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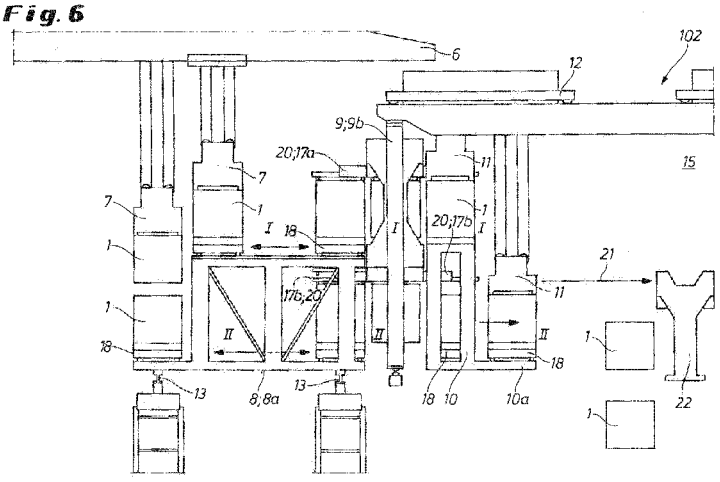
(54) **Title**: METHOD AND CONTAINER TRANSFER INSTALLATION FOR PLACING CONTAINERS INTO AND REMOVING CONTAINERS FROM CONTAINER STORAGE AREAS

(54) **Bezeichnung** : VERFAHREN UND CONTAINER-UMSCHLAGANLAGE ZUM EIN- UND AUSLAGERN VON CONTAINERN IN CONTAINERLAGERN

Fig. 6



(57) **Abstract**: The invention relates to a method and to a container transfer installation (2, 102) for placing containers into and removing containers from or transferring containers (1) in high-rack or block storage ares (3, 15) of a seaport or inland port within a container transfer installation (2, 102) having an integrated, fully automatic container transport system. An accelerated process having high total throughput is achieved in that individual containers (1) are deposited by the at least one loading gantry (6) successively onto pallets (19) or transverse conveying carts (18) provided on a transfer cart (8; 8a, 8b) that at least has an upper and a lower accommodating and conveying level (I, II) and can be moved parallel to the container storage area (3, 15), and the pallets (19) loaded with a container (1) are led over means of pallet transverse conveying means (25) or the containers (1) are led over by means of the transverse conveying carts (18) of the transfer cart (8; 8a, 8b) from the transfer cart onto an end distribution vehicle (9; 9a, 9b), which can be moved parallel to the container storage area (3, 15) and is positioned in line before the transfer cart (8; 8a, 8b) and has an upper and a lower level (I, II) and are led

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over by means of transverse conveying means (20; 25) from the end distribution vehicle onto a stationary transfer station (10) of the container storage area (3, 15), which transfer station likewise has an upper and a lower level (I, II) and from which transfer station a storage area crane (12) lifts the container (1) in order to place the container in the container storage area (3, 15).

(57) Zusammenfassung: Die Erfindung betrifft ein Verfahren und eine Container-Umschlaganlage (2, 102) zum Ein- und Auslagern oder Umlagern von Containern (1) in Hochregal- oder Blocklager (3, 15) eines See- oder Binnenhafens innerhalb einer Container-Umschlaganlage (2, 102) mit integriertem, vollautomatischem Containertransportsystem. Ein beschleunigter Ablauf mit hoher Gesamtdurchsatzleistung wird dadurch erreicht, dass einzelne Container (1) von der mindestens einen Verladebrücke (6) sukzessive an auf einem zumindest jeweils eine obere und eine untere Aufnahme- und Förder-Ebene (I, II) aufweisenden, parallel zum Containerlager (3, 15) verfahrbaren Übernahmewagen (8; 8a, 8b) bereitgestellten Paletten (19) oder Querförderwagen (18) abgegeben werden, von dem die mit einem Container (1) beladenen Paletten (19) durch Paletten-Querfördermittel (25) oder die Container (1) durch die Querförderwagen (18) des Übernahmewagens (8; 8a, 8b) auf ein parallel zum Containerlager (3, 15) verfahrbares, in Linie vor dem Übernahmewagen (8; 8a, 8b) positioniertes, eine obere und eine untere Ebene (I, II) aufweisendes Endverteilerfahrzeug (9; 9a, 9b) und von diesem mit Querfördermitteln (20; 25) auf eine stationäre, ebenfalls eine obere und eine untere Ebene (I, II) aufweisende Transferstation (10) des Containerlagers (3, 15) übergeleitet werden, aus der ein Lagerkran (12) den Container (1) zur Einlagerung im Containerlager (3, 15) abhebt.

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Method and container transfer installation for placing containers into and removing containers from container storage areas

Technical Field of the Invention

The invention relates to a method for storage and retrieval or redisposition of containers in high-bay storage facilities or block facilities of a seaport or an inland port within a container transfer installation with an integrated fully automated container transport system, comprising, for transfer of the containers from a ship to land and conversely, at least one gantry crane and at least one storage facility crane, by which the containers are stored and retrieved or redisposed in the storage facility, wherein several levels are provided in the transfer procedure between a gantry crane and the storage facility cranes for the containers. In addition, the invention relates to a container transfer installation for carrying out the method.

Background

A transfer installation in a seaport and an inland port for, in particular, standard containers such as 20 TEU or 40 FEU containers with a container storage facility, which is provided along a quay and consists of individual line-like storage modules, in the form of a block storage facility and at least one loading installation, which co-operates with the storage modules, for load transfer from and to a ship berthed at the quay has been made known through EP 1 272 414 B1. The storage installation for load redisposition may be equipped with at least one movable port mobile crane, the pivotable load jib of which reaches into the region of at least one transfer location, which is provided within the container storage facility - which consists of a number of storage modules with a number of container rows dependent on the module width - and forms an interface between the port mobile crane and the storage modules of the container storage facility.

A container deposited by the pivotable jib of the port mobile crane on the transfer location may be directly picked up thereat by a storage facility crane, which takes over horizontal transport and stacking of the containers. The storage facility crane may be constructed as an elevated gantry crane with a travelling crab and in each instance spans a storage module, which is, for example, nine containers wide and three to four containers high, of the container storage facility extending transversely to the quay. The storage modules may be linked together by at least two transverse transporters which are movable on rail tracks extending transversely to the individual storage modules in different horizontal

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planes and which operate independently of one another. The containers may be stacked one above the other, in which case the stack height may be limited by the load-bearing capability of the individual containers; consequently, usually at most six containers are stacked one above the other in a block storage facility.

It is known from DE 10 2008 007 860 A1 to store and retrieve containers in any number one above or alongside the other individually in bays of a high-bay storage facility. In that case the containers are individually accessible by means of a gantry crane, which in each instance spans a lane between two adjacent storage facility modules, and are introduced with some spacing one above the other into the multi-storey bays, which are equipped at both longitudinal sides and in the direction of the bay depth with guide rails corresponding with the width of the containers, which are introduced by the ends thereof into the bay. The gantry crane movable over the lanes carries a container receiver which is raisable and lowerable by means of cables and is arranged on a transfer bridge equipped with guide rails and which at its ends has container grippers, these being adjustable in height by way of motor drive or hydraulically and being lockable with suspension points of the containers at the corners. For adaptation to different lengths of the containers the container receiver has support beams which are adjustable in length and at which the container grippers are provided.

In the case of the container terminal known from DE 4439740 C1 high transfer rates such as have to be ensured by, for example, the use of several loading or container gantries at a ship are achieved in co-operation with the storage facility cranes by a fully automated container transport system integrated within a container transfer installation. For that purpose, travel track levels offset in height and with loading and unloading positions are arranged on a step-shaped support construction offset in height and are connected together by a plurality of supports, each level having a travel track network with a plurality of transport pallets movable thereon and driven by linear motor. Apart from the fact that a very large number of transport pallets specially constructed with linear motor drives as contactless drive means may be needed, a substantial outlay on steel construction is inevitable due to the travel track network, since each level has a plurality of interconnected travel tracks for movement of the transport pallets on a travel track network to loading and/or unloading and/or junction positions. The different or individual levels connected together by supports may be predetermined by a step-shaped support construction offset in height.

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It is to be understood that, if any prior art publication is referred to herein, such reference does not constitute an admission that the publication forms a part of the common general knowledge in the art, in Australia or any other country.

Summary of the DIsclosure

In some embodiments, the present disclosure may provide a simpler, more reliable, and an accelerated, fast container transfer even with very high piece numbers. In that case, the outlay on plant may be reduced by extensive utilisation of already existing equipment (loading or container bridges, high-bay or block storage facility structures, storage facility or bridge cranes, storage and retrieval units movable in the lanes of a high-bay storage facility).

In a first aspect of the disclosure is a method for placing containers into and removing containers from or transferring containers in high-bay or block stores of a seaport or inland port within a container transloading facility having an integrated, fully automatic container transport system, comprising at least one loading gantry, for the transloading of the containers from a ship to land and vice versa, and at least one store crane with which containers are placed into and removed from or transferred in the store, multiple height levels being provided for the containers in the transloading process between the at least one loading gantry and the store cranes. Individual containers are deposited by the at least one loading gantry successively onto pallets or cross-conveying trolleys provided on a transfer wagon which has at least an upper and a lower receiving and conveying level and can be moved parallel to the container store, from which transfer wagon the pallets loaded with a container are moved by means of pallet cross-conveyors or the containers are moved by means of the cross-conveying trolleys of the transfer wagon onto an end distribution vehicle, which can be moved parallel to the container store facility and is positioned in line in front of the transfer wagon and, like the transfer wagon, has an upper and lower level, and are moved by means of cross-conveyors from said end distribution vehicle onto a stationary transfer station of the container store, which transfer station likewise has an upper and a lower level and from which a store crane lifts the containers in order to place them into storage in the container store.

A decoupled container transfer able to manage very high piece numbers in continuous operation of all components involved may thereby be achieved. Thus, for example,

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associated with a gantry crane and the take-over carriage co-operating therewith may be two or - depending on the performance capability of the gantry crane - several end distributor vehicles. As soon as the first end distributor vehicle has removed the containers from the two levels (always called just "level" for short in the following instead of receiving level and conveying level) or - in an optional construction of the end distributor vehicle with pallet return on the lower level - from the upper level of the take-over carriage and is thus loaded, the first end distributor vehicle may for further handling of the containers be moved to one of several stationary transfer stations of the container storage facility and at the same time the second end distributor vehicle may be positioned for furnishing with following containers. In some embodiments, in the case of simultaneous operation with a plurality of gantry cranes a take-over carriage may be associated with each gantry crane. For section-by-section unloading or loading of the ship by only one gantry crane this may be moved, just like the associated take-over carriage, at the quay to each section. If the width of the levels of the components involved may be designed in accordance with the largest container dimension, two 20 TEU containers may be transferred simultaneously in each level instead of a 40 FEU container.

According to an embodiment of the disclosure the take-over carriage and the end distributor vehicle may move on rails, which may assist with aligned positioning of the vehicles by their levels relative to one another.

A proposal of the disclosure may provide that in the case of construction of the container storage facility as a high-bay storage facility the take-over carriage and the end distributor vehicle may be moved on elevated rails and the stationary transfer station is provided in the two uppermost floors of the high-bay storage facility, in which case the take-over levels, which correspond with the two levels of the take-over carriage, of the end distributor vehicle may be fixedly installed load receiving means or a vertically adjustable load receiving means of the end distributor vehicle is positioned at the respective level to be serviced. Due to the height of the travel tracks the gantry crane may not have to lower the containers to the quay floor level. By virtue of the omission, as far as possible, of the vertical lowering movement the use of energy and, additionally to the acceleration achieved through the decoupling of the functions, also the cycle time may be further reduced.

In some embodiments, the disclosure may provide that a front section, which faces the

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quay side, of the pallet transverse conveying means of the take-over carriage and a rear section, which faces in the direction of the container storage facility, of the pallet transverse conveying means of the stationary transfer station may be lowered or raised from the lower level to the upper level and conversely, wherein the pallet transverse conveying means in both the lowered and raised end position extend in alignment with pallet transverse conveying means of the interposed end distributor vehicle. The take-over carriage, when the front section is lowered, may be loaded with a pallet or two mutually adjacent pallets in the lower level, in which case, however, after raising of the front section and loading of the pallets with a container the onward guidance of the container takes place by way of only the upper level of the end distributor vehicle. In the stationary transfer station the containers arriving at the upper level of the end distributor vehicle may be successively taken over by the storage facility crane or two storage facility cranes for introduction into the container storage facility. The unloaded pallets may then be successively lowered to the lower level and transported back by transverse conveyors to the take-over carriage for reuse. In the case of a high-bay storage facility the storage facility cranes may deliver the containers for further handling to storage and retrieval units movable in the storage facility lanes to the respective bays.

According to the disclosure the aforesaid described mode of operation may make it possible for empty pallets, after lowering to the lower level, to be able to be conveyed from the stationary transfer station by way of the lower level of the end distributor vehicle back to the lower level of the take-over carriage. A closed pallet circuit or circulation may thus be achieved, for which, for example, six pallets available for use may be needed. In addition, the end distributor vehicle in that case may serve as a coupling element from the transfer station to the take-over carriage.

In a further aspect of the disclosure is a container transloading facility having an integrated, fully automatic container transport system, for placing containers into and removing containers from or transferring containers in high-bay or block stores of a seaport or inland port, comprising at least one loading gantry, for the transloading containers from a ship to land and vice versa, and at least one store crane, with which the containers are placed into and removed from or transferred in the store, multiple height levels being provided for the containers in the transloading process between a loading gantry and the store cranes,

wherein towards the container store, on tracks each running parallel to the

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container store, a loading gantry is assigned first a transfer wagon and, adjacent to the container store, at least one end distribution vehicle, wherein the distribution vehicle can be moved independently of the transfer wagon and can be positioned in alignment with at least one stationary transfer station formed on the feed side of the container store and situated in the working area of a store crane, wherein the transfer wagon, the end distribution vehicle and the stationary transfer station are each formed at least with an upper and a lower receiving and conveying level and container cross-conveyors and/or pallet cross-conveyors provided there.

According to one embodiment of the disclosure the take-over carriage and the end distributor vehicle may be movable in track-bound manner, namely on elevated rails in the case of construction of the container storage facility as a high-bay storage facility. The possibility of thereby reducing the use of energy and the cycle time have already been described.

An embodiment of the disclosure may provide that the levels of the take-over carriage may be provided at a fixed spacing from one another and the associated end distributor vehicle may be constructed as a storage and retrieval unit with an upper and a lower load receiving means or a vertically adjustable load receiving means for successive removal of the containers from the upper and lower levels of the take-over carriage. The transverse conveying means of the frame-like storage and retrieval unit may, in some embodiments, be preferably telescopic forks or arms which are provided at the load means and which remove the containers, suspended at the corner catch points thereof, from the take-over carriage or, in this construction without pallets, from the transverse conveying carriage thereof arranged to be reciprocatingly movable in the two levels, and conduct the containers onward to the transfer station.

According to some embodiments, the associated stationary transfer station may have in the lower level a transverse conveyor section projecting relative to the upper level in the direction of the container storage facility. The containers may thus be positioned offset relative to one another and may therefore be freely accessible in both levels for the at least one storage facility crane.

In some embodiments of the invention with containers transversely conveyed on pallets, it may be provided that the take-over carriage is constructed with an upper level divided into

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two and has a front part-level section lowerable and raisable from the upper to the lower level and conversely, wherein the associated end distributor carriage is constructed with a continuous upper level receiving the containers fed from the take-over carriage and the projecting transverse conveyor section of the stationary transfer station is constructed with lifting means lowerable and raisable from the upper to the lower level and conversely. Through this mode of construction it may be achieved that the end distributor vehicle further conveys the pallets, which are laden with the containers, only at its upper level, whereas the lower level in co-operation with, on the one hand, the lower level of the stationary transfer station and, on the other hand, after movement of the end distributor carriage into alignment with the lower level of a take-over carriage brings the empty pallets into use in a closed circuit.

According to the disclosure it is proposed in some embodiments that the front part-level section of the take-over carriage and the projecting transverse conveying section of the stationary transfer station may be constructed with scissor lifting tables. The scissor lifting tables may be designed with a stroke bridging over the spacing of the levels.

The transverse conveying means transporting the containers deposited on pallets may, in accordance with a proposal according to the invention, be constructed as a roller conveyor or roller track or, in the case of transport of the containers without pallets, as a transverse conveying carriage. The transverse conveying means may be an integrated element of the plant components.

Brief Description of the Figures

Further features and details of the invention are evident from the claims and the following description of embodiments of the invention schematically illustrated in the drawings, in which:

Figure 1 shows a container transfer installation in a perspective plan view with a ship berthed at the quay for unloading, a gantry crane, a take-over carriage, an end distributor carriage and a container storage facility as a block storage facility with transfer station and storage facility crane at the feed side, wherein the take-over carriage, the end distributor carriage and the transfer station successively transversely convey the containers, which are deposited on pallets, at an upper level, whereas the empty pallets are transported back at a

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lower level of these components;

Figure 2 shows the container transfer location of Figure 1 in a side view;

Figure 3 shows, in a perspective plan view as a part view, a container transfer location with a high-bay storage facility as container storage facility, and a take-over carriage and an end distributor vehicle arranged on elevator tracks and constructed in a different form for transverse conveying of containers by means of displaceable transverse conveyor carriages at both an upper level and a lower level;

Figure 4 shows, as a part view of a container transfer installation in a perspective front view, the high-bay storage facility of Figure 3 without gantry cranes, with take-over carriages arranged in different positions and end distributor vehicles constructed as storage and retrieval units;

Figure 5 shows, in a perspective part view as seen from above, a container transfer installation with a high-bay storage facility and vehicles which are movable and positionable on parallel rail tracks in front of the feed side of the high-bay storage facility, here in an embodiment of the end distributor carriage, which is arranged directly adjacent to the high-bay storage facility, in a mode of construction as illustrated in Figures 1 and 2;

Figure 6 shows, as a detail of a container transfer installation with a high-bay storage facility in the mode of construction according to Figures 3 and 4, the co-operation of gantry crane, take-over carriage, end distributor carriage in the mode of construction as a storage and retrieval unit, stationary transfer station and storage facility crane, in a side view; and

Figure 7 shows, in a perspective plan view as a detail of the container transfer installation of Figures 1 and 2 or Figure 5, the co-operation of take-over carriage, an end distributor carriage of modular construction and a stationary transfer station.

Detailed Description of some Embodiments of the Disclosure

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A container transfer installation 2 with a block storage facility 3, of which only one of several loading units disposed adjacent to one another at a spacing is shown, for transfer of containers 1 from a ship to land and conversely is illustrated in Figures 1 and 2. The containers 1 are removed by a gantry crane 6, which is positionable on a rail track 4 in the quay floor 5 in front of the ship, by the load receiving means 7 of the gantry crane, deposited on a take-over carriage 8, transferred from this to an end distributor vehicle 9, which in the embodiment according to Figures 1, 2 as well as 5 and 7 is constructed as a flat vehicle 9a of modular construction, transported to a stationary transfer station 10 of the block storage facility 3, transferred to the stationary transfer station 10 and removed thereat by a lifting means 11 of a storage facility crane 12, which spans the storage unit of the block storage facility 3, and stored, for which purpose the storage facility crane 12 is movable in the direction of the length dimension of the block storage facility or the storage unit and thus transversely to the block storage facility 3. Ship loading takes place in reverse sequence. The take-over carriage 8 is arranged, just like the end distributor vehicle 9, on rail tracks 13 and 14 extending at the feed side of the block storage facility parallel to the block or container storage facility, wherein the rail track 14 of the end distributor vehicle 9, 9a extends directly adjacent to the stationary transfer station 10, of which several are provided adjacent to one another to be distributed at a spacing.

The container transfer installation 102 of Figures 3, 4 and 5 is constructed with a high-bay storage facility 15 as container storage facility and the rail tracks 13, 14 for the take-over carriage 8 and the end distributor vehicle 9, which in the embodiment according to Figures 3 and 4 is constructed as a storage and retrieval unit 9b (cf. also Figure 6), are arranged to be elevated. The stationary transfer stations 10 are integrated in the steel structure on the two uppermost floors of the high-bay storage facility 15. The storage facility crane or storage facility cranes 12 is or are compartmented by roof superstructures 16 and cover the storage facility lanes to engage over all multi-floor bay installations, which are arranged to be separated from one another at a spacing in succession rearwardly in the plane of the drawing. Transport tied to the floor is eliminated in the case of container transfer installations 102 with high-bay storage facilities 15. The transfer procedures otherwise correspond, since the containers 1 are brought from the ship to the take-over carriage 8 by means of the gantry crane 6, transferred thereat to the variable reciprocatingly movable end distributor vehicles 9; 9a, 9b, moved by these until in front of a free stationary transfer station 10 and transferred to the transfer station, from which the containers 1 are taken over by the storage facility crane 12 and stored in the block storage facility 3 or delivered

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by the storage facility crane 12 of the high-bay storage facility 15 to storage and retrieval units movable on rails in the storage facility lanes, which units then take over distribution, at the storage facility side, of the containers in the bays.

The flexible handling of the containers 1 achievable by decoupling of the functions of take-over carriage 8, end distributor vehicle 9 - here in the form of storage and retrieval units 9b - and stationary transfer stations 10 with the possibility of direct coupling of these components can be seen in Figure 4, in which the gantry cranes associated with the take-over carriages 8, 8a are not shown. Whilst take-over carriages 8; 8a freed of the containers to be stored are prepared for reloading, other take-over carriages deliver the containers to the end distributor vehicles 9; 9b or laden end distributor vehicles can transfer the containers to stationary transfer stations 10. The container transfer thereby already significantly accelerated offers an overall throughput performance increased still further in that the take-over carriage 8; 8a, 8b, the end distributor vehicle 9; 9a, 9b and the stationary transfer station 10; 10a, 10b are each constructed with an upper level I and a lower level II for reception of containers 1 at both levels I, II (cf. Fig. 6) or at the upper level I, in which case the lower level II is used for return transport of empty pallets (cf. Fig. 7).

The take-over carriage 8 according to Figure 6 is constructed as a two-level vehicle 8a (cf. also Figures 3 and 4) with constant spacing of the two levels I and II from one another. This applies in the same way to the storage and retrieval unit 9b as end distributor vehicle 9, the load receiving means 17a, 17b of which are adapted by the telescopic forks 20 - which are constructed thereat as container transverse conveying means - in the vertical positon thereof for suspended take-over of the containers 1 from the levels I, II of the take-over carriage 8; 8a. Finally, the stationary transfer station 10 for receiving the transferred containers 1 also has an upper level I and a lower level II, wherein the lower level II has a section 10a which extends in the direction of the container storage facility 3; 15, for a transverse conveying means 18.

The containers 1 fed by the load receiving means 7 of the gantry cranes 6 are deposited in both levels I, II of the take-over carriage 8; 8a on transverse conveying carriages as transverse conveying means 18 and transversely conveyed or displaced up to the transfer point at the end distributor vehicle 9; 9b positioned in alignment in front of the take-over carriage 8; 8a, from where the containers suspended by means of the telescopic forks 20 (cf. Figure 4, on the right outside the two storage and retrieval units 9b) are taken over

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from the two levels I, II. The transverse conveying carriages 18 are, after take-over of the containers 1 by the storage and retrieval unit 9b or end distributor vehicle 9, moved back to the starting position thereof for reloading with containers 1, as indicated by the double arrows in Figure 6. Directly after transfer of the containers 1 the end distributor vehicle 9 or storage and retrieval unit 9b can be moved into an aligned position with the levels I, II of one of the stationary transfer stations 10 and positioned thereat. Through reversal of the direction of the telescopic forks 20 the containers 1 are deposited at the upper level I and on a transverse conveying carriage 18 of the lower level II of the stationary transfer station 10. The transverse conveying carriage 18 is moved on the projecting section 10a offset with respect to the container deposited at the upper level I so that the storage facility crane 12 has, by the lifting means 11 thereof, free access to the containers 1 of both levels I, II. As indicated by the directional arrow 21 in Figure 6 the storage facility crane 12 is movable in a high-bay storage facility 15 to extend over lanes and delivers the containers 1 for storage in the bays to storage and retrieval units 22 movable in the lanes, i.e. orthogonally to the directional arrow 21, of the high-bay storage facility 102.

Figure 7 shows another mode of construction of the components constructed with the upper and lower receiving and conveying levels I, II. The take-over carriage 8 is constructed as a part-level lowering vehicle 8b and has a part-level section, which is lowerable from the upper level I to the lower level II and conversely raisable, in the form a scissor lifting table 23a. The projecting transverse conveying section 10a of the stationary transfer station 10 is also constructed with a scissor lifting table 23b lowerable from the upper level I to the lower level II and conversely raisable.

The end distributor vehicle 9 is of flat modular construction 9a and constructed with a constant spacing of the two levels I and II from one another. For transverse conveying of the containers 1, rollers or roller tracks enabling conveying in both directions as indicated by the horizontal directional arrows 24 are provided at both levels I, II to supplement all components. In this mode of construction the unloaded pallets 19 can be lowered in the projecting transverse conveying section 10a of the stationary transfer station 10 from the upper level I to the lower level II and conducted from there back to the lower level II of the end distributor vehicle 9 or 9a. As soon as the end distributor vehicle 9a, 9a has then been positioned in front of the take-over carriage 8 or the part-level lowering vehicle 8b, the foremost pallet can be brought onto the scissor lifting table 23a disposed in the lower level II and through raising of the scissor lifting table 23a readied on the non-lowerable part

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section of the upper level I for fresh loading with a pallet 1. The scissor lifting table 23a is thereafter lowered again to the lower level II so that the next pallet is taken over and, after lifting to the upper level I, available for subsequent loading. In the modular construction 9a the end distributor vehicle 9 thus also serves, additionally to container distribution, as a coupling element for a closed pallet circuit, in particular on the one hand in co-operation with the stationary transfer station 10 and on the other hand with the take-over carriage 8 or 8b, wherein the pallet return after vertical lowering takes place exclusively in the lower levels II and the horizontal transverse conveying transport of the containers deposited on the pallets only in or at the upper levels of the components.

In the claims which follow and in the preceding description of the invention, except where the context requires otherwise due to express language or necessary implication, the word “comprise” or variations such as “comprises” or “comprising” is used in an inclusive sense, i.e. to specify the presence of the stated features but not to preclude the presence or addition of further features in various embodiments of the invention.

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Reference numeral list

1	container
2, 102	container transfer installation
3	block storage facility / container storage facility
4	rail track / rails
5	quay floor
6	gantry crane
7	load receiving means
8	take-over carriage
8a	two-level vehicle
8b	part-level lowering vehicle
9	end distributor vehicle
9a	modular-construction vehicle
9b	storage and retrieval unit
10	stationary transfer station
10a	front section / protruding transverse conveying section
11	lifting means
12	storage facility crane
13	rail tracks / rails
14	rail tracks / rails
15	high-bay storage facility / container storage facility
16	roof superstructure
17a, 17b	load take-over means (of the storage and retrieval unit 9b)
18	transverse conveying carriage
19	pallet
20	telescopic arm or fork / container transverse conveying means
21	directional arrow
22	storage and retrieval unit
23a, 23b	scissor lifting table / lifting means

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Patent claims

1. A method for placing containers into and removing containers from or transferring containers in high-bay or block stores of a seaport or inland port within a container transloading facility having an integrated, fully automatic container transport system, comprising at least one loading gantry, for the transloading of the containers from a ship to land and vice versa, and at least one store crane with which containers are placed into and removed from or transferred in the store, multiple height levels being provided for the containers in the transloading process between the at least one loading gantry and the store cranes,

wherein individual containers are deposited by the at least one loading gantry successively onto pallets or cross-conveying trolleys provided on a transfer wagon which has at least an upper and a lower receiving and conveying level and can be moved parallel to the container store, from which transfer wagon the pallets loaded with a container are moved by means of pallet cross-conveyors or the containers are moved by means of the cross-conveying trolleys of the transfer wagon onto an end distribution vehicle, which can be moved parallel to the container store facility and is positioned in line in front of the transfer wagon and, like the transfer wagon, has an upper and lower level, and are moved by means of cross-conveyors from said end distribution vehicle onto a stationary transfer station of the container store, which transfer station likewise has an upper and a lower level and from which a store crane lifts the containers in order to place them into storage in the container store.

2. The method according to claim 1, wherein the transfer wagon and the end distribution vehicle are moved on rails.

3. The method according to any one of claims 1 or 2, wherein if the container store is in the form of a high-bay store, the transfer wagon and the end distribution vehicle are moved on elevated rails and the stationary transfer station is provided in the top two tiers of the high-bay store, wherein receiving levels of the end distribution vehicle corresponding to the two levels of the transfer wagon can be load-handling means installed in a fixed location or a vertically moveable load-handling means of the end distribution vehicle is positioned at the level to be used in each case.

4. The method according to any one of claims 1 to 3, wherein a front section, facing

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the quay side, of the pallet cross-conveyors of the transfer wagon and a rear section, facing in the direction of the container store, of the pallet cross-conveyors of the stationary transfer station can be lowered and raised from the lower level to the upper level and vice versa, wherein the pallet cross-conveyors both in the lowered end position and the raised end position, are aligned with pallet cross-conveyors of the interposed end distribution vehicle.

5. The method according to claim 4, wherein empty pallets, after being lowered into the lower level from the stationary transfer station via the lower level of the end distribution vehicle, are conveyed back to the lower level of the transfer wagon, where, after being raised into the upper level of the transfer wagon, they are reloaded with a container.

6. A container transloading facility having an integrated, fully automatic container transport system, for placing containers into and removing containers from or transferring containers in high-bay or block stores of a seaport or inland port, comprising at least one loading gantry, for the transloading containers from a ship to land and vice versa, and at least one store crane, with which the containers are placed into and removed from or transferred in the store, multiple height levels being provided for the containers in the transloading process between a loading gantry and the store cranes,

wherein towards the container store, on tracks each running parallel to the container store, a loading gantry is assigned first a transfer wagon and, adjacent to the container store, at least one end distribution vehicle, wherein the distribution vehicle can be moved independently of the transfer wagon and can be positioned in alignment with at least one stationary transfer station formed on the feed side of the container store and situated in the working area of a store crane, wherein the transfer wagon, the end distribution vehicle and the stationary transfer station are each formed at least with an upper and a lower receiving and conveying level and container cross-conveyors and/or pallet cross-conveyors provided there.

7. The container transloading facility according to claim 6, wherein the transfer wagon and the end distribution vehicle are movable on rails, on elevated rails if the container store is in the form of a high-bay store.

8. The container transloading facility according to any one of claims 6 or 7, wherein the levels of the transfer wagon are provided at a fixed distance from one another, and the

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assigned end distribution vehicle is in the form of a storage and retrieval machine having an upper and a lower load-handling means with cross-conveyors or a vertically moveable load-handling means for successively removing and cross-conveying the containers out of the upper and lower levels of the transfer wagon.

9. The container transloading facility according to claim 8, wherein the assigned stationary transfer station has in the lower receiving level a cross-conveying section which protrudes in the direction of the container store relative to the upper receiving level.

10. The container transloading facility according to any one of claims 6, 7 and 9, wherein the transfer wagon is formed with an upper level divided into two and has a front part-level section which can be lowered from the upper into the lower level and vice versa, wherein the assigned end distribution wagon is formed with a continuous upper level which receives the containers fed by the transfer wagon and the protruding cross-conveying section of the stationary transfer station is formed with a lift means which can be lowered from the upper into the lower level and vice versa.

11. The container transloading facility according to claim 10, wherein the front part-level section of the transfer wagon and the protruding cross-conveying section of the stationary transfer station are designed with scissor lift platforms.

12. The container transloading facility according to any one of claims 6 to 11, wherein the cross-conveyors which transport set-down containers are in the form of cross-conveying trolleys, or the cross-conveyors which transport the containers set-down on pallets are in the form of rollers or roller tracks.

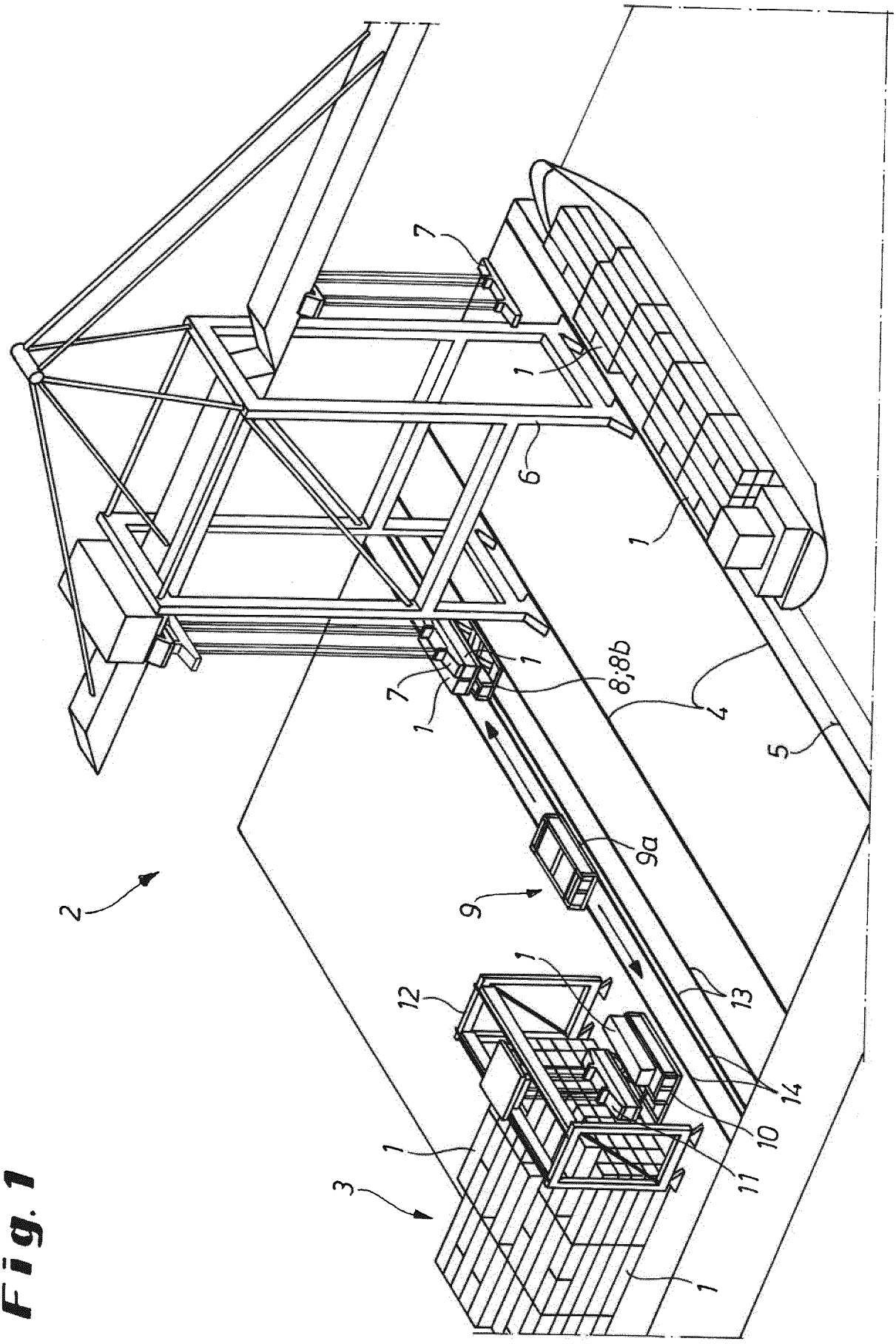

Fig. 1

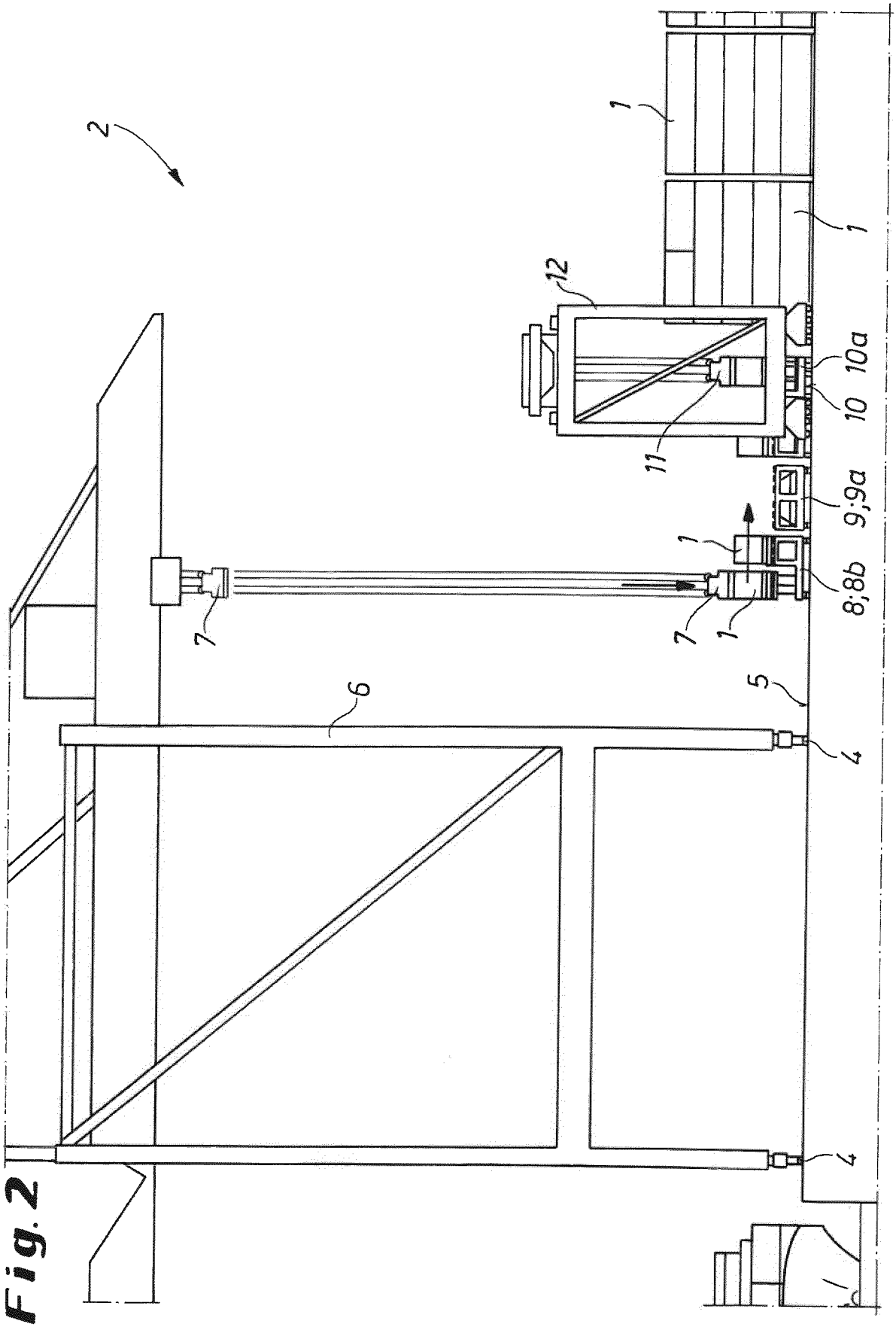

Fig. 2

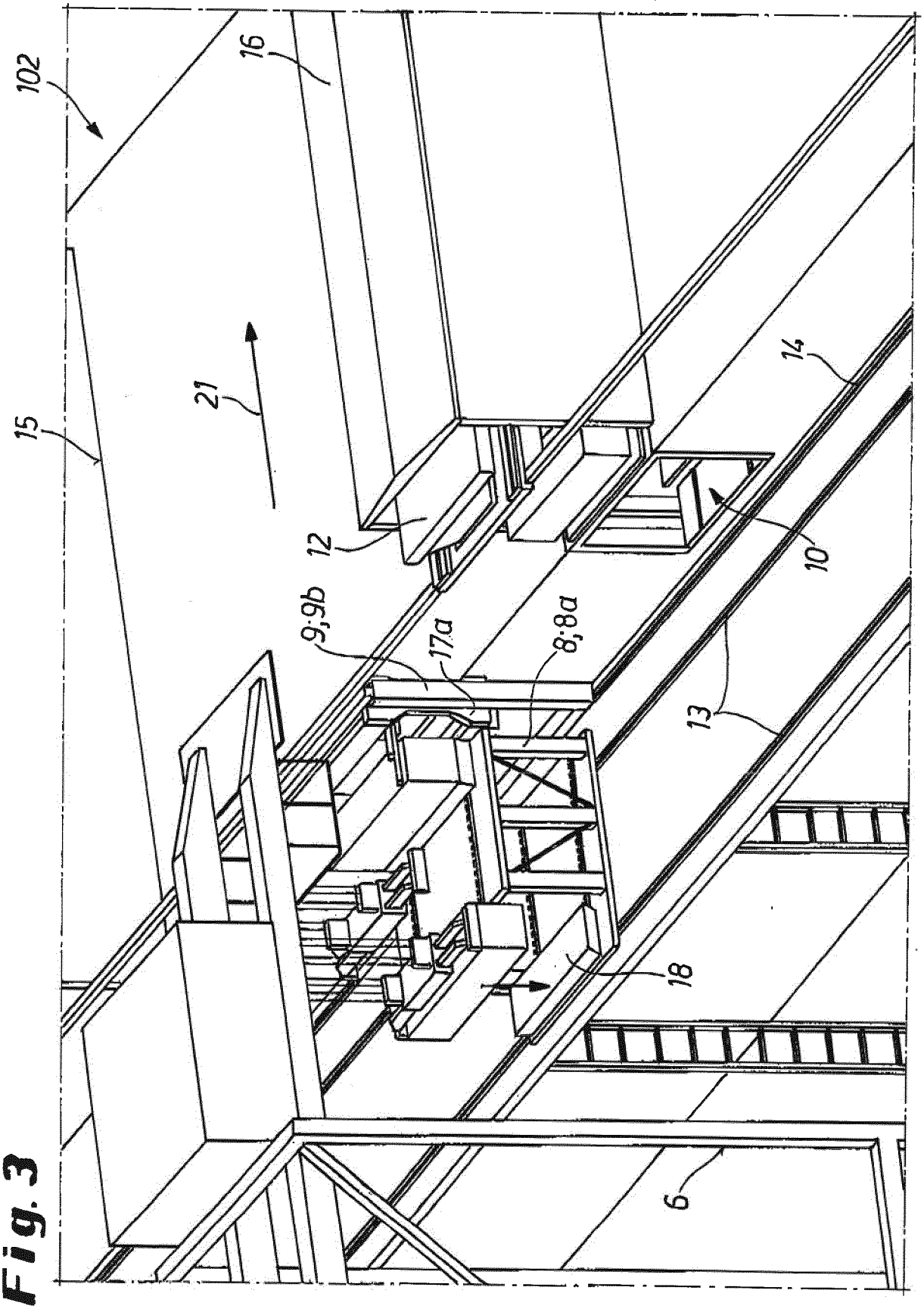

Fig. 3

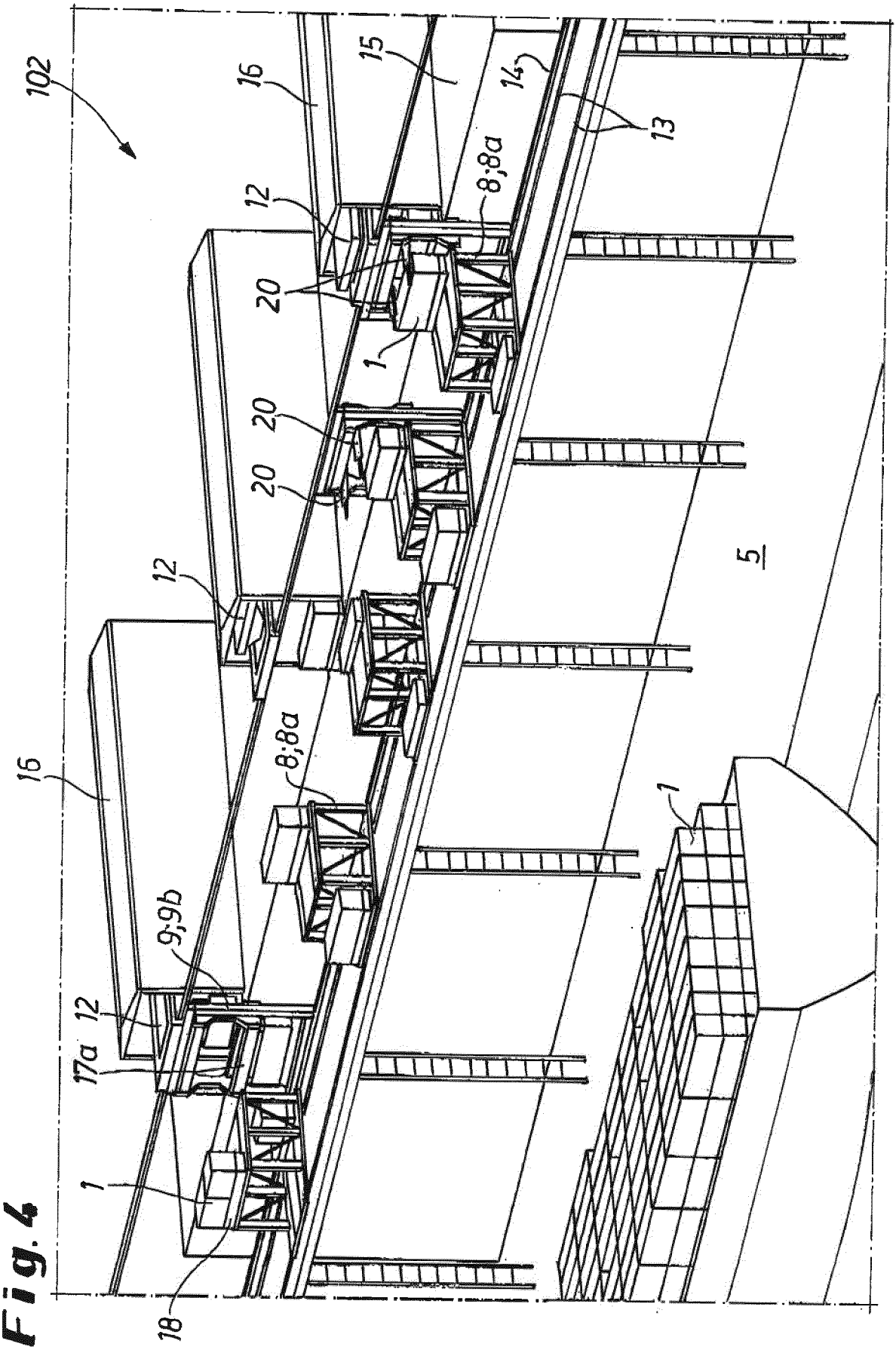

Fig. 4

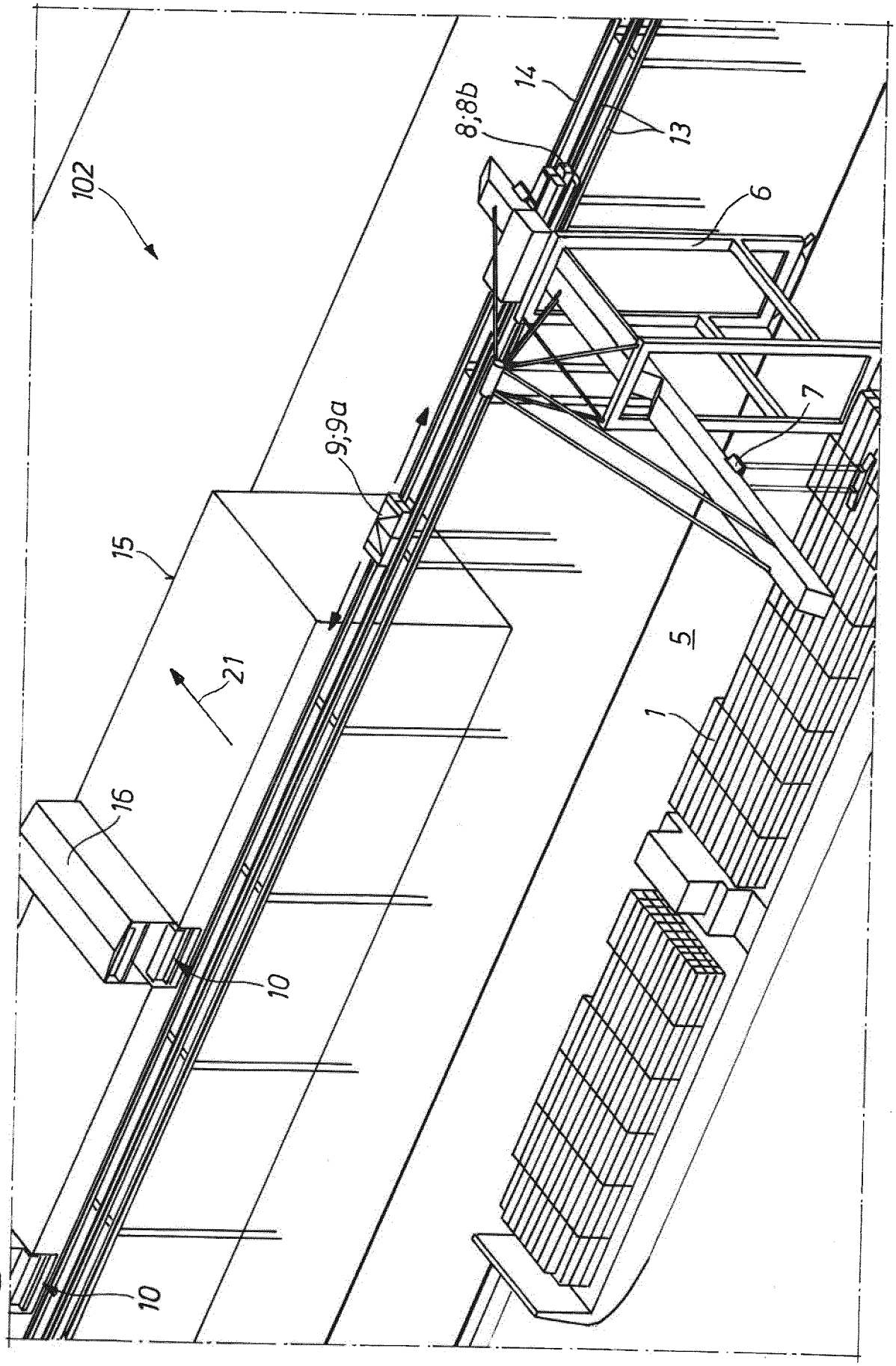

Fig. 5

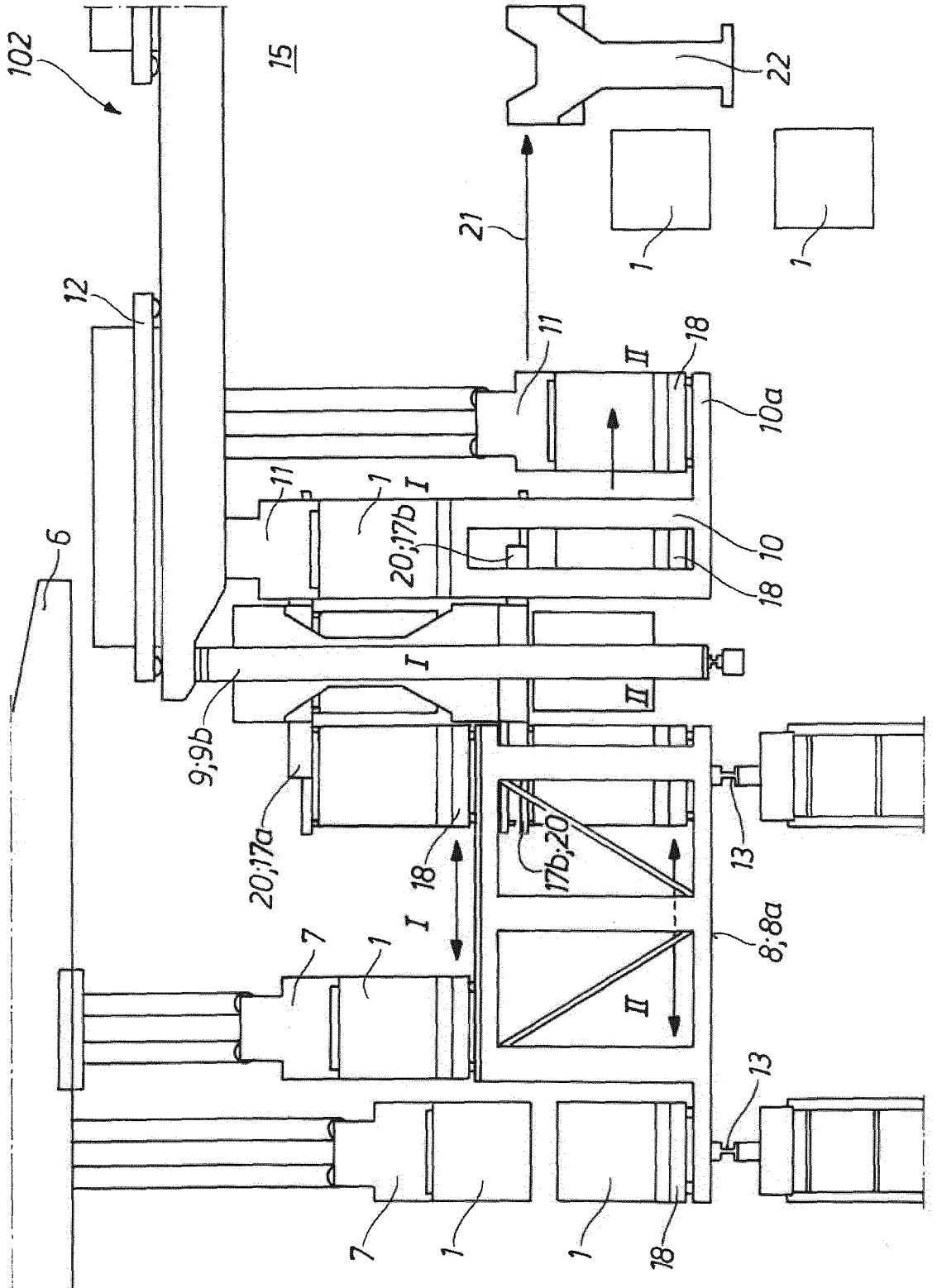
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Fig. 6

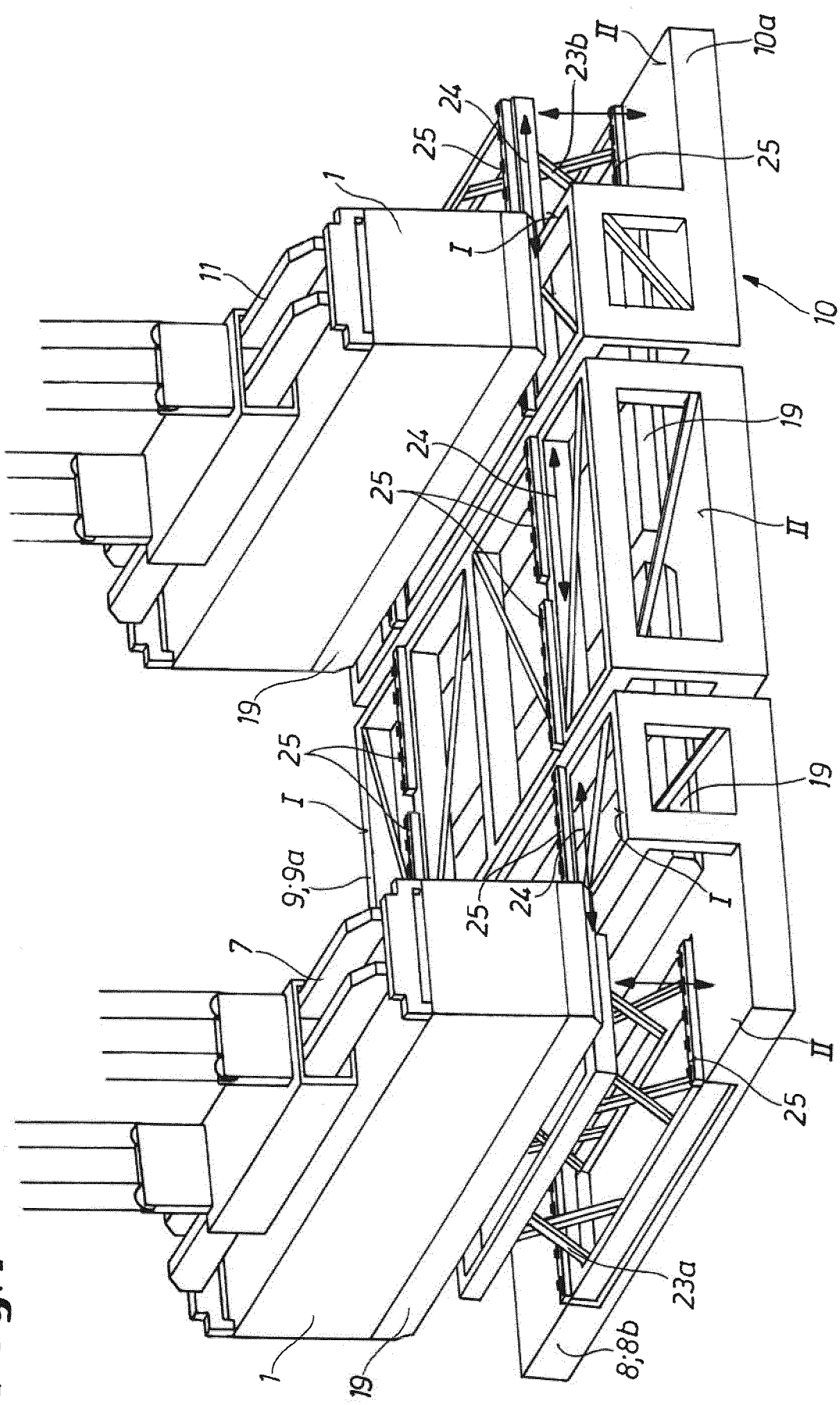
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Fig. 7