39 between the extended position and the retracted position around a Z-axis, in use, that is vertical. The first lifting arm 37 may comprise a single support element defining a support surface such that the support components ST are properly supported; alternatively, the lifting arm 37 may comprise a plurality of support elements 41 spaced apart along a direction parallel to the extension trajectory T1' of the frame 11'. In particular, the first lifting arm 37 may comprise a number of support elements between 2 and 6, optionally between 2 and 5, for example equidistant from each other.

[0184] The first column 31 may comprise at least one actuator 31a (Figure 11) configured to allow movement of the first lifting arm 37 relative to the frame 11'. For example, the at least one actuator 31a comprises two hydraulic cylinders both active on the first lifting arm 37 at the first and second columns 33, 35 respectively.

[0185] The first column 31 may further comprise at least one actuator 43 (Figure 16A) active on the at least one support element 41, optionally on a plurality of support elements: the actuator 43 is configured to move said at least one support element from the retracted position to the extended position, and vice versa. The actuator 43 may also comprise at least one of: a hydraulic cylinder, a pneumatic actuator, an electric motor.

[0186] The second column 32 may comprise:

- a first and second uprights 32, 36 spaced apart along a direction parallel to the extension trajectory T1' of the frame 11', wherein said first and second uprights 34, 34 are parallel to each other and extend along directions orthogonal to the support surface of the first and second carriages 13', 14',
- a second lifting arm 38 slidably engaged along said first and second uprights 34, 36 between the plurality of operating positions.

[0187] The first and second uprights 34, 36 of the second column are fixed with respect to the frame 11', in particular they emerge from the second lateral edge without the possibility of moving with respect to said edge 11d'; the second lifting arm 38 of the second column 32 is instead movable with respect to the frame 11' along said first and second uprights 34, 36 which essentially act as sliding guides for said second arm 38. In greater detail, the second lifting arm 38 comprises a connecting body 40, for example defined by a bar made of a metal material, slidably engaged to said first and second uprights 34, 36; the connecting body 40 extends along a direction parallel to the support surface 13a', 14a' of said first and second carriages 13', 14', i.e., in use, horizontal.

[0188] The second lifting arm 38 may further comprise at least one support element 42 carried by the connecting body 40 which is configured to receive one or more support components ST. In fact, the support element

42 defines at least one protrusion suitable for receiving one or more support components ST in support.

[0189] The at least one supporting element 42 is movable with respect to the connecting body 40 at least between:

an extended position where said support element is configured to intercept and support one or more ST support components,
a retracted position.

[0190] In detail, the support element 42, in the retracted position, is configured not to contact the support components ST carried by the first and/or second carriage 13', 14': the support element 42 is configured to contact one or more support components ST only when arranged in the extended position.

[0191] The support element 42 is hinged to the link body 40: the support element 42 is configured to rotate relative to the link body 40 between the extended position and the retracted position around an axis, in use, that is vertical. The second lifting arm 38 may comprise a single support element defining a support surface sufficient to ensure proper support of the support components ST; alternatively, the lifting arm 38 may comprise a plurality of support elements 42 spaced apart along a direction parallel to the extension trajectory T1' of the frame 11'. In particular, the second lifting arm 38 may comprise a number of support elements between 2 and 6, optionally between 2 and 5, for example equidistant from each other.

[0192] The second column 32 may comprise at least one actuator 32a (Figure 11) configured to allow movement of the second lift arm 38 relative to the frame 11'. For example, the at least one actuator 32a comprises two hydraulic cylinders both active on the first lifting arm 38 at the first and second columns 34, 36 respectively.

[0193] The second column 32 may further comprise at least one actuator active on the at least one support element 42, optionally on a plurality of support elements: the actuator is configured to move said at least one support element 42 from the retracted position to the extended position, and vice versa. The actuator may also comprise at least one of: a hydraulic cylinder, a pneumatic actuator, an electric motor.

[0194] In fact, the first and second columns 31, 32 have essentially an identical structure: these columns are set against each other in relation to the second zone Z2 in such a way that the columns may support, from opposite sides, a plurality of support components.

[0195] The first and second lifting arms 37, 38 are configured to move simultaneously so as to stably maintain the plurality of ST support components on the de-stacker. On the other hand, the connecting bodies 39, 40 extend along respective directions to define an ideal, in-use, substantially horizontal lying plane. Similarly, the support elements 41, 42 of the first and second lifting arms 37, 38 are configured to define a support plane for one or more support components ST, in use, substantially horizontal.

[0196] The handling system 1' in accordance with the second variant may also comprise a control unit connected to at least one actuator of the handling system 1' to control the synchronisation of the movements of the at least one carriage (optionally of the first and second carriages 13', 14'), the lift 20' and the de-stacker 30. In particular, the control unit is active in command on:

the actuator configured to move at least one carriage, optionally on the actuator configured to move said first and second carriages 13', 14', along guide 12',
the actuator 23'of the 20' lift,
the actuator 31a is configured to allow movement of the first arm 37,
actuator 43 active on at least one supporting element 41 of the first column,
actuator 32a' configured to allow movement of the second arm 38,
the active actuator on at least one support element 42 of the second column.

[0197] The control unit of the handling system 1' is configured to perform a singularisation procedure, optionally configured to allow the picking up and moving of one ST support component from a plurality of ST support components placed one above the other; this procedure is schematised in Figures 12 to 18.

[0198] The singularisation procedure comprises the following steps:

arrange the lift in the lowered position, optionally in the lowered position the first carriage 13' is configured to receive a plurality of ST support components placed one above the other to define a stack of supports,
when lift 20' is in the lowered position, command the movement of the first and second carriages 13', 14' along guide 12' so that the first carriage 13' may move from the first zone Z1' to the second zone Z2' while the second carriage 14' may move from the second zone Z2' to the outer zone of the frame,
when the first carriage 13' is in the second zone Z2', arrange the at least one lifting arm of the de-stacker 30 in the lowered position,
then, command the movement of at least one lifting arm from the lowered position to the raised position, optionally to lift the entire stack of ST support components,
then, command the movement of the first and second carriages 13', 14' along guide 12' in such a way that the first carriage 13' may move from the second zone Z2' to the first zone Z1' while the second carriage 14' may move from the outer zone to the second zone Z2' of the frame,
then, move the at least one lift arm to the lowered

position, optionally to unload the stack of ST support components onto the second carriage 14',
then, move the at least one lifting arm to the intermediate pick-up position, optionally to intercept the support components above the support component in direct contact with the second carriage 14',
then, move the at least one lifting arm from the intermediate pick-up position back to the raised position in order to lift the support components above the support component in direct contact with the second carriage 14',
then, command the movement of the first and second carriages 13', 14' along the guide 12' in such a way that the first carriage 13' may move from the second zone Z2' to the first zone Z1' while the second carriage 14' may move from the outer zone to the second zone Z2' of the frame, optionally to move only one support component (optionally the support component in direct contact with the second carriage 14') from the second zone Z2 to the outer zone of the frame 11' of the handling system 1'.

[0199] Figures 12 to 18 schematically show a singularisation procedure involving the first bogie 13' and the second bogie 14' of the same 1' handling system; the possibility of performing a singularisation procedure using a single bogie of the 1' handling system and a further bogie of a different handling system, e.g. carried by a different rail wagon, is of course not excluded.

[0200] During the singularisation procedure, the control unit is configured to command the movement of the first and second arms in the various operating positions; wherein said arms are to be moved from one position to another without the need to move support elements, the control unit is configured to command the retracted position to the active actuators on the support elements 41, 42 in such a way that they do not interfere with said support elements. The control unit is configured to command the extended position of the support elements only when said support elements need to support support components to move them relative to the frame 11'.

Handling system 1"

[0201] Figures 19 to 25 show a third embodiment variant of the 1" handling system. This 1" handling system comprises:

a frame 11" essentially identical to frame 11 described above in relation to the first variant of handling system 1,
a guide 12" essentially identical to guide 12 described above in relation to the first variant of handling system 1. In fact, as visible from the joined figures, the frame 11" has the front portion 11b", the rear portion 11a", the first and second lateral edges 11c", 11d", the first and second zones Z1", Z2". The elements and sub-parts of the frame 11" of the handling system 1", identical to those of the frame 11 of the handling system 1 in accordance with the first variant have been identified with the same numerical references with the addition of the superscript ' ". Therefore, the description of the elements 11 a", 11b", 11c" 11d", Z1", Z2", of the frame 11" will not be duplicated as they are substantially identical in shape, position, structure, size and relation with respect to other elements with respect to the elements 11a, 11b, 11c, 11d, Z1, Z2 of the frame 11 described above.

[0202] Identically, the guide 12" is identical in shape, position, structure, size and relationship to other elements with respect to the guide 12 of the handling system 1 described above. In the joined figures, the guide 12" of the handling system 1", in accordance with the second variant, may in fact comprise the tracts 12a", 12b". Therefore, the description of the guide 12" will not be duplicated.

[0203] The handling system 1" in accordance with the third embodiment variant may also comprise at least one carriage slidably engaged to the guide 12" and configured to move back and forth between the first and second zones Z1", Z2" of the frame 11". In detail, the carriage defines a support surface configured to receive and support one or more support components ST and move them between the first and second zones Z1", Z2" of the frame 11". In the following figures, a handling system 1" comprising a single carriage 13" has been illustrated in a non-limiting way; obviously, the possibility of realising a handling system 1" comprising two or more carriages is not excluded. The single carriage 13" of the handling system 1" in accordance with the third variant is identical in shape, position, structure, size and relation with respect to other elements to the first carriage 13" of the handling system 1 in accordance with the first variant described above. Therefore, the description of the carriage 13", as well as of the elements related to these carriages (e.g., the actuator for moving the carriage as well as the connecting element 15") will also not be duplicated. Identically, the handling system 1" in accordance with the third implementation variant comprises a lift 20" substantially identical in shape, size, position, structure and operation to the first lift 20 of the handling system 1 in accordance with the first variant. The elements and sub-parts of the lift 20" of the handling system 1", which are identical to those of the first lift 20 of the handling system 1 in accordance with the first variant, have been identified with the same numerical references with the addition of the superscript " ' ". In the joined figures, the lift 20" of the handling system 1" in accordance with the third variant may in fact comprise the upper surface 21", the first and second arms, the actuator. Therefore, the description of lift 20" will not be duplicated.

[0204] In contrast to the handling system 1 described above, the handling system 1" according to the second

variant comprises only one lift 20". The lift 20" is configured to lift one or more support components relative to the carriage. Further, the single lift 20" at least partially movable between the lowered position and the raised position to move (raise and lower) the one or more support components ST relative to the frame 11" along a direction orthogonal to the support surface of at least one of said first and second carriages, optionally along a direction, in use, vertical. As can be seen from Figures 19-25, the handling system 1" in accordance with the third variant may comprise an unloading device 70 engaged at the frame 11" and active at the second zone Z2". The unloading device 70 is configured to take the at least one support component from the at least one carriage 13", optionally from the single carriage 13", located at the second zone Z2" and unload it into an external zone outside the frame 11". In greater detail, the unloading device 70 is placed at least partially above the second zone Z2" in such a way that one or more supporting components may be taken, from above, from the carriage; the unloading device 70 is engaged at least one of the first lateral edge 11c" and the second lateral edge 11d": the frame 11" thus supports the unloading device in such a way that the same may be arranged, in use, above the guide 12". In greater detail, the unloading device 70 may comprises:

a first shoulder 71 fixed to the first lateral edge 11c" of the frame 11", at the second zone Z2", wherein the first shoulder 71 extends from a base end fixed to the first lateral edge 11c" of the frame to an opposite top end,
a second shoulder 72 fixed to the second lateral edge 11d" of the frame 11", at the second zone Z2", wherein the second shoulder 72 extends from a base end fixed to the second lateral edge 11d" of the frame to an opposite top end,
a base 73 fixed to the first and second abutments 71, 72 at the top ends.

[0205] In fact, the base 73 is placed, in use, above the guide 12": the carriage 13", in use and when placed at the second zone Z2", is placed below the base 73 of the unloading device. In particular, the base 73 is arranged at a minimum distance from the frame 11" of more than 400 mm, optionally between 500 and 1200 mm; the base 73 also has a minimum distance from the support surface 13a" of the carriage 13" of more than 350 mm, optionally between 400 and 1000 mm.

[0206] As can be seen from the accompanying figures, unloading device 70 also comprises:

at least one unloading arm 74 carried by the base 73, said unloading arm extending between a first and second end portions 74a, 74b,
at least one gripping device 75 engaged at the second end portion 74b of the unloading arm.

[0207] The first end portion 74a faces the rear portion 11a" of the frame 11" while the second end portion 74b, supporting the gripping device 75, faces the front portion 11b". The unloading arm 74 is of an extendable type: the second end portion 74b of the unloading arm 74 carrying the gripping device is movable with respect to the base 73 at least between:

a pick-up position where the second end portion 74b is placed, in use, above the second zone Z2',
an unloading position where the second end portion 74b is placed, in use, outside the frame.

[0208] In fact, the arm extension allows one or more components to be picked up from the frame 11" and brought out of an size of the frame 11' to allow them to be unloaded. In detail, the second end portion 74b, in use and in the pick-up position, is configured to allow the gripping device 75 to pick up the at least one support component ST from the carriage 13" placed in the second zone Z2" while, in use and in the unloading position, the second end portion 74b is configured to allow the gripping device to unload the one or more support components outside the frame 11". In contrast, the position of the first end portion 74a of the unloading arm 74 is fixed: at the first end portion 74a, the unloading arm carries a counterweight 76. The movement of the unloading arm 74 is generated by an actuator, which may comprise at least one of: a hydraulic cylinder, an electric motor, a hydraulic cylinder, a hydraulic motor, an electric actuator, a pneumatic actuator.

[0209] The grasping device 75 may also be movable with respect to the frame 11", for example by means of a respective actuator, capable of allowing the movement in approach and departure of said grasping device 75 with respect to the frame 11", for example along a direction orthogonal to the support surface 13a" of the carriage 13". The grasping device 75 may comprise at least one hook 75a movable in approach and departure with respect to the frame 11' optionally along a direction orthogonal to the support surface 13a" of the carriage 13"; the movement of the grasping device may allow the operator in charge to bring the hook closer to the support component to facilitate its grasping. Also by the movement of the gripping device 75, it is possible to lift the support component relative to the frame 11" to facilitate its unloading outside the frame 11".

[0210] The handling system 1" according to the third variant may also comprise a control unit connected to at least one actuator of the handling system 1" to control the synchronisation of the movements of the at least one carriage, the lift 20" and the unloading device 70. In particular, the control unit is active in command on:

the actuator configured to move the 13" carriage along the 12" guide,
the lift 20"actuator,
the actuator active on the unloading arm 74,

the actuator active on the socket 75.

[0211] The control unit of the 1" handling system is configured to perform an unloading procedure, optionally configured to allow an ST support component to be picked up and moved from a carriage and placed on the ground; this procedure is schematised in Figures 21 to 25. The unloading procedure performed by the control unit comprises the following steps:

arrange the 20" lift in the lowered position, optionally in the lowered position the 13" carriage is configured to receive at least one ST support component,
when lift 20" is in the lowered position, command the movement of carriage 13" along guide 12" so that carriage 13" may move from the first zone Z1" to the second zone Z2",
when the carriage 13" is in the second zone Z2", arrange the second end portion 74b of the unloading arm 74 above the carriage 13",
then, command the approach of the 75 gripping device to the 13" carriage to allow the ST support component to be engaged to the gripping device,
then, command the movement of the gripping device 75 away from the frame 11" to allow the support component ST to be lifted away from the frame,
then, command the movement of the second end portion 74b of the unloading arm 74 outside the 11" frame,
then, command the movement of the 75 pick-up device away from the unloading arm to allow the ST support component to be unloaded onto the ground.

[0212] The unloading procedure carried out by the control unit also comprises a phase to control the movement of the carriage 13" along the guide 12" so that the carriage 13" may move from the second zone Z2" to the first zone Z1", optionally during this phase of movement of the carriage 13" the control unit is configured to control the movement of the lift 20" from the lowered position to the raised position.

[0213] In this way, the 13" carriage may receive another ST support component, which will then be moved by the same carriage to the second Z2" zone to be prewashed by the unloading device 70.

Process

[0214] It is also an object of the present invention to provide a process for moving one or more support components ST by means of a 1, 1', 1" handling system in accordance with the above description. The support component ST may comprise at least one reinforced concrete slab configured to receive in engagement at least one rail of a railway line. Figures 6 to 9 schematically illustrate a process for moving a plurality of support components by means of a handling system 1 in accordance with the first variant described above. In detail, the process may comprise a first step of arranging the first and second carriages 13, 14 respectively in the first and second zones Z1, Z2 with the first and second lifts 20, 25 in the lowered position; in this condition, the process may comprise loading a first stack P1 of support components ST on the first carriage 13 and a second stack P2 of support components ST on the second carriage 14 of a same first handling system 1. Subsequently, the process provides for the handling of the first carriage 13 in the second zone Z2; consequently, given the connection in the movement of the first carriage 13 with the second carriage 14, said second carriage is guided outside the frame 11 of the first handling system. In Figure 7, the second carriage 14 of the first handling system has been schematically shown to move in correspondence with a first zone Z1 of a second handling system 1 which is identical and immediately adjacent to the first handling system 1. However, the possibility of moving said second carriage 14 in correspondence with a first zone of a different handling system, for example the first zone Z1' of the handling system 1' in accordance with the second variant is not excluded. Next, the process involves moving the first and second lifts 20, 25 from the lowered position to the raised position so that the second lift 25 may receive the first stack P1 of support components ST; during this step, an additional stack FP of support components ST may be placed on the first lift 20 (figure 9).

[0215] During the raised position of the first and second lifts 20, 25 carrying respectively the further FT stack of support components and the first P1 stack of support components, the process is to move the first and second carriages with respect to the frame 11 in such a way that the first carriage 13 may move from the second Z2 zone to the first Z1 zone while the second carriage 14 may move back to the second Z2 zone of the first handling system.

[0216] The process then involves moving the first and second lifts 20, 25 from the raised position to the lowered position so that the first stack P1 of ST support components may rest on the second carriage 14 while the further stack FP of ST support components may rest on the first carriage 13.

[0217] In this way, the process allows the advancement of stacks of ST support components from one carriage to another and, if present, between adjacent handling systems. Each stack (e.g. stack P1, P2 or FP) of support components may comprise 2 or more support components, optionally between 2 and 6.

[0218] Figures 6 to 9 illustrate a movement process employing a first and second carriage 13, 14 of a handling system. Of course, the possibility of employing a single carriage 13 and a second carriage of a different handling system, for example a second carriage 14 of the handling system 1' in accordance with the second variant, is not excluded.

[0219] Figures 12-15, 17 and 18 schematically illustrate a singularisation process of a plurality of support

components performed by means of a handling system 1' in accordance with the second variant described above. Again, a singularisation process employing a first and second carriage 13', 14' of the same handling system 1' is illustrated in figures 12-15, 17 and 18. Of course, we do not exclude the possibility of employing a single carriage 13' and a second carriage of a different handling system, for example a second carriage of the 1' handling system in accordance with the third variant.

[0220] The process involves setting up the lift 20' in the lowered position so that a first stack P1 of support components may be loaded onto the first carriage 13'; this step may also be carried out by means of the shifting process described above, for example by using a second carriage 14 to move said stack P1 of support components at the first zone Z1' of the handling system 1'; said stack may then be lifted by the lift 20' and loaded onto the first carriage 13' when arranged at the first zone Z1'.

[0221] Subsequently, the singularisation process, during the lowered position of the lift 20', provides for a first movement of the first and second carriages 13', 14' with respect to the frame 11' in such a way that the first carriage 13' may move from the first zone Z1' to the second zone Z2' while the second carriage 14' may move from the second zone Z2' to the outer zone of the frame 11; for example, the second carriage 14' may be guided on an additional handling device 1'. In this way, the first carriage 13' may carry the stack P1 of support components at the second zone where the de-stacker 30 operates.

[0222] When the first carriage 13' is in the second zone Z2', the process may place the at least one lifting arm of the de-stacker 30 in the lowered position to allow interception of the entire stack of support components placed on the first carriage 13'. In detail, said phase provides for the movement of the first and second lifting arms 37, 38 of the first and second columns 31, 32 with respect to the frame 11': during said phase, in order to avoid undesired impacts of the lifting arm with the stack P1, the process provides for the movement of the support components 41, 42 in the retracted position.

[0223] When the lifting arm is in the lowered position, the process comprises moving the support elements to the extended position so that said support elements may position themselves below the entire stack P1. Subsequently, the singularisation process provides for a first movement of the at least one lifting arm (optionally of the first and second lifting arms 37, 38) from the lowered position to the raised position in order to raise the entire stack of support components ST (figure 14); in this way, the first carriage 13' may be released and may be moved from the second zone Z2' to the first zone Z1'. In more detail, the process provides for a first movement of the first and second carriage in order to place them in correspondence with the first zone Z1' and the second zone Z2' respectively.

[0224] Thereafter, the process comprises a second movement of the at least one lifting arm into the lowered position to unload the entire stack P1 of support components onto the second carriage 14' (figure 13). Subsequently, the process comprises a third movement of the at least one lifting arm into the intermediate pick-up position to intercept the support components placed above the support component in direct contact with the second carriage 14'; during this movement, the support elements 41, 42 are maintained in the retracted position so as to avoid undesired contact with the stack P1: only when the lifting arm is stably in the intermediate pick-up position, the support elements are moved into the extended position so that they may lift one or more support components. In detail, the intermediate pick-up position is calculated in such a way that only one support component may remain on the second carriage 14' while the remaining support components of the same stack may be lifted relative to the frame 11'.

[0225] Next, the process involves moving the at least one lifting arm from the intermediate pick-up position to the raised position in such a way that the support components placed above the support component in direct contact with the second carriage 14' (figure 17) are lifted.

[0226] Subsequently, the singularisation process performs a third movement of the first and second carriages 13', 14' along the guide 12' in such a way that the first carriage 13' may move from the second Z2' zone to the first Z1' zone while the second carriage 14' may move from the outer zone to the second Z2' zone of the frame in order to move only one support component from the second Z2' zone to the outer zone of the frame 11' of the handling system 1', e.g. to move a single component to another handling system.

[0227] By repeating the steps from the second lift arm movement onwards, it is possible to pick up a single support component from a stack of support components, thus generating a substantially singularised flow.

[0228] Figures 21 to 25 schematically illustrate a process for unloading support components using a 1" handling system in accordance with the third variant described above. Again, an unloading process employing a single 13" carriage is illustrated in Figures 21 to 25. Of course, the possibility of employing two carriages, one of which is configured to reach a different handling system, for example a second zone Z2' of a handling system 1' in accordance with the second variant, is not excluded.

[0229] The process involves setting up the lift 20" in the lowered position so that a single support component ST may be loaded onto the carriage 13"; this step may also be carried out by means of the singularisation process described above, for example by using a second carriage 14' to move a single support component ST at the first zone Z1" of the handling system 1"; this stack may then be lifted by the lift 20" and loaded onto the carriage 13" when arranged at the first zone Z1".

[0230] The unloading process involves a first movement of the carriage 13" relative to the frame 11" in such a way that the carriage 13" moves from the first zone Z1" to the second zone Z2"; in this way, the carriage 13" may

bring the single support component to the second zone Z2" where the unloading device 70 operates.

[0231] When the carriage 13" is in the second zone Z2", the process comprises arranging the second end portion 74b of the unloading arm above the carriage 13" and then moving the gripping device 75 in approach to the support component ST. In this way, an attendant operator may engage said support component ST to the gripping device 75; only then does the process comprise lifting the gripping device 75 in such a way that the single support component ST may be distanced from the carriage 13".

[0232] Only then does the process involve moving the second end portion 74b of the unloading arm 74 away from the base 73 in such a way that the support component hooked by the gripping device 75 is moved out of the way of the frame 11" and then placed on the ground.

[0233] The process, following the step of picking-up the support component ST from the carriage 13", provides for a second movement of the carriage 13" from the second zone Z2" to the first zone Z1" so that the carriage 13" may receive another support component ST; in other words, when the support component ST is supported by the unloading arm 74, the carriage 13" may be moved at the first zone Z1" so that a further support component may be loaded onto the carriage 13".

Railway wagon 60

[0234] A railway wagon comprising one or more carriages 61 configured to support a platform 62; the carriage is of the type configured to move on a rail and/or track of a railway line.

[0235] The platform 62 extends longitudinally along an extension direction between a first and a second lateral edge 62a, 62b. The platform 62 has a respective first and second lateral edge 62c, 62d spaced apart from each other along a direction orthogonal to the direction of extension of the same platform: the first and second lateral edges 62c, 62d define a lateral size of said platform 62. In detail, the first and second lateral edges 62c, 62d are placed at a minimum distance from each other, optionally measured orthogonally to the direction of extension of said platform, which is greater than 2,000 mm, optionally between 2,300 and 2,800 mm.

[0236] As can be seen from the accompanying figures, the railway wagon 60 comprises at least one handling system described above. The handling system is engaged at the platform 62 on the opposite lateral of the carriage 61; in fact, the handling system is used to allow the movement of one or more support components ST along the railway wagon 60, regardless of whether said railway wagon is movable along a railway line or not.

[0237] As can be seen from the accompanying figures, the frame of the handling system has a size substantially similar to that of the platform 62; in detail, the rear portion of the frame is located at the first end 62a of the platform 62 while the front portion of the frame is located at the second end 62b of the platform (62); in fact, the frame extends along the entire longitudinal extension of the platform 62.

[0238] In Figures 1, 2, 6-9 a railway wagon 60 comprising a handling system 1 in accordance with the first variant to essentially define a railway wagon for transporting a plurality of support components ST is shown. In fact, thanks to the handling system 1 the railway wagon shown in Figures 1, 2, 6-9 is capable of performing the process of moving a plurality of support components described above.

[0239] Figures 10, 12-18 instead show a railway wagon 60 comprising a handling system 1' in accordance with the second variant to essentially define a railway wagon for singularising support components ST. In fact, thanks to the handling system 1' the railway wagon shown in Figures 10, 12-18 is capable of performing the singularisation process described above.

[0240] Figures 19-25 instead show a railway wagon 60 comprising a handling system 1" in accordance with the third variant to essentially define a railway wagon for unloading support components ST. In fact, thanks to the handling system 1" the railway wagon shown in Figures 19-25 is capable of performing the singularisation process described above.

Railway vehicle

[0241] It is also an object of the present invention to provide a railway vehicle movable along a railway line, for example on a track, comprising at least one railway wagon 60 in accordance with the above. For example, the rail vehicle may comprise:

- one or more railway wagons 60 for the transport of support components or one or more railway wagons joined together by couplings and each carrying a handling system 1 in accordance with the first variant,
- a railway wagon 60 for the singularisation of support components immediately adjacent to a railway wagon for the transport of support components, wherein said railway wagon 60 for the singularisation of support components carries a handling system 1' in accordance with the second variant,
- a railway wagon 60 for the unloading of support components immediately adjacent to a railway wagon for the unloading of support components, wherein said railway wagon 60 for the unloading of support components carries a 1" handling system in accordance with the third variant.

[0242] In fact, the rail vehicle by means of the handling system 1 in accordance with the first variant allows a plurality of ST support components to be moved along the vehicle, which, once they reach the handling system 1' in accordance with the second variant, are singularised in such a way that only one component at a time may be served to a handling system in accordance with the third

variant for unloading one component at a time on the ground.

[0243] The vehicle may be equipped with a locomotive that allows the vehicle to be moved along the railway line, so that, following the installation of support components and the definition of a tract of a railway line, the vehicle may be moved along that railway line.

Claims

1. A handling system (1") for support components (ST) configured to be engaged on at least one rail of a railway line, said handling system (1") being associated with a railway wagon (60) movable along at least one rail, wherein the handling system (1") comprises:

at least one frame (11") extending between a rear portion (11a") and a front portion (11b") along a longitudinal trajectory (T1"), wherein said frame (11") presents:

at least a first zone (Z1") defined between the rear portion (11a") of the frame (11") and a middle portion of the same frame (11"), wherein the middle portion is placed substantially between the rear portion (11a") and the front portion (11b") of the frame (11"),
at least a second zone (Z2") defined between the front portion (11b") of the frame (11") and said middle portion,

at least one guide (12") extending for at least part of the frame extension (11") substantially parallel to the longitudinal trajectory (T1") of the frame,
at least one carriage (13") slidingly movable along the guide (12") between the first and second zones (Z1", Z2") of the frame,

characterised by the fact that the handling system comprises at least one unloading device (70) engaged to the frame (11") and configured to engage at least one support component placed on the at least one carriage (13") located at the second zone (Z2") and unload it in an external zone outside the frame (11").

2. Handling system according to claim 1, wherein the unloading device (70) is placed at least partially above the second zone (Z2").

3. Handling system according to any of the preceding claims comprising a single carriage (13") movable along the guide (12") between the first and second zones (Z1", Z2").

4. Handling system according to any of the preceding claims, wherein the unloading device (70) comprises:

a base (73) fixed to the frame,
at least one unloading arm (74) of an extendible type constrained to the base (73), said unloading arm being configured to engage at least one support component located at the base (73) and move said support component outside the frame (11").

5. Handling system according to the preceding claim, wherein the frame (11") has a first and a second lateral edge (11c", 11d") spaced apart along a direction orthogonal to the longitudinal trajectory (T1") of the same frame, wherein the guide (12") is interposed between said first and second lateral edges (11c", 11d"),

wherein the unloading device (70) comprises:

a first shoulder (71) fixed to the first lateral edge (11c") of the frame (11) at the second zone (Z2"), wherein the first shoulder (71) extends from a base end (71a) fixed to the first lateral edge (11c") of the frame to an opposing top end (71b),
a second shoulder (72) fixed to the second lateral edge (11d") of the frame (11), at the second zone (Z2"), wherein the second shoulder (72) extends from a base end (72a) fixed to the second lateral edge (11d") of the frame to an opposing top end (72b),

wherein the base (73) is fixed to the first and second shoulders (71, 72) at the top ends.

6. Handling system according to the preceding claim, wherein the unloading arm (74) extends between a first and a second end portion (74a, 74b), wherein the unloading device further comprises at least one gripping device (75) engaged at the second end portion (74b) of the unloading arm.

7. Handling system according to the preceding claim, wherein the first end portion (74a) of the unloading arm (74) faces the rear (11a") portion of the frame (11") while the second end portion (74b) faces the front (11b") portion of the frame,
wherein at least the second end portion (74b) of the unloading arm (74) is movable relative to the base.

8. Handling system according to claim 6 or 7, wherein the second end portion (74b) of the unloading arm (74) is movable at least between:

a pick-up position wherein the second end portion (74b) is placed, in use, above the second zone (Z2"), wherein the second end portion (74b), in use and in the pick-up position, is configured to allow the pick-up organ (75) to pick up at least one support component (ST) from the single carriage (13") located in the second zone (Z2"),
an unloading position wherein the second end portion (74b) is placed, in use, outside the frame, wherein the second end portion (74b), in use and in the unloading position, is configured to allow the gripper to unload one or more support components outside the frame (11").

9. Handling system according to any one of the preceding claims comprising at least one lift (20") engaged at the frame (11") and active at the first zone (Z1"), wherein the at least one lift is configured to move the one or more support components along a direction orthogonal to said at least one carriage support plane.

10. A process of unloading support components (ST) by means of a handling system (1") in accordance with any one of the preceding claims from 1 to 9, wherein the process comprises the following steps:

arrange the carriage (13") at the first zone (Z1"),
arrange at least one support component (ST) on the carriage (13"),
perform an initial movement of the carriage (13") relative to the frame (11") so that the carriage (13") moves from the first zone (Z1") to the second zone (Z2"),
when the carriage (13") is in the second zone (Z2"), arrange the second end portion (74b) of the unloading arm above the carriage (13"),
then, arrange the gripper (75) close to the support components (ST) and hook said support components (ST) onto the gripper (75),
lift the support components (ST) relative to the carriage (13") by moving the gripper (75) away from the frame (11"),
then, move the second end portion (74b) of the unloading arm (74) away from the base so that the support component engaged by the gripper is outside the frame (11"),
unload the support components on the ground by moving the gripper (75) in relation to the unloading arm (74).

11. Railway wagon (60) comprises:

a plurality of axles (61), wherein each axle is constrained by at least one or more wheels configured to move along at least one rail,
a platform (62) supported by said plurality of axles,
at least one handling system (1) in accordance with any one of claims 1 to 9 engaged at the platform (62) opposite the plurality of axles (61),
wherein said handling system (1) is configured to allow handling of support components (ST) with respect to the platform (62).

12. Railway wagon according to the preceding claim, wherein the platform (62) extends longitudinally along an extension trajectory between a first and a second end (62a, 62b), wherein the extension trajectory of the platform (62) is substantially parallel to the longitudinal trajectory (T1") of the frame (11"),
wherein the frame (11") of the handling system (1") extends along the entire longitudinal extension of the platform (62).

13. Railway wagon according to claim 11 or 12, wherein the rear portion of the frame is positioned at the first end (62a) of the platform (62) and the front portion of the frame is positioned at the second end (62b) of the platform (62),
wherein the platform (62) has a respective first and second side edge (62c, 62d) spaced apart along a direction orthogonal to the direction of extension of said platform (62), wherein the first and second side edges (62c, 62d) define a lateral size of said platform (62), wherein the first side edge of the frame is positioned at the first edge of the platform (62) and the second side edge of the frame is positioned at the second edge (62d) of the platform (62).

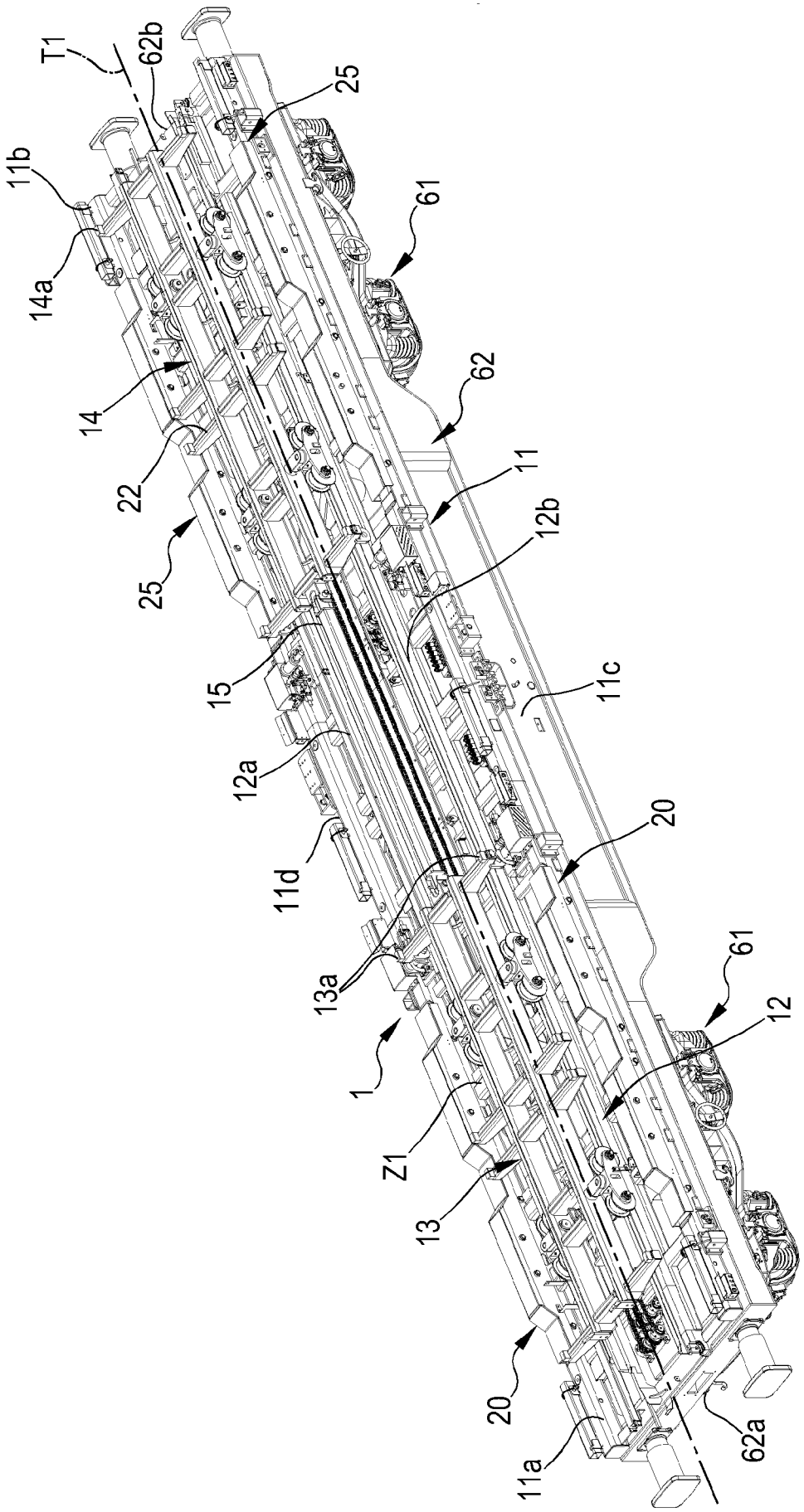

T1
62b
25
11b
61
14a
14
62
22
11
12b
25
15
11c
12a
20
11d
13a
61
12
1
Z1
13
20
62a
11a

FIG.1

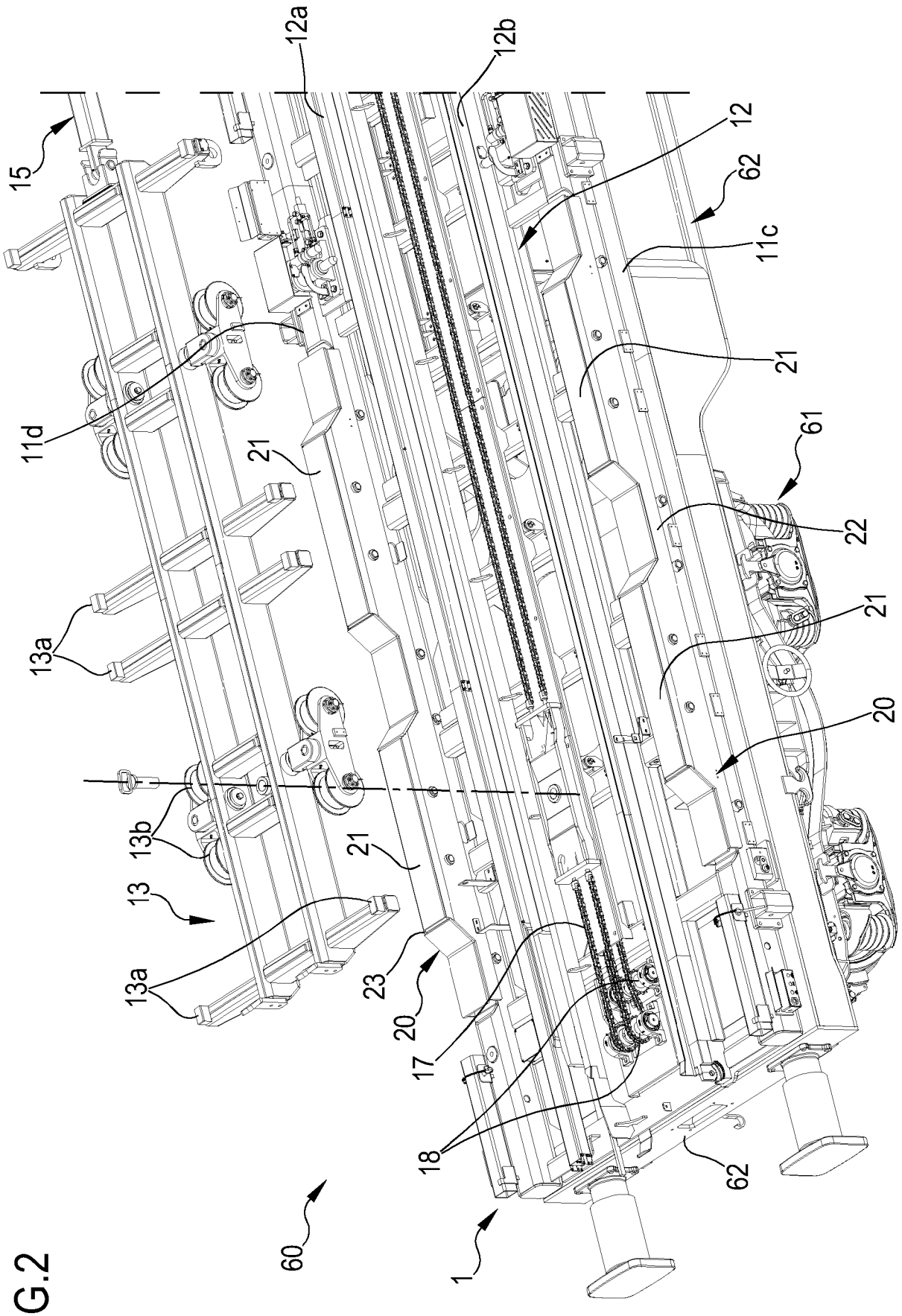


FIG.2

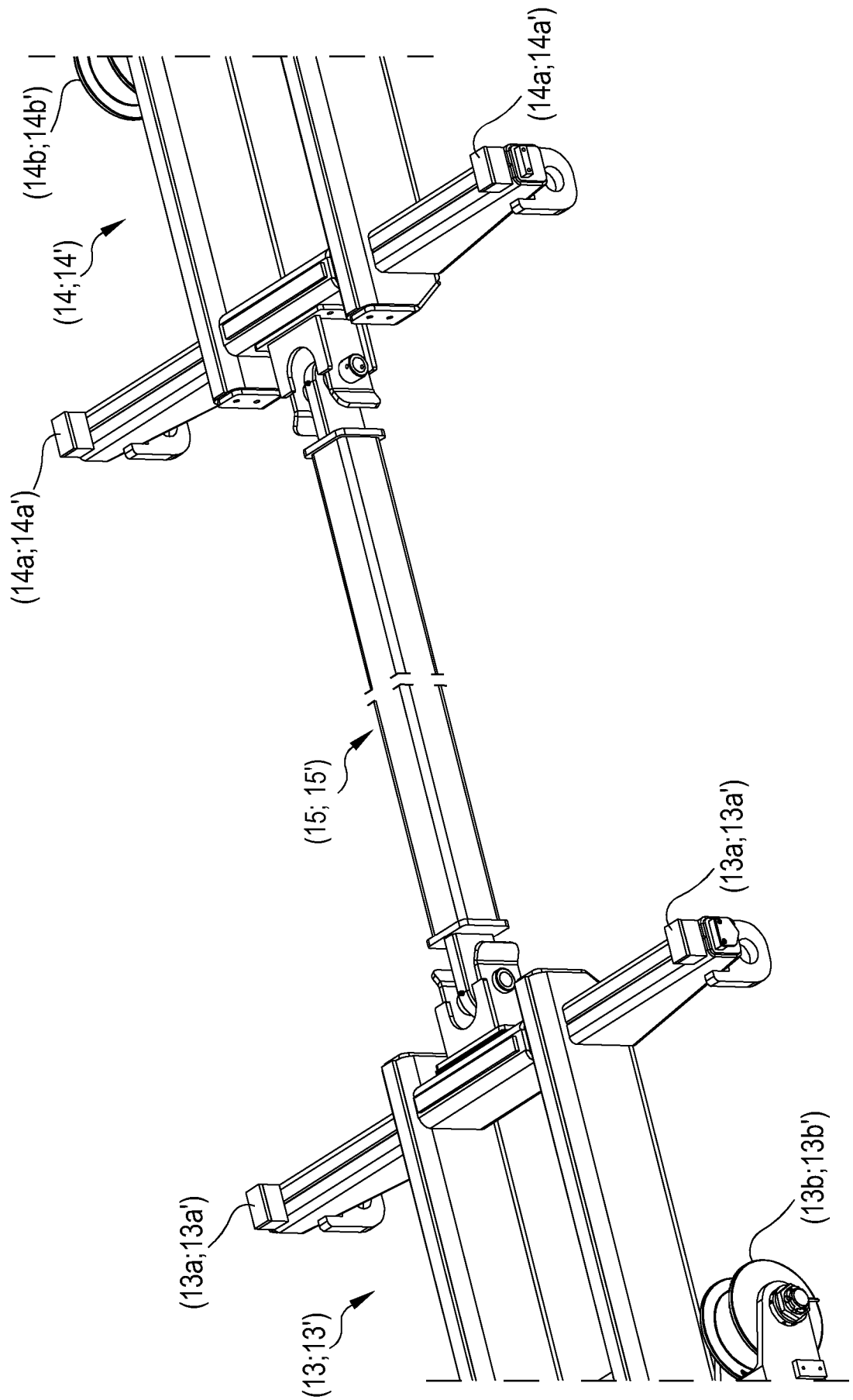


FIG.3

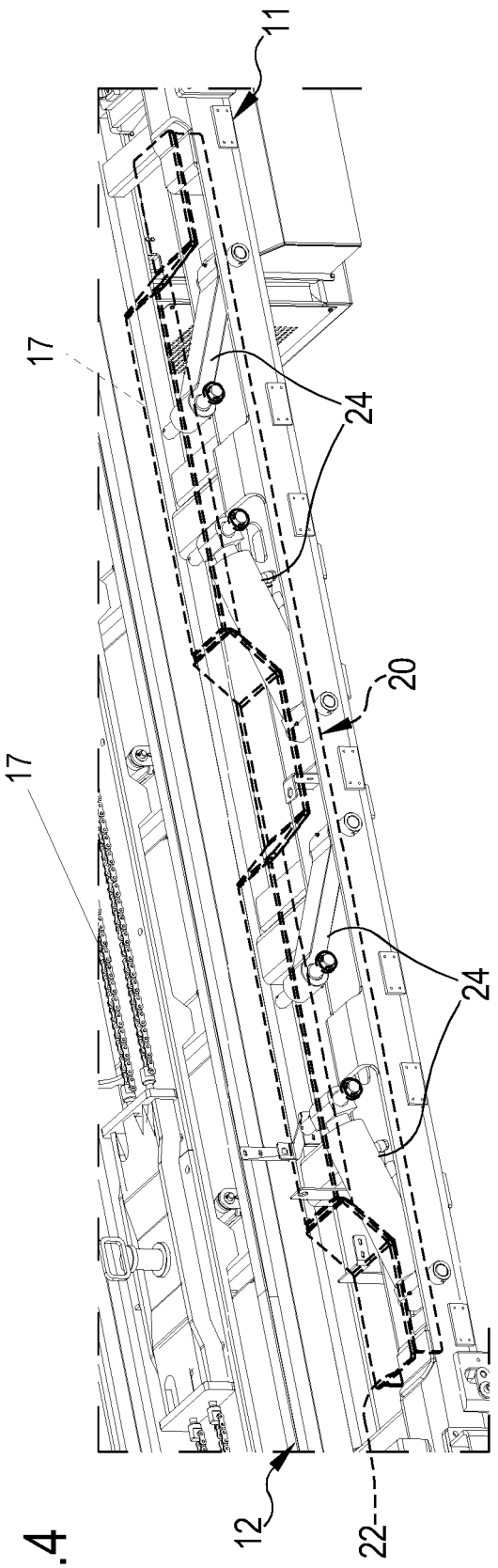


FIG.4

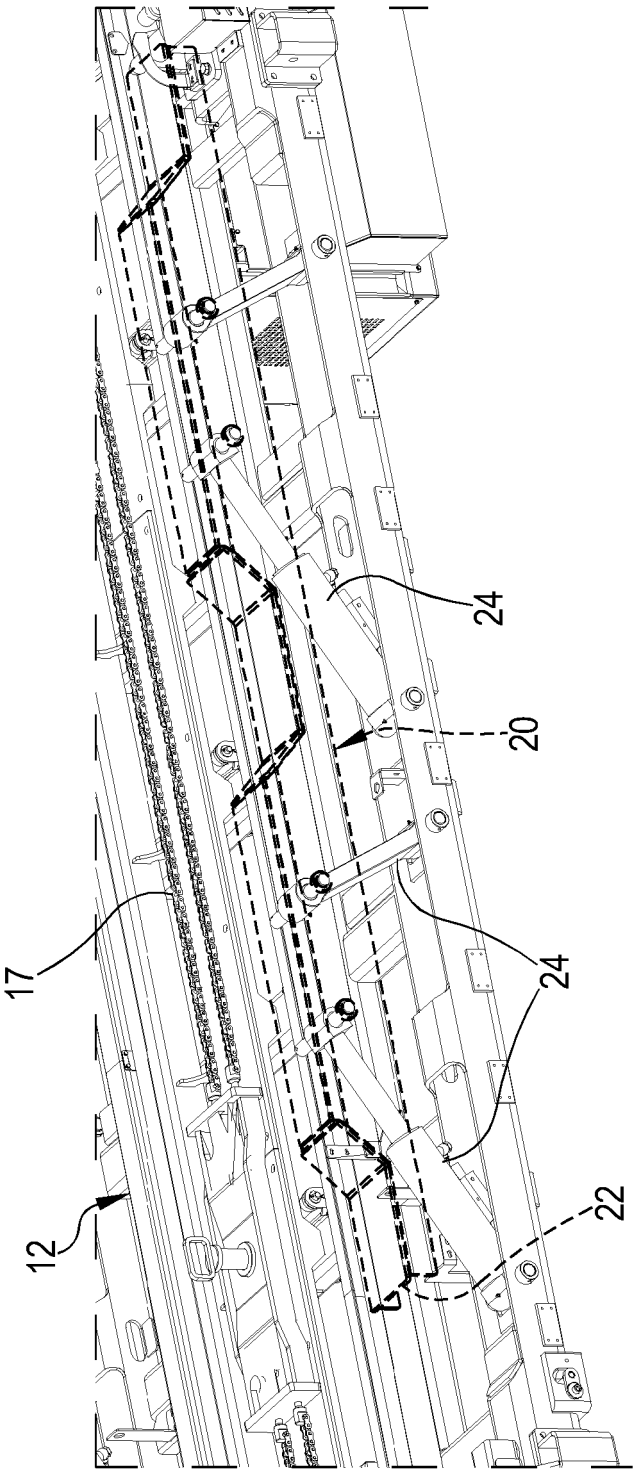


FIG.5

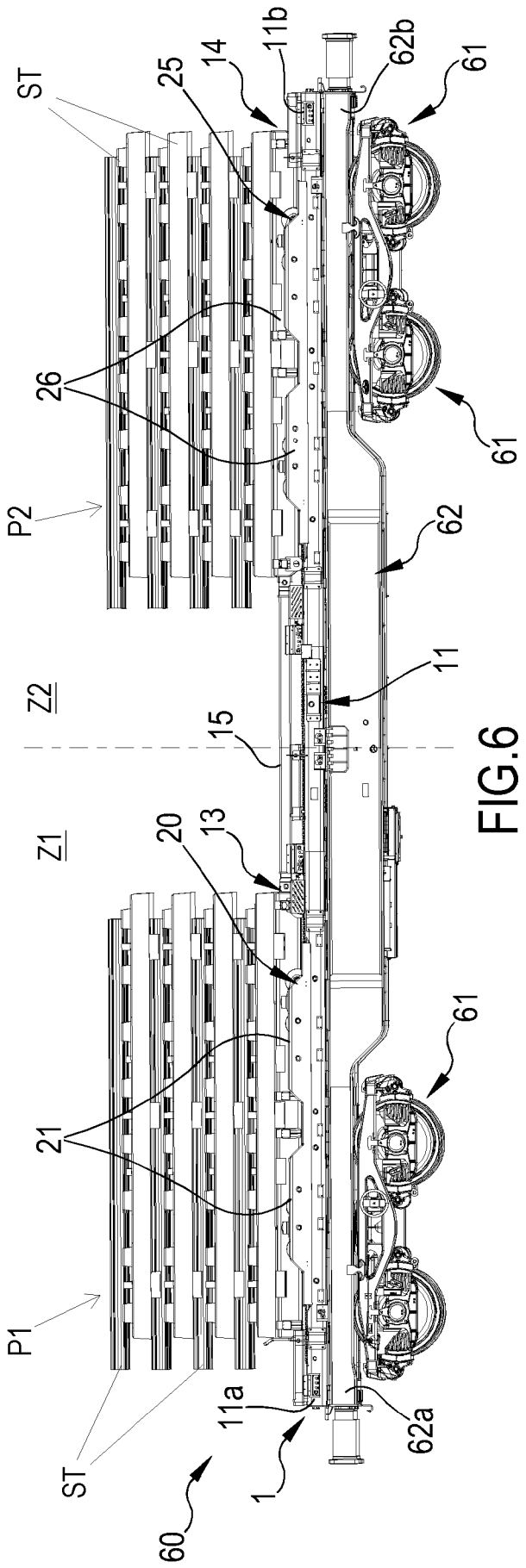

ST
25
14
11b
62b
61
26
61
P2
62
11
Z2
15
Z1
20
13
61
21
P1
ST
11a
62a
60
1

FIG.6

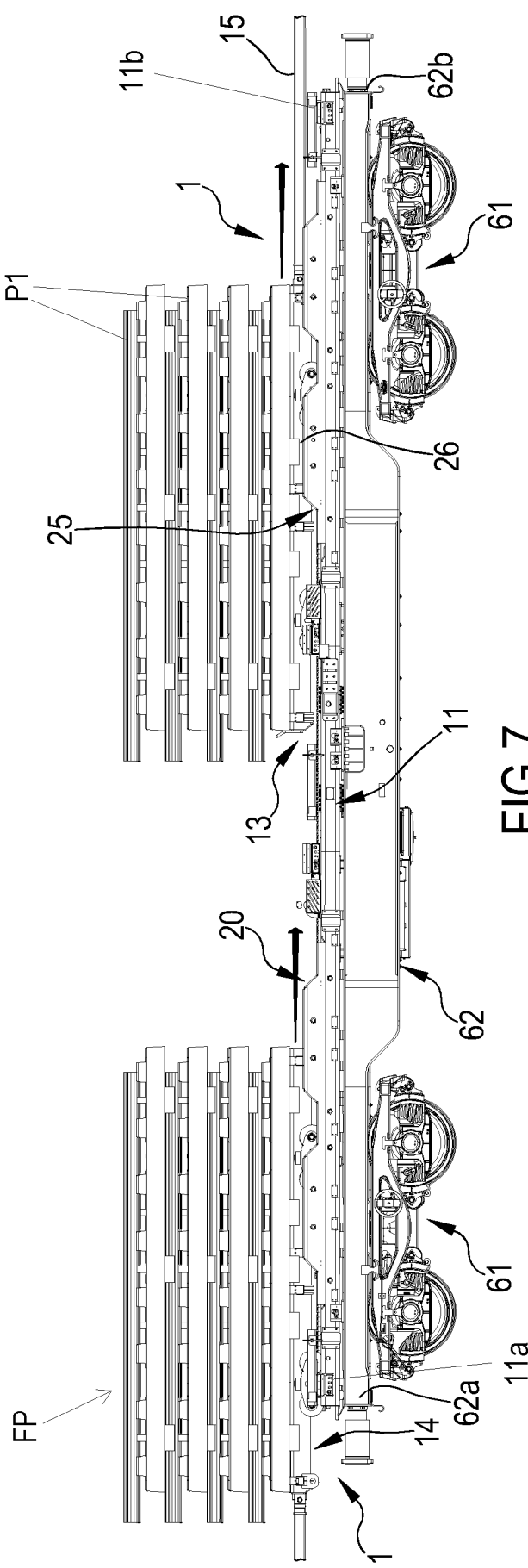

15
11b
62b
1
61
P1
26
25
11
13
20
62
61
11a
FP
62a
14
1

FIG.7

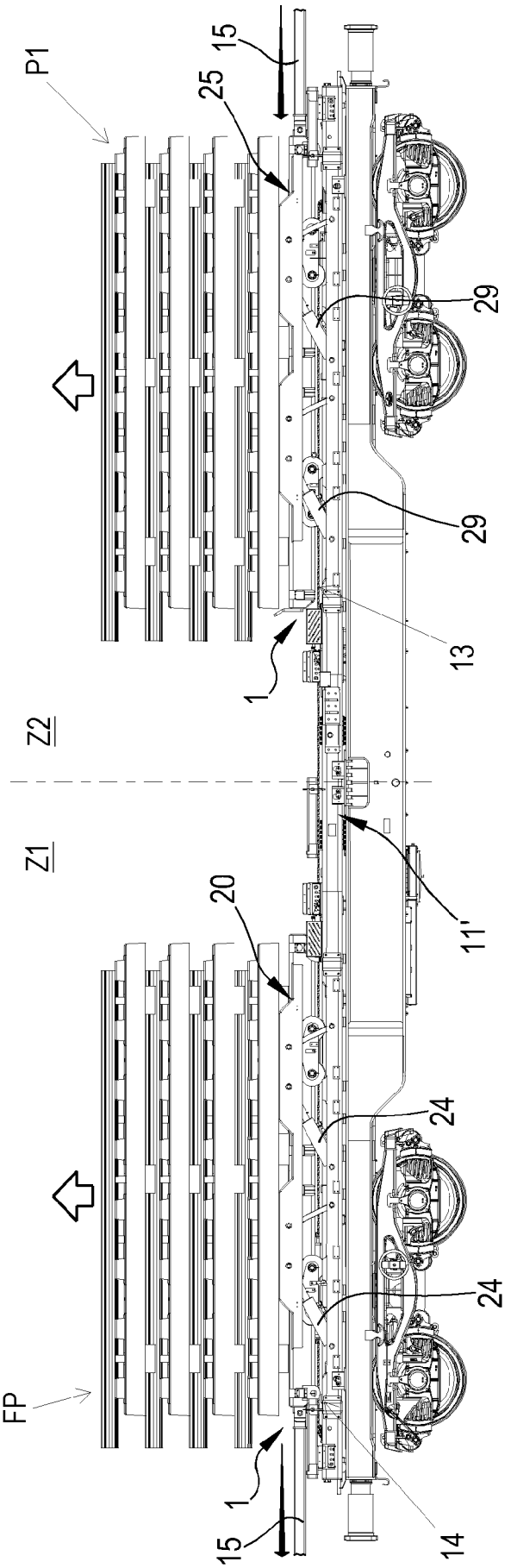

P1
15
25
29
29
13
1
Z2
Z1
20
11'
24
24
FP
1
15
14

FIG.8

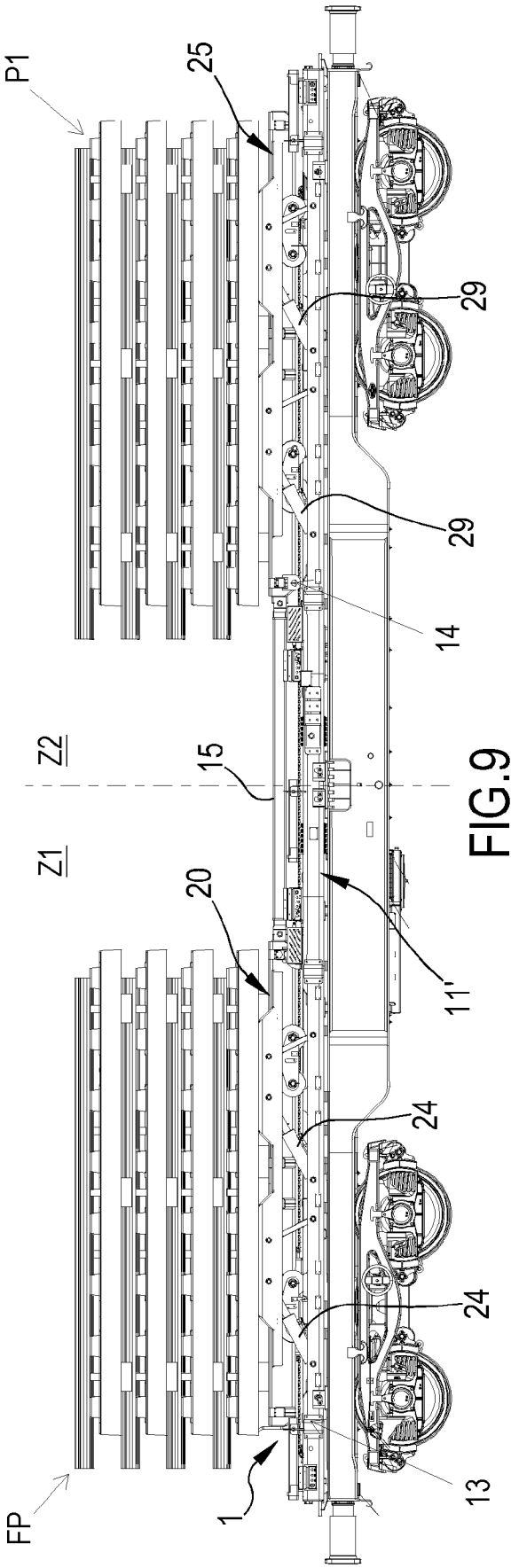

P1
25
29
29
14
Z2
15
Z1
20
11''
24
24
FP
1
13

FIG.9

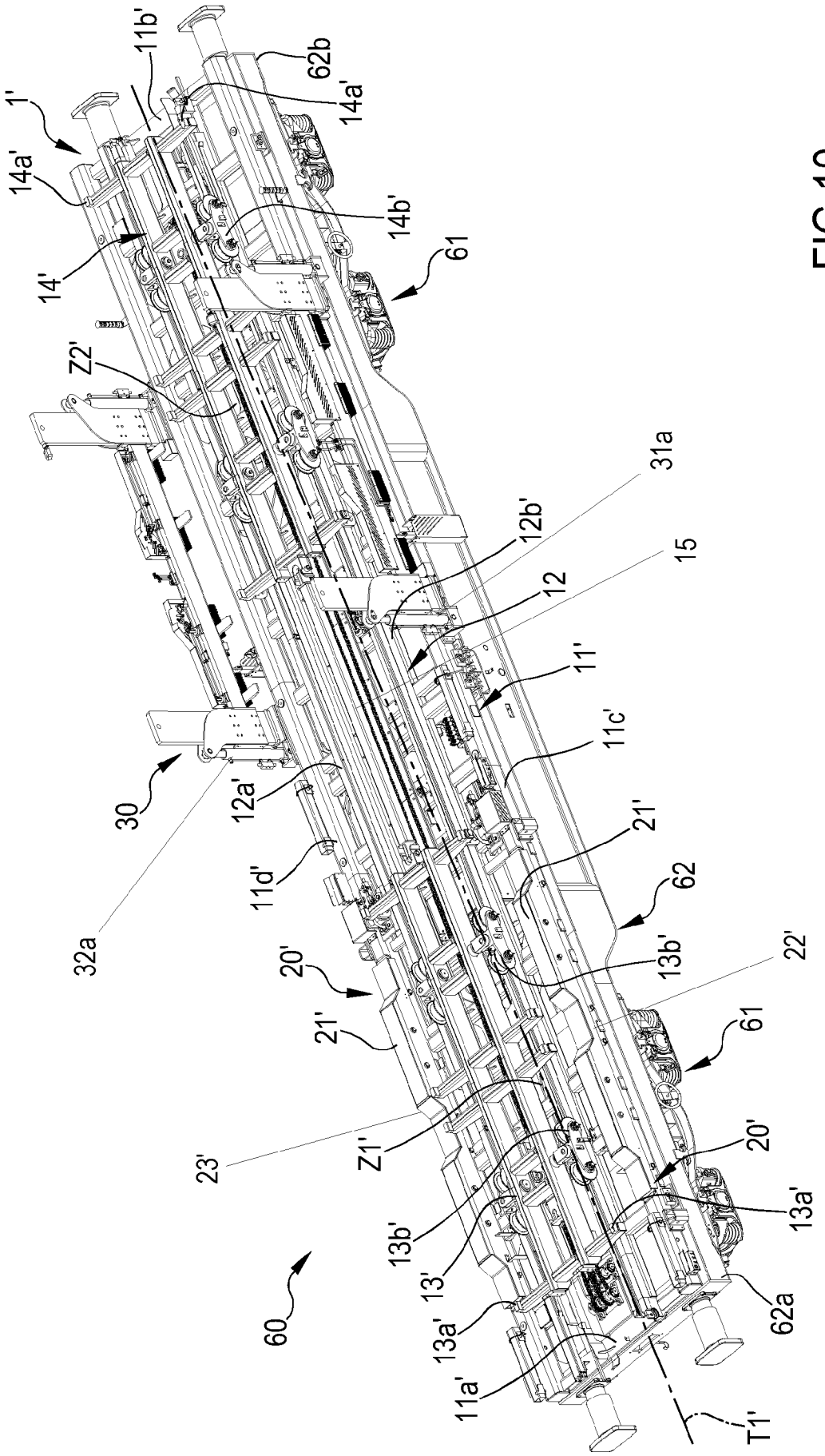

1'
11b'
62b
14a'
14a'
14b'
14'
61
Z2'
31a
12b'
15
12
11'
11c'
30
12a'
21'
11d'
62
32a
20'
13b'
22'
21'
61
23'
Z1'
20'
13b'
13'
13a'
13a'
62a
60
11a'
T1'

FIG.10

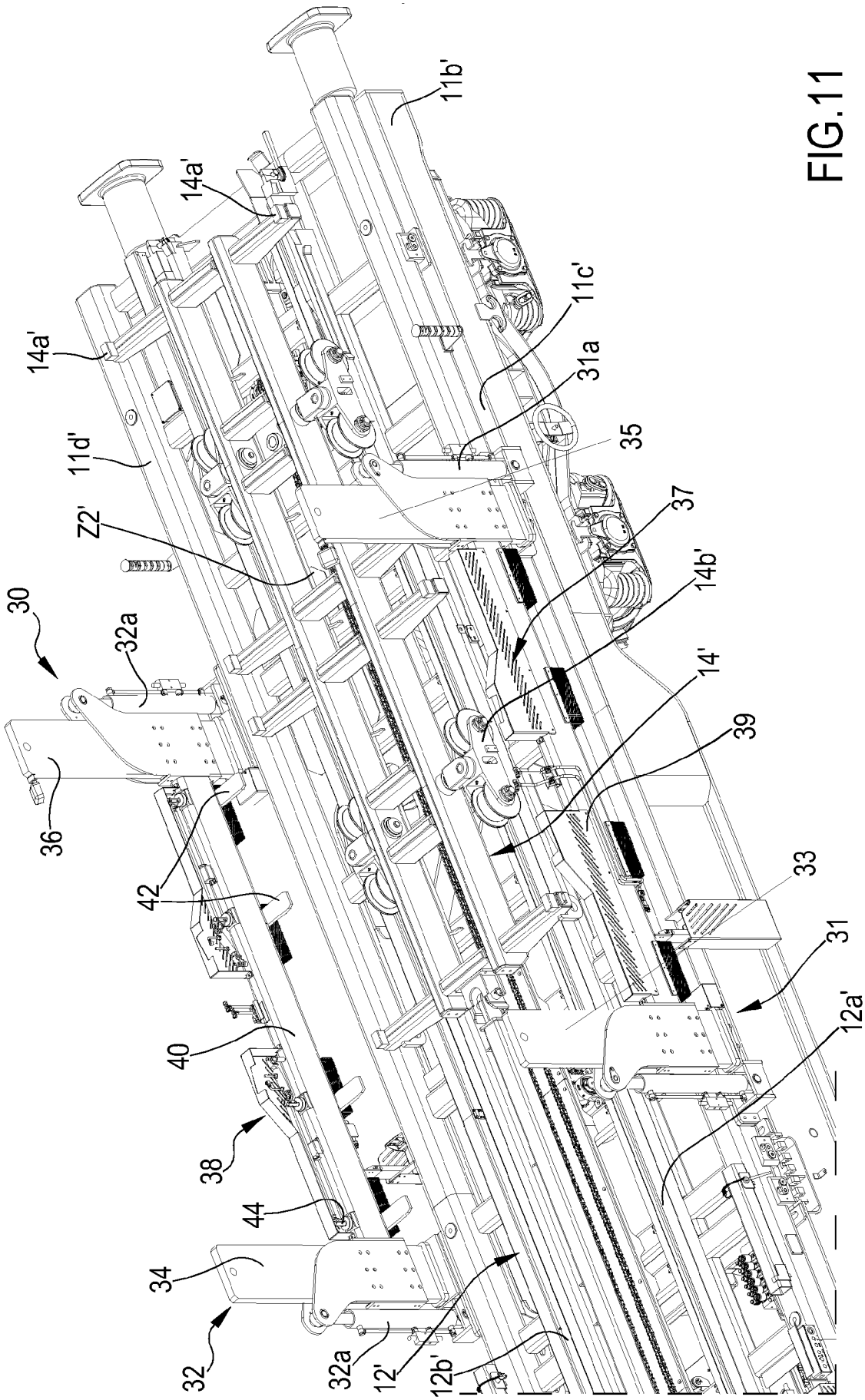

11b'
14a'
14a'
11c'
31a
11d'
35
Z2'
37
14b'
30
32a
14'
39
36
42
33
31
12a'
40
38
44
34
32
32a
12'
12b'

FIG.11

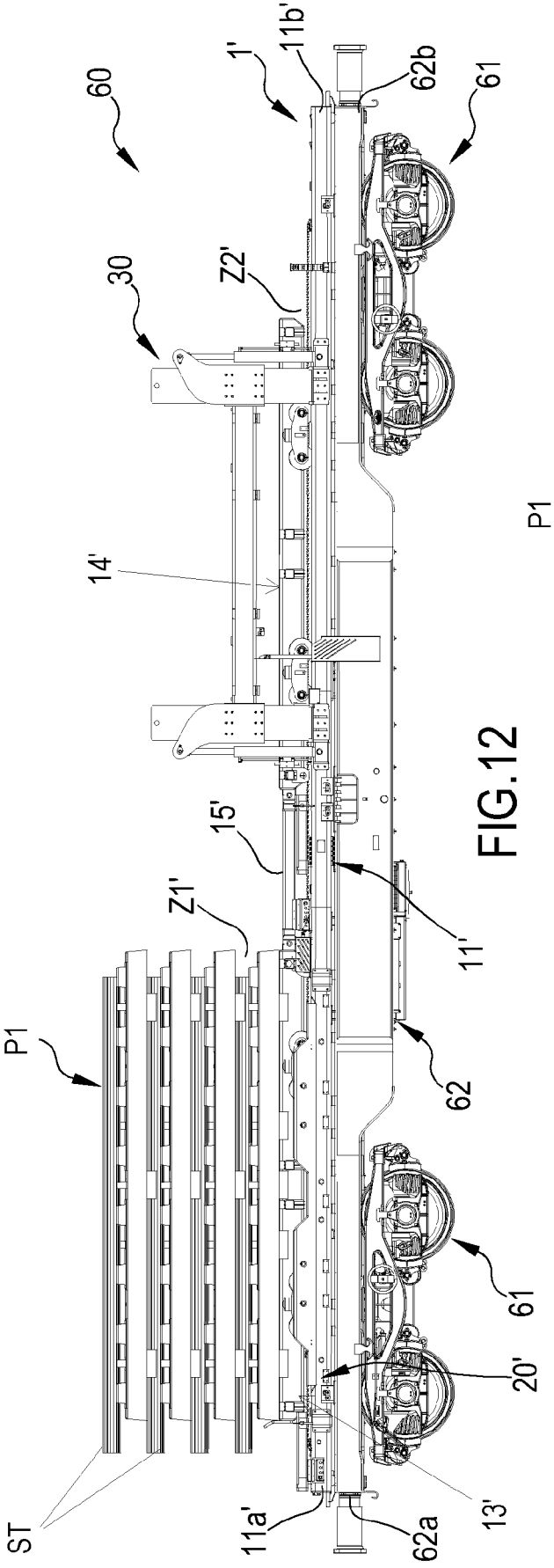

60
1'
11b'
62b
61
30
Z2'
14'
15'
Z1'
11'
62
61
20'
ST
13'
11a'
62a
P1

FIG.12

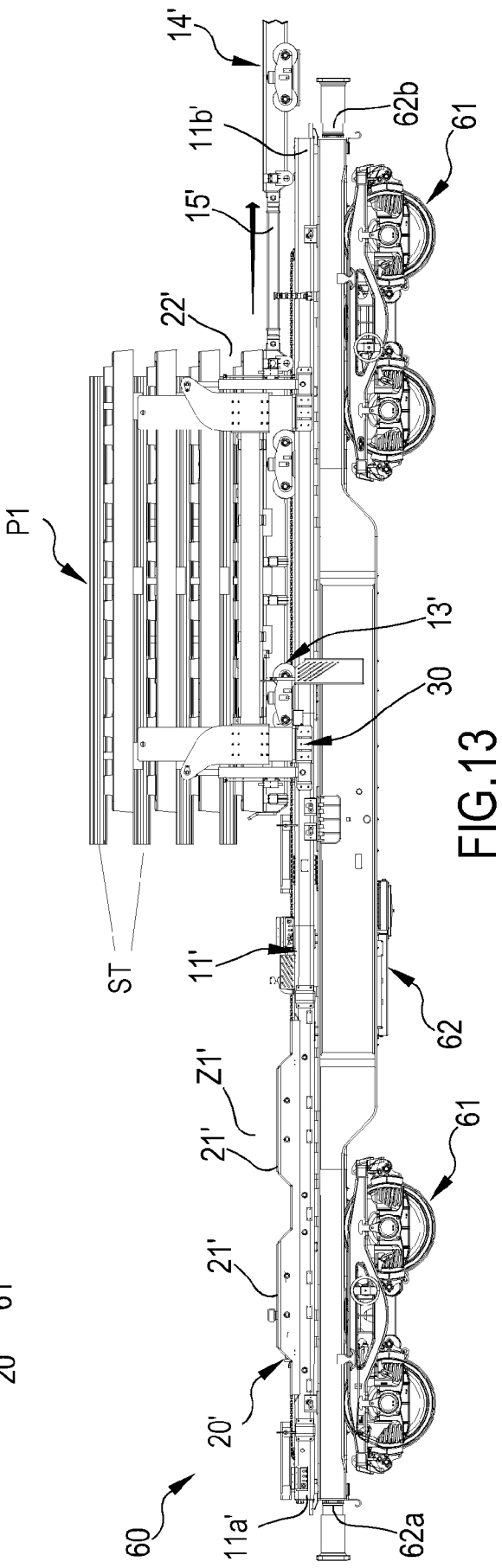

14'
11b'
62b
61
15'
22'
P1
13'
30
ST
11'
62
Z1'
21'
61
21'
20'
60
11a'
62a

FIG.13

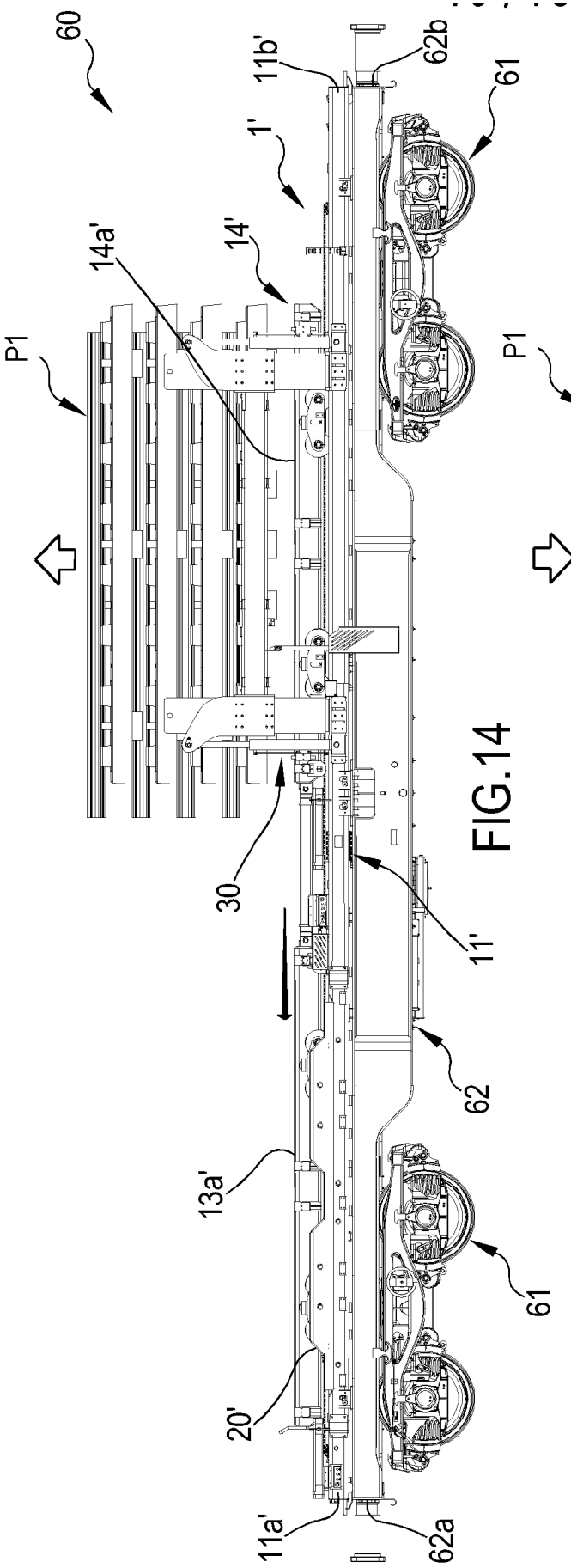

60
11b'
62b
61
1'
14'
14a'
P1
30
11'
62
13a'
61
20'
11a'
62a

FIG.14

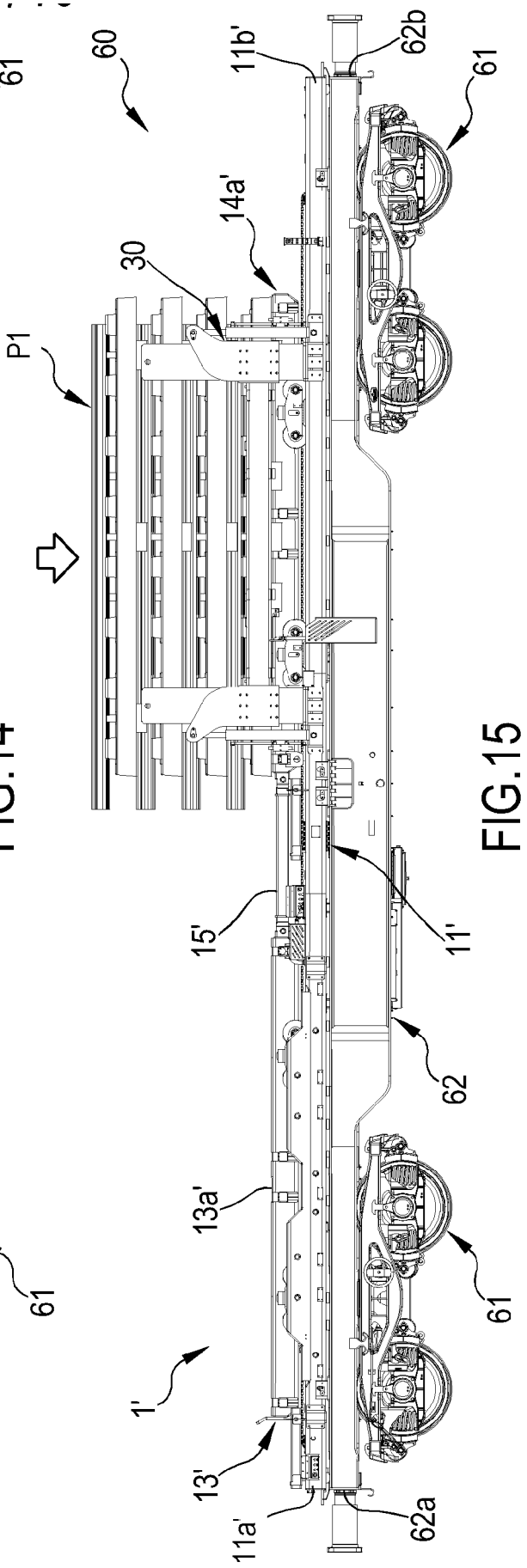
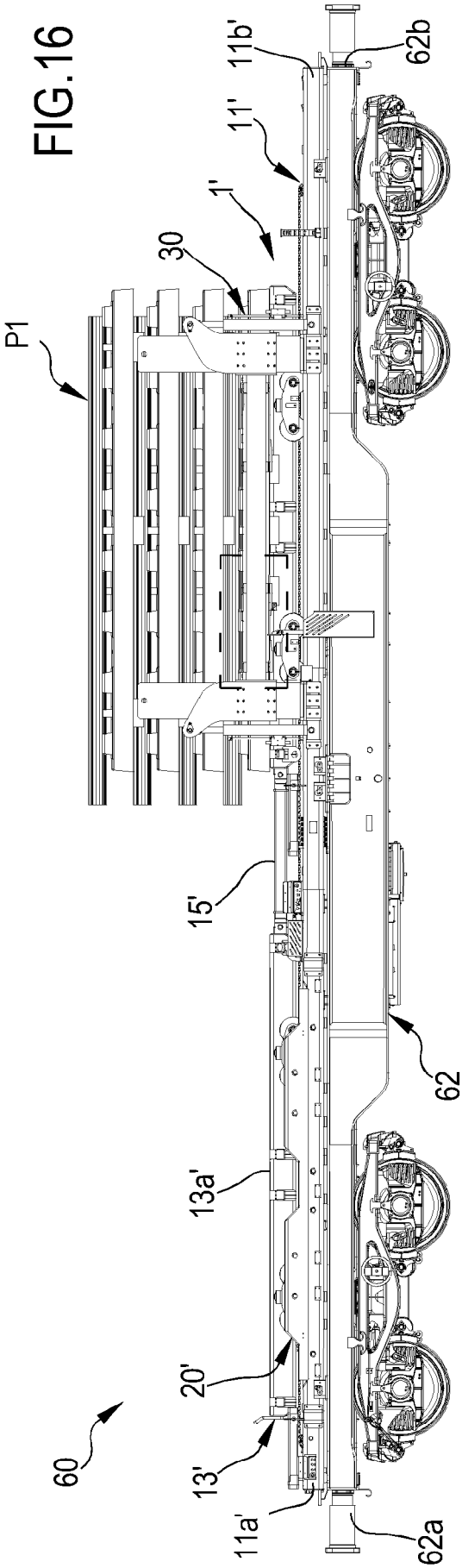

60
11b'
62b
61
14a'
30
P1
15'
11''
62
13a'
61
1'
13'
11a'
62a

FIG.15

FIG.16



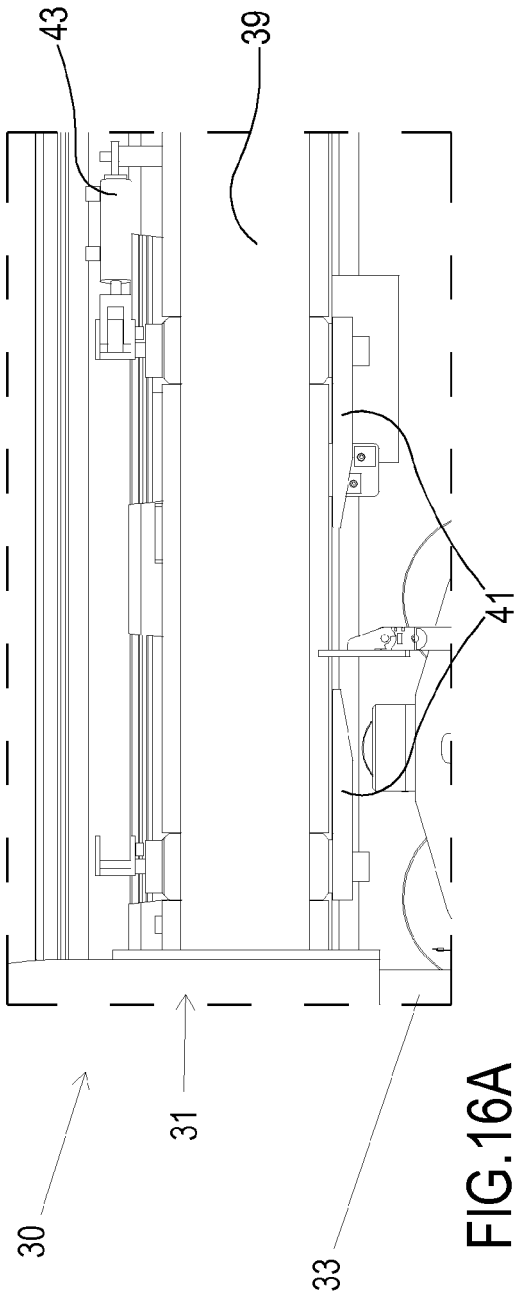


FIG.16A

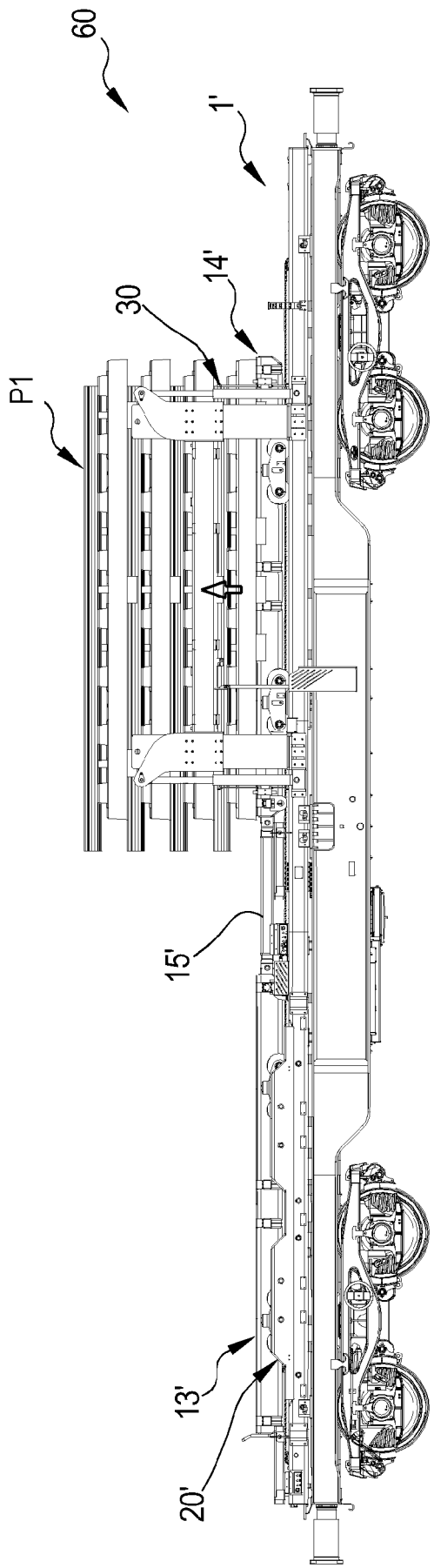


FIG.17

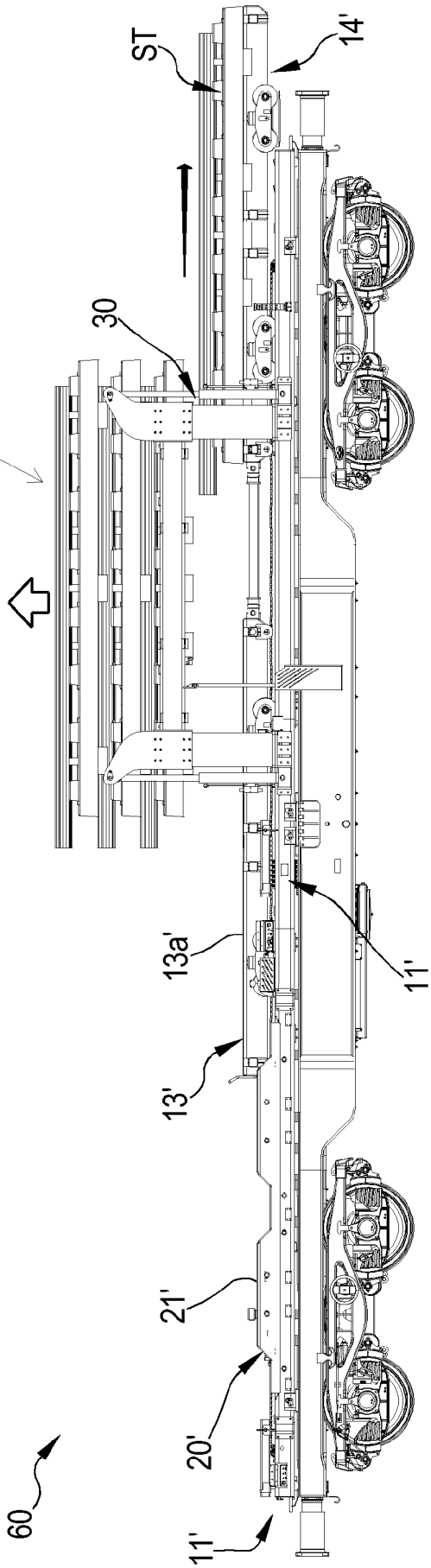
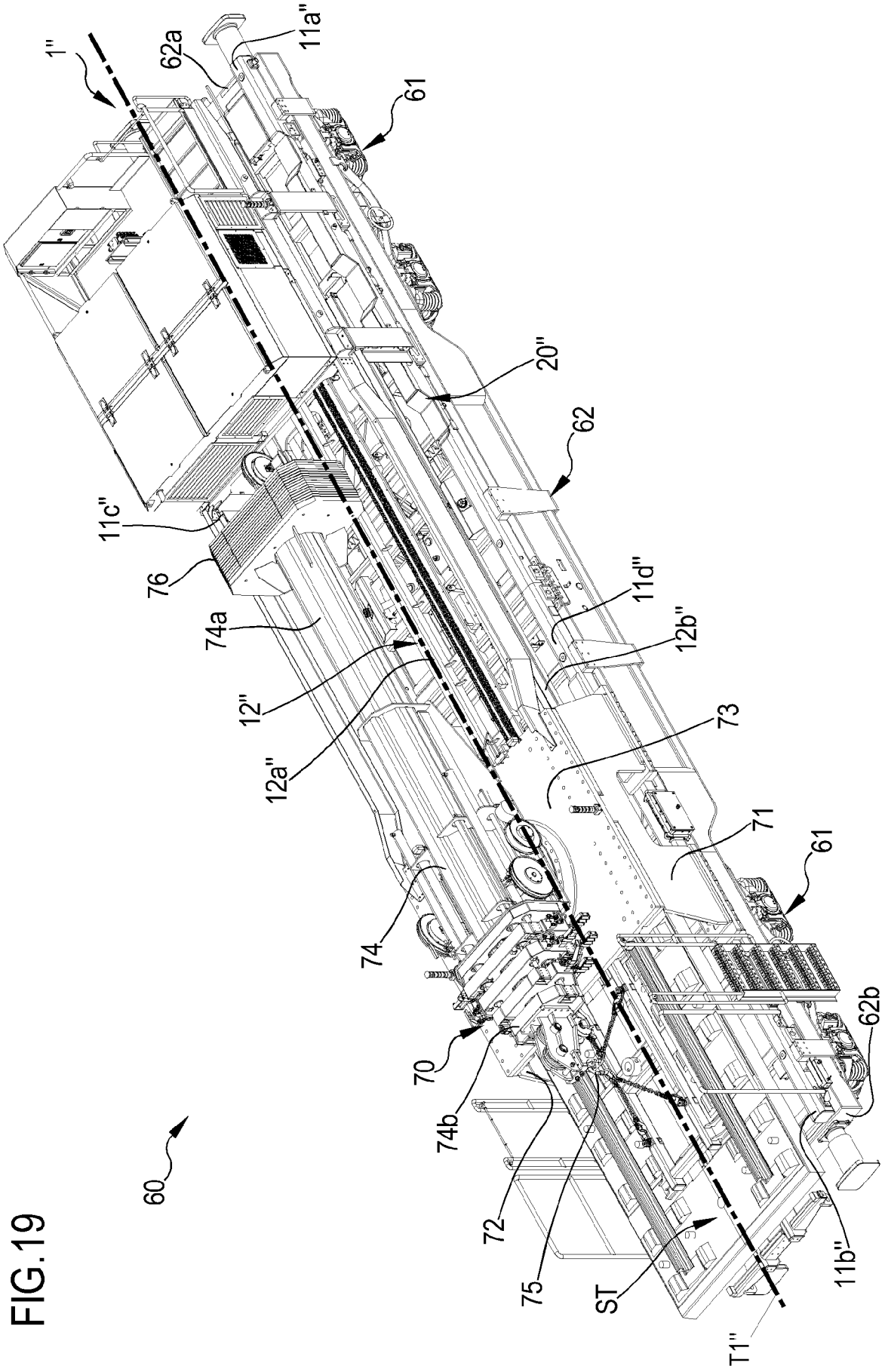


FIG.18

FIG.19


1''
62a
11a''
61
20''
62
11c''
76
11d''
74a
12b''
12''
12a''
73
71
61
74
62b
70
74b
72
75
ST
11b''
T1''
60

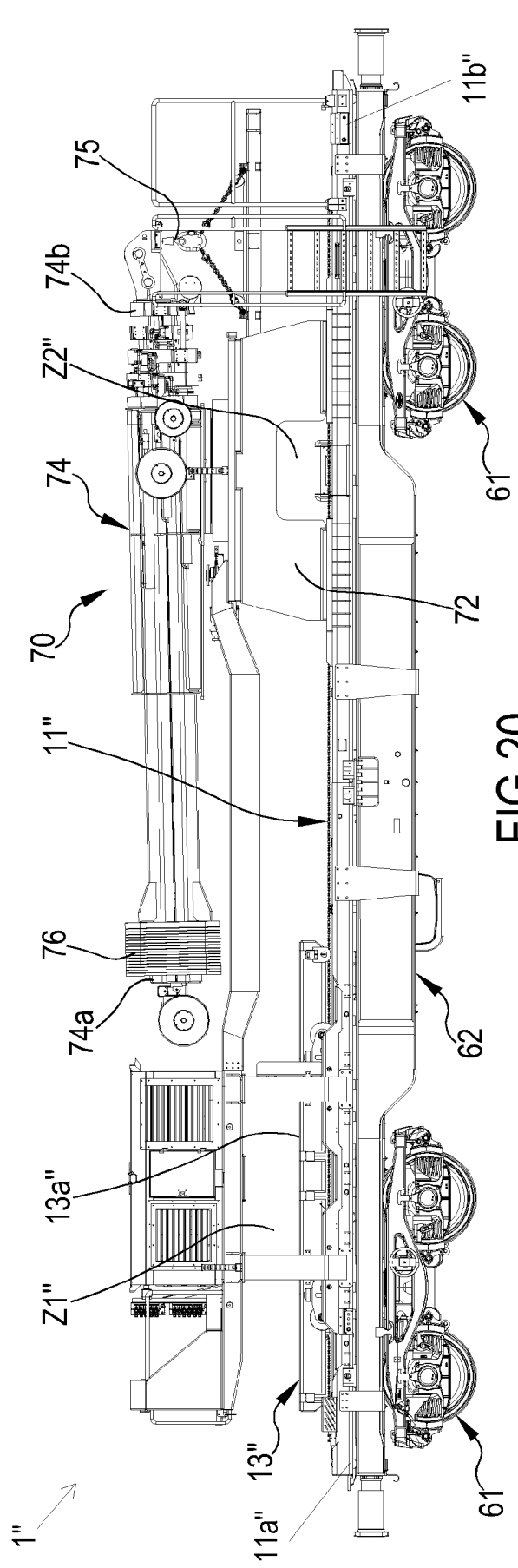

1"
11a"
13"
61
11b"
75
74b
Z2"
74
70
72
11"
76
74a
62
13a"
Z1"

FIG.20

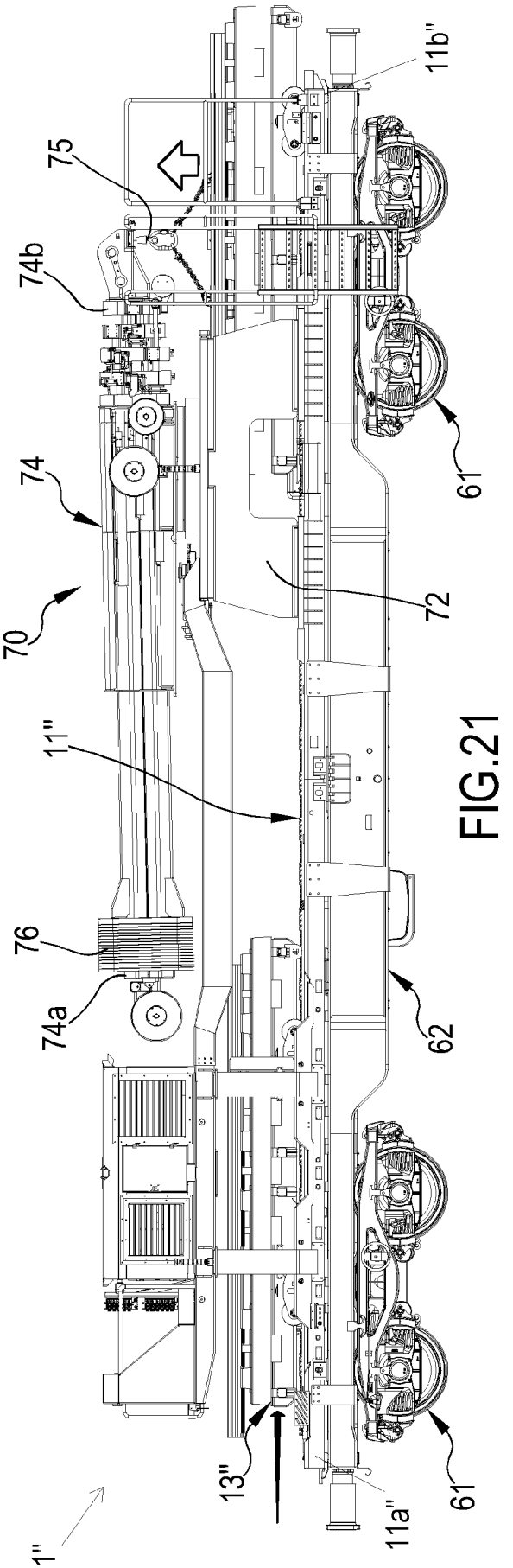

1"
11a"
13"
61
11b"
75
74b
74
70
72
11"
76
74a
62

FIG.21

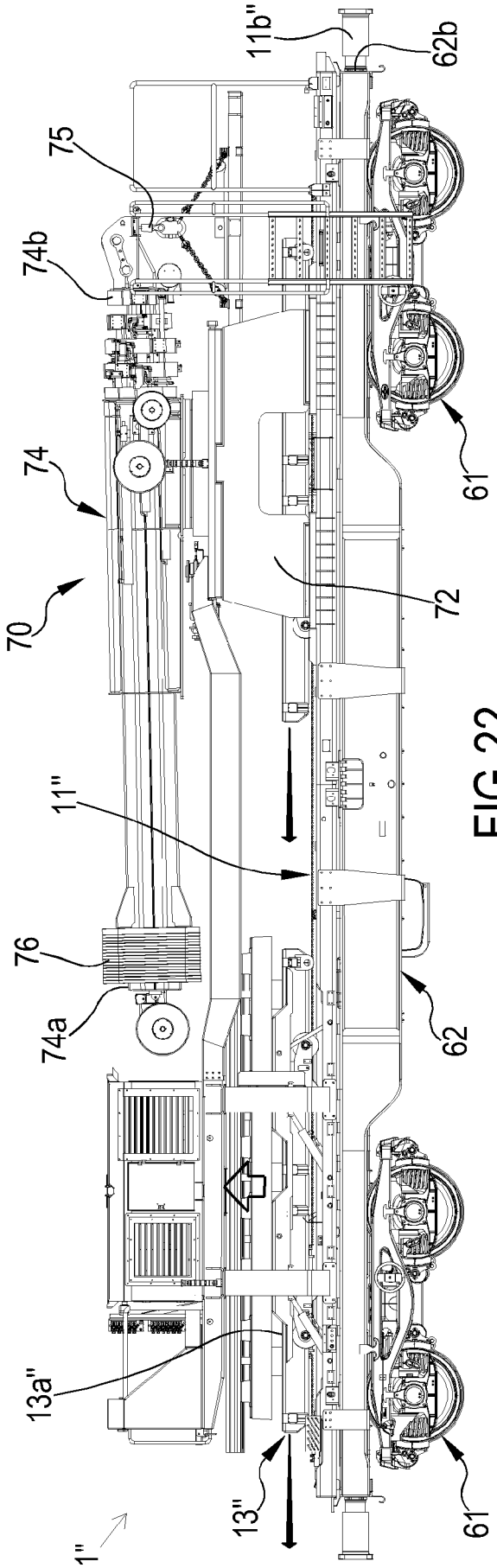

11b"
62b
75
74b
74
70
72
61
11"
76
74a
62
13a"
13"
1"

FIG.22

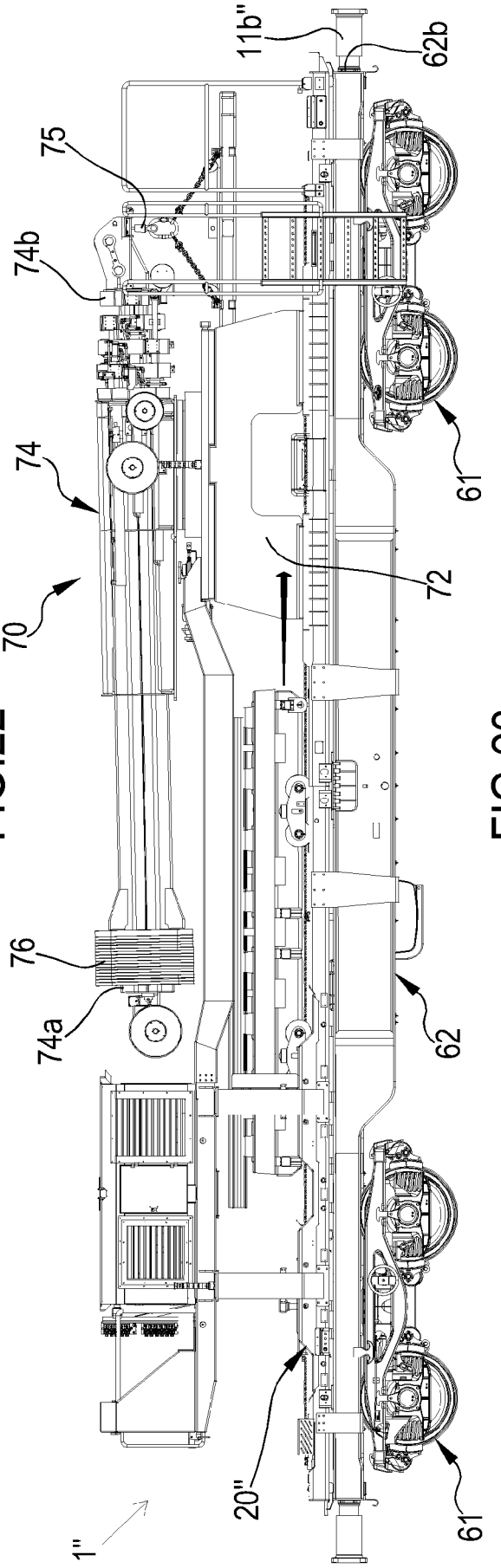

11b"
62b
75
74b
74
70
72
61
76
74a
62
20"
1"

FIG.23

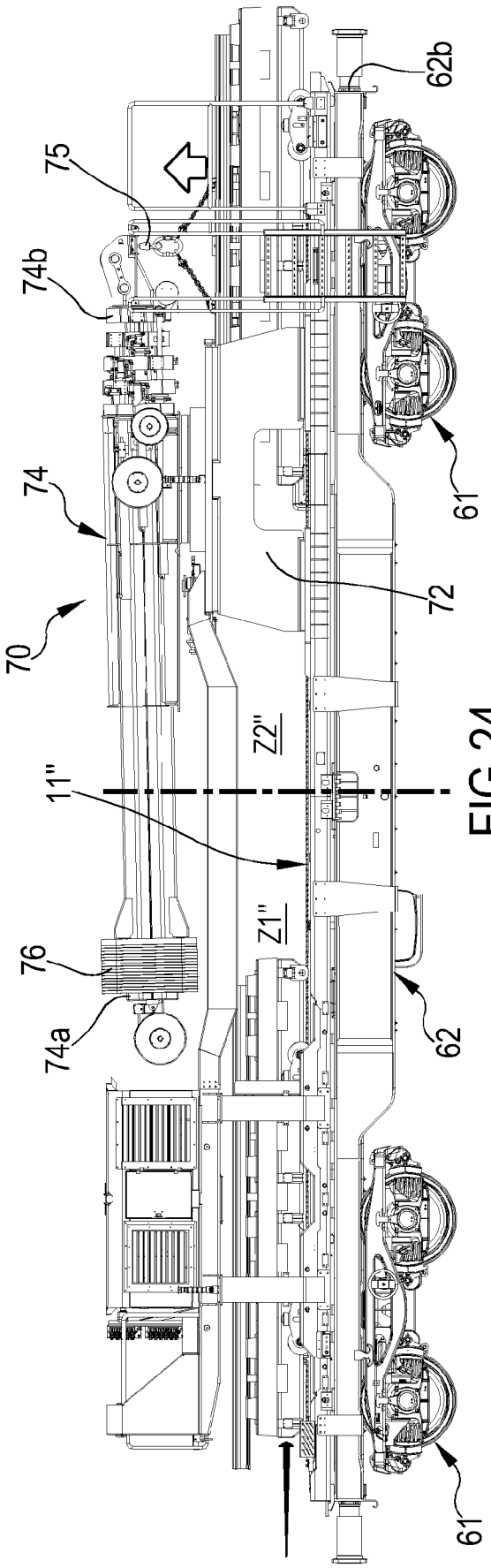

62b
75
74b
74
70
72
Z2"
11"
Z1"
76
74a
62
61
61

FIG.24

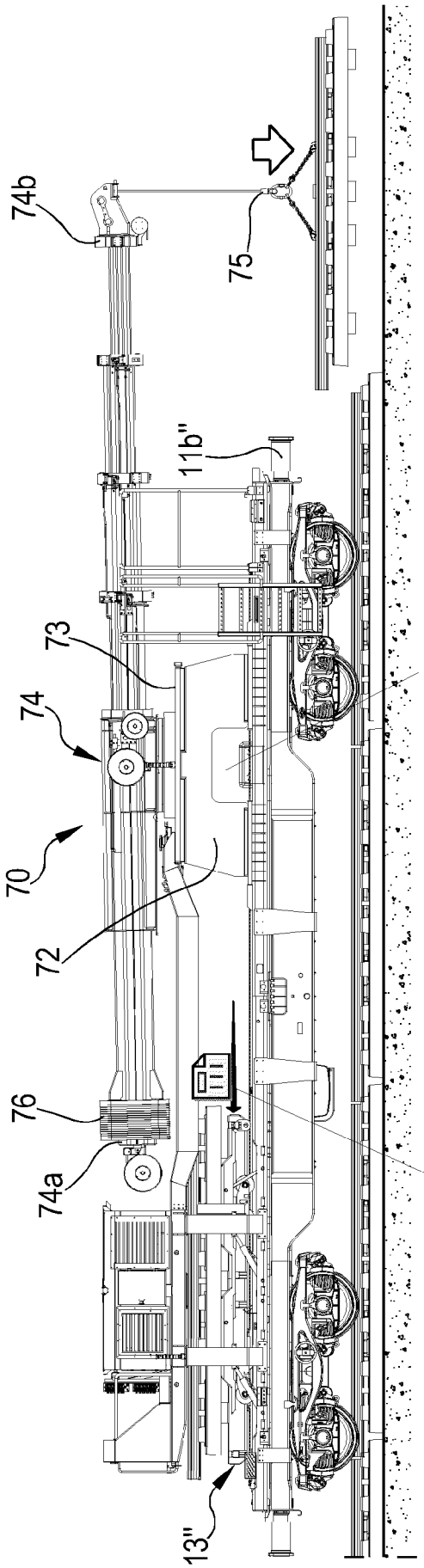

74b
75
11b"
73
Z2"
74
70
72
76
74a
Z1"
13"

FIG.25

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EUROPEAN SEARCH REPORT

Application Number
EP 24 19 9248

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X,D	US 2021/054576 A1 (MARKELZ PAUL [US] ET AL) 25 February 2021 (2021-02-25) * figures 1-13 * * the whole document *	1-8, 10-13	INV. E01B29/02
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TECHNICAL FIELDS SEARCHED (IPC)

E01B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	24 January 2025	Klein, A

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