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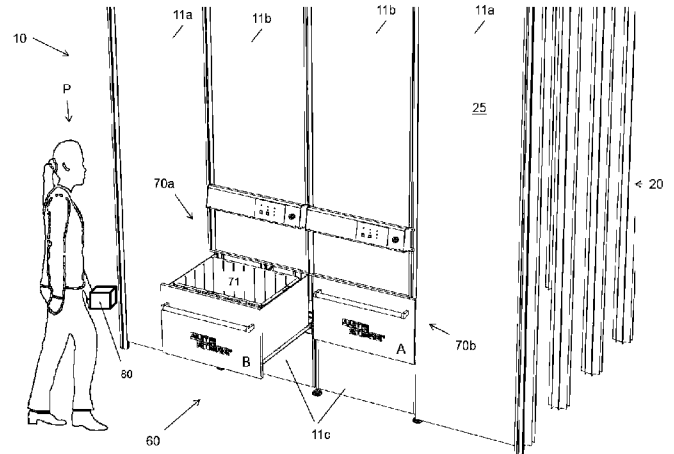
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(54) Title **STORAGE SYSTEM WITH DRAWER PORT**

(56) References Cited: US 2016129587 A1, WO 2014075937 A1, WO 2012148287 A1, US 9326599 B1, US 2012160793 A1, US 2016129587 A1, US 2014102859 A1, US 2016019367 A1

(57) Abstract

The present invention relates to a storage system (10) for storing product items (80), comprising a grid structure (20) and a number of storage bins (30) configured to be stored in vertical compartments in the grid structure (20). Each storage bin (30) is configured to contain at least one product item (80). The storage system (10) comprises a picking and/or supply station (60) where a product item (80) is configured to be picked from one of the storage bins (30) and/or where a product item (80) is configured to be supplied to one of the storage bins (30). The picking and/or supply station (60) comprises a drawer device (70), where the drawer device (70) comprises a storage container (72) with a compartment (71) for temporarily storing a product item (80) to be picked from or supplied to the storage system (10). The drawer device (70) is configured to be in a closed state (A) or in an open state (B); where an person (P) is prevented from accessing the compartment (71) in the closed state and where the person (P) is allowed to access to the compartment (71) in the open state.



FIELD OF THE INVENTION

The present invention relates to a storage system.

BACKGROUND OF THE INVENTION

5 The Applicant's already known AutoStore system is a storage system comprising a three dimensional storage grid structure wherein storage bins are stacked on top of each other to a certain height. Such a prior art system is shown in fig. 1.

10 The storage system 10 comprises a grid structure 20 constructed as aluminium columns interconnected by top rails. Between the columns, vertical compartments are defined, in which the storage bins 30 may be stacked vertically above each other. A number of vehicles 40, or robot vehicles, are arranged on the top rails and may move horizontally on top of the storage grid.

Each vehicle is equipped with a lift for picking up, carrying, and placing storage bins 30 that are stored in the storage grid.

15 The system also comprises picking and/or supply stations 60, where one or several product items are picked out from the storage bin 30 or where one or several product items are filled into the storage bin 30.

20 When a product item stored in a storage bin is to be picked from the storage grid, the robot vehicle is arranged to pick up the storage bin containing that product type and then transport it to a bin lift device 50. The bin lift device is transporting the storage bin to the picking and/or supply station 60, where the item of the product type is retrieved from the storage bin. The storage bin with the remaining product items is thereafter returned to the storage grid by means of a bin lift device and a robot vehicle.

25 The same procedure is used for supplying product items into the storage grid. First, items are supplied into a storage bin at a picking and/or supply station. The bin lift device is then lifting the storage bin up to the upper level where a robot vehicle is transporting the storage bin into its correct position within the storage grid.

30 A storage control and communication system is used to monitor inventory, to keep track of the location of respective storage bins (within storage grid and/or during transport), the content of each storage bins etc. Moreover, the storage control and communication system may also comprise, or may be provided in communication with, a control system for controlling the robot vehicles to control the vehicles to pick the desired storage bin and to deliver it at the desired location at the desired time – without colliding with other vehicles.

The picking and/or supply stations of the present storage systems 1 are rather large and complex. Hence, one object of the invention is to provide a smaller and simpler picking and/or supply station.

- 5 US 2016129587 describes an a storage-and-retrieval system comprising: a structural framework defining a grid of storage locations configured for receiving a plurality of containers; a plurality of robotic load handlers for retrieving containers from any one of the storage locations; and at least one rail arranged about the grid to enable access to each of the storage locations by at least one of the plurality of robotic load handlers
- 10 US 2016019367 describes a medication storage and dispensing workstation for use in a medication management system administering the inventory and distribution of pharmaceuticals and medical supplies in a healthcare environment is disclosed. The workstation incorporates a linear drawer assembly having a plurality of discrete, removable, storage modules for containing medications and/or other medical
- 15 supplies. The storage modules are arranged in a linear array extending longitudinally along the travel path of the linear drawer assembly. Each storage module, in turn, comprises a drawer that is extensible laterally relative to the linear arrangement of the storage modules. As such, the drawer assemblies comprise a compartmentalized “drawer-in-drawer” arrangement that provides an efficient use
- 20 of storage space and enables a user to utilize the workstation in a workspace having a smaller footprint than traditional storage cabinet apparatus.

Typically, a person of the picking and/or supply station is employed by the owner of the storage system, where the person is picking a product item out from the storage bin and is then packing and sending the product item to the end user via a postal

25 service or another delivery service. However, in some storage systems it may be desired that end user is collecting the product item at the location of the storage system. Hence, one object of the invention is to provide a storage system which enables such end users to collect product items themselves automatically. Care must be taken, as the interface between the end user and the storage system should not

30 introduce risks for personal injuries (typically fingers or hands getting squeezed by moving parts).

Moreover, only users with a suitable key or key code should be able to access the product item retrieved from the storage system.

Another object is to make the picking and/or supply station smaller.

- 35 Another object is to reduce the manufacturing costs for the picking and/or supply station.

SUMMARY OF THE INVENTION

The above objects are achieved by a storage system for storing product items as defined in the independent claim 1. Aspects of the invention are defined in the dependent claims

DETAILED DESCRIPTION

5 Embodiments of the invention will now be described with reference to the enclosed drawings, where:

Fig. 1 illustrates a prior art storage system;

Fig. 2 illustrates a picking and/or supply station a storage system according to the invention, the station comprising two drawer devices;

10 Fig. 3 illustrates a perspective view of the drawer device of fig. 2;

Fig. 4 illustrates a front view of the drawer device of fig. 3;

Fig. 5 illustrates a cross sectional side view of the drawer device of fig. 3 and 4;

Fig. 6 illustrates an alternative embodiment of the invention;

15 It is now referred to fig. 1, where the storage system 10 for storing product items 80 is shown. The system 10 comprises a grid structure 20 and a number of storage bins 30 configured to be stored in vertical compartments in the grid structure 20, where each storage bin 30 is configured to contain at least one product item 80.

20 The storage system 10 comprises a picking and/or supply station 60 where a product item 80 is configured to be picked from one of the storage bins 30 and/or where a product item 80 is configured to be supplied to one of the storage bins 30.

Typically, persons are working at the picking and/or supply stations 60, they may for example work with handling picking orders from buyers of product items and with preparing the product items for delivery to the buyers. They may for example
25 also work with supplying the storage grid with new product items from the subsuppliers, manufacturers of the product items etc.

As shown in fig. 1 and 6, the storage system 1 may also comprise a vehicle 40 configured to move horizontally on top of the storage grid 20, where the vehicle 40 is configured to transport the storage bins 30 between different locations within the
30 grid structure 20 and between the grid structure 20 and the picking and/or supply station 60.

Initially, it should be noted that in prior art, a storage control and communication system is used to monitor inventory, to keep track of the location of respective

storage bins (within storage grid and/or during transport, etc. Moreover, the storage control and communication system may also comprise, or may be provided in communication with, a control system for controlling the robot vehicles to control the vehicles to pick the desired storage bin and to deliver it at the desired location at the desired time – without colliding with other vehicles.

It is now referred to fig. 2, where it is shown that the picking and/or supply station 60 comprises a drawer device 70. The drawer device 70 is configured to be in a closed state A or in an open state B, where an person P is prevented from accessing the compartment 71 in the closed state and where the person P is allowed to access to the compartment 71 in the open state. In fig. 2, it is shown two drawer devices, a first drawer device 70a (to the left) and a second drawer device 70b (to the right), where the first drawer device 70a is in the open state B and where the second drawer device 70b is in the closed state A. The person P is holding a product item 80 which has been retrieved from the first drawer device 70a.

In fig. 2, it is also shown that the grid structure 20 faced towards the person P is covered with a wall surface 25, comprising wall structure elements 11a, 11b and 11c. The wall structure elements 11a are covering the grid from bottom to top (i.e. from floor to top of grid structure) while wall structure elements 11b is covering the grid structure above the drawer devices 70a, 70b and wall structure elements 11c is covering the grid structure 20 below the drawer devices 70a, 70b. If provided inside a building, the purpose of the wall structure elements may be to prevent personal injuries, to reduce noise, to prevent dust etc. If the wall structure elements are faced towards the outside of a building, the purpose of the wall structure elements may also be to protect the grid structure 20 from theft, vandalism etc, to protect the grid structure 20 from weather conditions (rain, snow, wind etc) etc.

It is now referred to fig. 3. Here it is shown that the drawer device 70 comprises a storage container 72 with a compartment 71. A product item 80, or several product items 80, may be temporarily stored in the compartment 71 to be picked from or supplied to the storage system 10.

In fig. 3, 4 and 5 it is shown that the storage container 72 is supported by a supporting structure 73. Preferably the supporting structure 73 is connected to the supporting structure of the storage grid 20. The drawer device 70 further comprises a front side surface 75 with a handle 74. The front side surface 75 is preferably aligned with the front side surface 25 of the grid structure 20 in the closed state A, as shown in fig. 2. In the closed state A, the person P may use the handle 74 to bring the drawer device to the open state B. In the open state B the person P may use the handle 74 (or push the front side surface 75) to bring the drawer device to the closed state A again.

In fig. 5, the drawer device 70 is shown both in its open state B and its closed state A, where the letter A in the reference numbers indicates the position in the closed state and where the letter B in the reference numbers indicates the closed position.

5 In the following, one embodiment will be described where the picking and/or supply station 60 is a picking station where customers may retrieve their ordered product items themselves.

10 Here, the drawer device 70 is further configured to be in a locked state C, where the person P is prevented from bringing the drawer device 70 from the closed state A to the open state B. This is achieved by providing the drawer device 70 with a locking device. In fig. 5 the locking device of the drawer device 70 is indicated by reference numbers 77, 78.

15 The drawer device 70 may comprise a first user interface 76 configured to perform an approval process of the person P, where the drawer device 70 is brought from the locked state C to the closed state A if the approval process results in an approval of the person P.

20 The locking device 77, 78 may for example comprise a locking dog 78 and a locking dog receptacle 77, where the locking dog 78 may be releasably engaged with the locking dog receptacle 77. Alternatively, the locking device 77, 78 may comprise a locking bolt 78 and a locking groove 77, where the locking bolt 78 may be releasably engaged in the locking groove 77. The release of the locking device 77, 78 may be performed mechanically, for example by means of a key operated locking device. Alternatively, the release of the locking device may be performed electronically, for example by means of a pin-code actuated locking device, an electronic card actuated locking device etc, where the pin code key pad or the card reader is connected to an electromagnetic actuator for releasing the locking device. When the locking device is released, the person P may open the drawer device by pulling the handle 74. The drawer device 70 may be configured to lock the locking device automatically when the user is closing the drawer device.

30 Preferably, the locking device 77, 78 is connected to the abovementioned storage control and communication system.

35 When retrieving the product items 80, the customer is identifying himself by using the user interface 76, for example by means of an access code (the user interface comprising a touch screen, a keyboard, a bar code reader, a QR code reader etc) or by means of a credit card (the user interface comprising a card reader), a smart phone (the user interface comprising a NFC (near field communication) unit) etc.

When identified, the storage control and communication system retrieves the pre-ordered product items and transports them to the drawer port, whereafter the drawer

port is brought from the locked state C to the closed state A. The customer may now open the drawer device by using handle 74 and may retrieve his product items.

Alternatively, the user interface 76 may provide the possibilities for buying product items on-site, i.e. without pre-ordering them.

5 The drawer device 70 is in the present embodiment a drawer where the storage container 72 of the drawer device 70 is pulled in a horizontal direction H, as shown in fig. 4 between the closed state A and the open state B. Alternatively, the drawer device may be of a hinged-type of drawer.

10 Preferably, the storage container 72 is one of the storage bins 30 where the storage system 1 is configured to transport the storage bin 30 from the storage grid 20 to the drawer device 70 and/or to transport the storage bin 30 from the drawer device 70 to the storage grid 20. The vehicle 40 will typically be configured to transport the storage bins 30 between the storage grid 20 and the drawer device 70.

15 Alternatively, the storage container 72 is fixed to the drawer device 70 itself, where product items 80 are transported from the storage bin 30 and into the storage container 72 or vice versa.

20 In one alternative embodiment, there is no handle 74. Instead, the person P is using the user interface 76 for bringing the drawer device 70 from the closed state A to the open state B and possibly also from the open state B to the closed state A again. An electric or hydraulic push/pull-mechanism may be used for the movement of the drawer.

25 When the drawer device is closed after opening, a signal may be sent to the abovementioned storage control and communication system, the signal indicating that the product item has been picked up. The system may then send a vehicle for retrieving the storage bin from the drawer device and storing it into the storage grid again.

30 In the following, one embodiment will be described where the picking and/or supply station 60 is a picking station where customers may retrieve their ordered product items themselves. Only one type of product items 80 are typically stored in one storage bin 30, for reducing the risk of errors during picking/supplying the grid. However, a customer may often order several different types of product items.

35 In this embodiment, the storage system 1 comprises a collecting station 90 configured to collect one or more product item from one or more storage bins 30a, 30b into a further storage bin 30c, where the storage system 1 is configured to transport the further storage bin 30c to the drawer device 70. The collecting station 90 here comprises a robot device 90 having a robot arm 92 and a picking mechanism 93 provided in the end of the robot arm. This type of robot 90 is

considered known for a skilled person and will not be described here further in detail.

5 The drawer device may also be used in the example mentioned in the introduction above, where the person using the picking and/or supply station is employed by the owner of the storage system. Here, the locking device of the drawer device is not needed. The user interface 76 may comprise a screen showing a picking order or a selection of picking orders, or it may comprise a reader for reading picking orders (the abovementioned card reader, NFC reader, QR reader or bar code reader etc).

10 The storage system 10 will then, by means of its storage control and communication system, pick the product items of the picking order either manually product type by product type or by automatically by means of the collecting station 90 and move the product items to the drawer device. The person will then provide packing and sending of the product item to the end user via a postal service or another delivery service.

15

CLAIMS

1. A storage system (10) for storing product items (80), comprising:

a grid structure (20);

5 a number of storage bins (30) configured to be stored in vertical compartments in the grid structure (20), where each storage bin (30) is configured to contain at least one product item (80);

10 where the storage system (10) comprises a picking and/or supply station (60) where a product item (80) is configured to be picked from one of the storage bins (30) and/or where a product item (80) is configured to be supplied to one of the storage bins (30);

where the storage system (1) comprises a vehicle (40) configured to move horizontally on top of the storage grid (20);

15 the storage system (1) comprises a collecting station (90) configured to collect one or more product item from one or more storage bins (30a, 30b) into a further storage bin (30c), where the vehicle (40) of the storage system (1) is configured to transport the storage bins (30a, 30b, 30c);

characterized in that

20 the picking and/or supply station (60) comprises a drawer device (70), where the drawer device (70) comprises a storage container (72) with a compartment (71) for temporarily storing a product item (80) to be picked from or supplied to the storage system (10);

25 the drawer device (70) is configured to be in a closed state (A) or in an open state (B); where a person (P) is prevented from accessing the compartment (71) in the closed state and where the person (P) is allowed to access to the compartment (71) in the open state;

the storage container (72) of the drawer device (70) is supported by a supporting structure (73) connected to the storage grid (20);

the storage container (72) is the further storage bin (30c);

30 where the grid structure (20) has a front side surface (25), where a front side surface (75) of the drawer device (70) is aligned with the front side surface (25) of the grid structure (20) in the closed state (A);

where the vehicle (40) is configured to transport the further storage bin (30c) between the storage grid (20) and the drawer device (70).

2. A storage system (10) according to claim 1, where the drawer device (70) comprises a locking device (77, 78), and where the drawer device (70) is further configured to be in a locked state (C), where the person (P) is prevented from bringing the drawer device (70) from the closed state (A) to the open state (B).
- 5 3. A storage system (10) according to claim 1, where the drawer device (70) comprises a first user interface (76) configured to perform an approval process of the person (P), where the drawer device (70) is brought from the locked state (C) to the closed state (A) if the approval process results in an approval of the person (P).
- 10 4. A storage system (10) according to claim 1, where the drawer device (70) comprises a handle (74) fixed to the front side surface (25).

PATENTKRAV

1. Et lagringssystem (10) for lagring av produktvarer (80), omfattende:

en rutenettstruktur (20);

5 et antall lagringsbeholdere (30) som er konfigurert til å lagres i vertikale rom i rutenettstrukturen (20), der hver lagringsbeholder (30) er konfigurert til å inneholde minst en produktvare (80);

10 hvor lagringssystemet (10) omfatter en plukke- og/eller etterfyllingsstasjon (60) der en produktvare (80) er konfigurert til å plukkes fra en av lagringsbeholderne (30) og/eller hvor en produktvare (80) er konfigurert til å bli etterfylt i en av lagringsbeholderne (30);

hvor lagringssystemet (1) omfatter et kjøretøy (40) konfigurert til å bevege seg horisontalt på toppen av lagringsstrukturen (20);

15 lagringssystemet (1) omfatter en oppsamlingsstasjon (90) konfigurert til å samle en eller flere produktvarer fra en eller flere lagringsbeholdere (30a, 30b) til en ytterligere lagringsbeholder (30c), der kjøretøyet (40) i systemet (1) er konfigurert til å transportere lagringsbeholderne (30a, 30b, 30c);

karakterisert ved at

20 plukke- og/eller etterfyllingsstasjonen (60) omfatter en skuffanordning (70), der skuffeanordningen (70) omfatter en lagringsbeholder (72) med et rom (71) for midlertidig lagring av en produktvare (80) som skal bli plukket fra eller etterfylles til lagringssystemet (10);

25 skuffanordningen (70) er konfigurert til å være i en lukket tilstand (A) eller i åpen tilstand (B); der en person (P) er forhindret fra å få tilgang til rommet (71) i den lukkede tilstanden og hvor personen (P) har adgang til rommet (71) i åpen tilstand; lagringsbeholderen (72) til skuffanordningen (70) er understøttet av en bærende konstruksjon (73) koblet til lagringsstrukturen (20);

lagringsbeholderen (72) er den ytterligere lagringsbeholderen (30c);

30 hvor rutenettstrukturen (20) har en frontsideflate (25), der frontsideflaten (75) hos skuffanordningen (70) er på linje med frontsideflaten (25) til rutenettstrukturen (20) i lukket tilstand (A);

hvor kjøretøyet (40) er konfigurert til å transportere den ytterligere lagringsbeholderen (30c) mellom rutenettstrukturen (20) og skuffanordningen (70).

2. Lagringssystem (10) ifølge krav 1, hvor skuffanordningen (70) omfatter en låseinretning (77, 78), og hvor skuffanordningen (70) videre er konfigurert til å være i en låst tilstand (C), der personen (P) er forhindret fra å bringe skuffanordningen (70) fra den lukkede tilstanden (A) til den åpne tilstanden (B).
- 5 3. Lagringssystem (10) ifølge krav 1, hvor skuffeanordningen (70) omfatter et første brukergrensesnitt (76) konfigurert til å utføre en godkjenningssprosess av personen (P), der skuffanordningen (70) bringes fra den låste tilstanden (C) til den lukkede tilstanden (A) hvis godkjenningssprossen resulterer i en godkjenning fra personen (P).
- 10 4. Lagringssystem (10) ifølge krav 1, karakterisert ved at skuffeanordningen (70) omfatter et håndtak (74) festet til frontsideflaten (25).

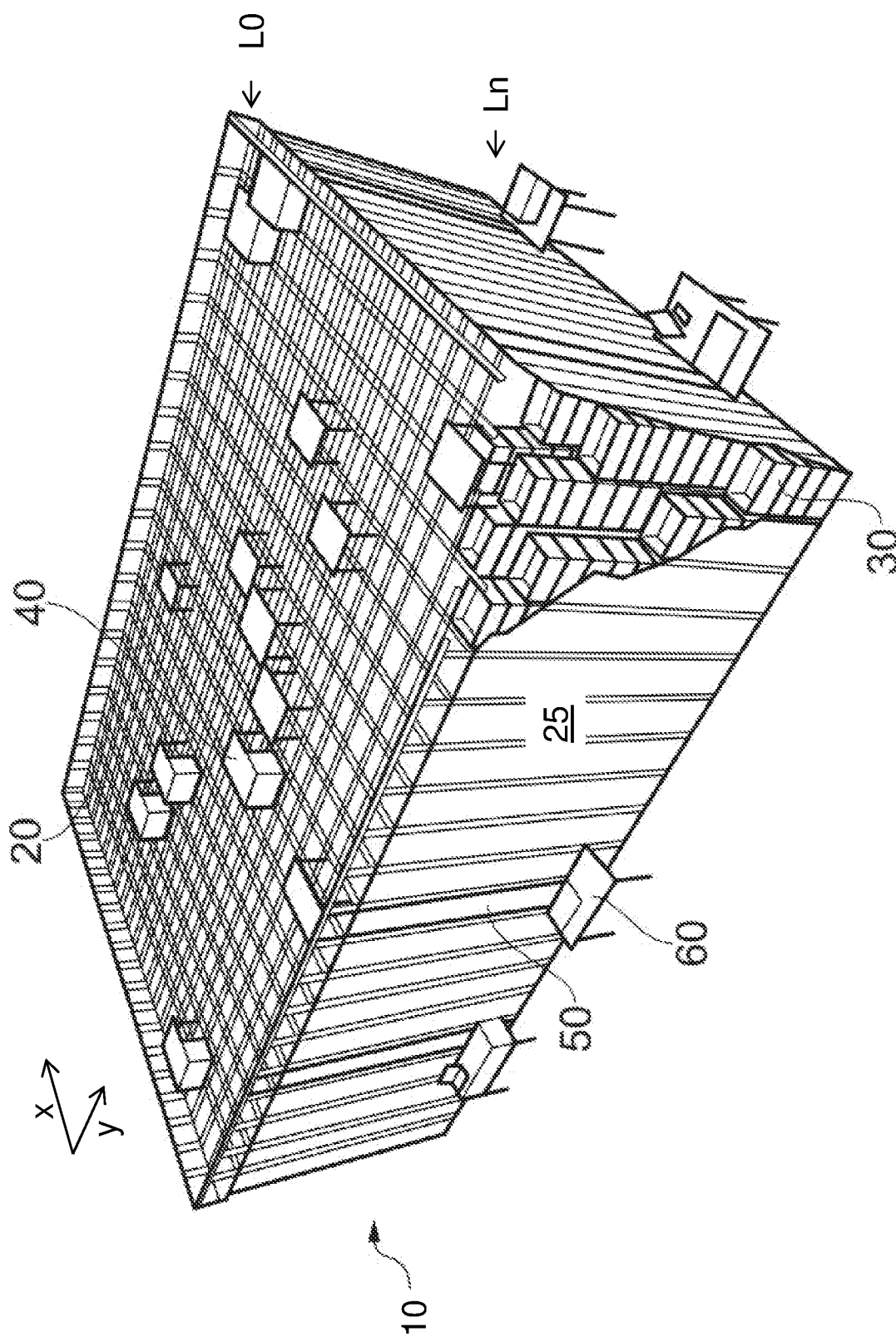


Fig. 1: Prior art

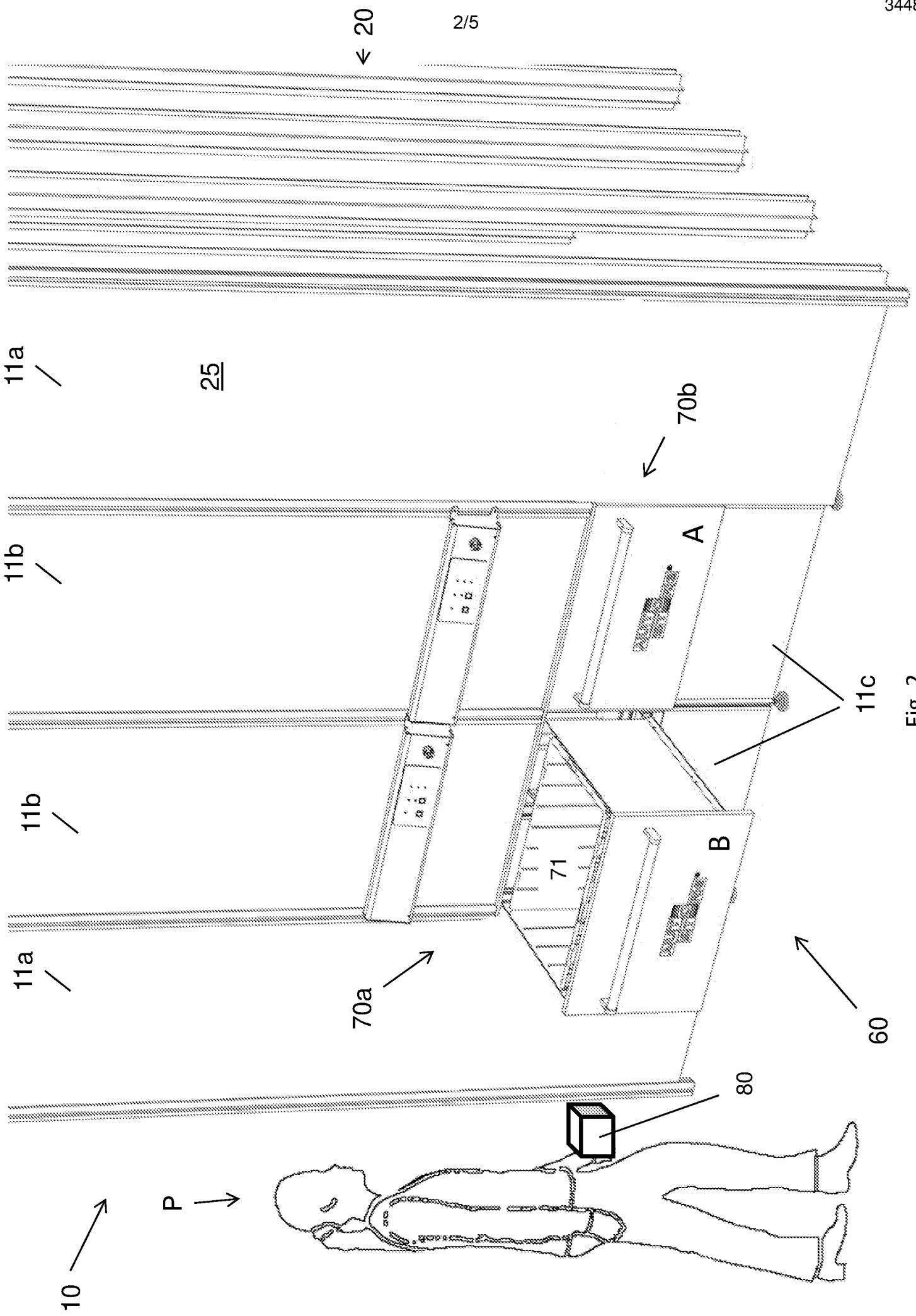


Fig. 2

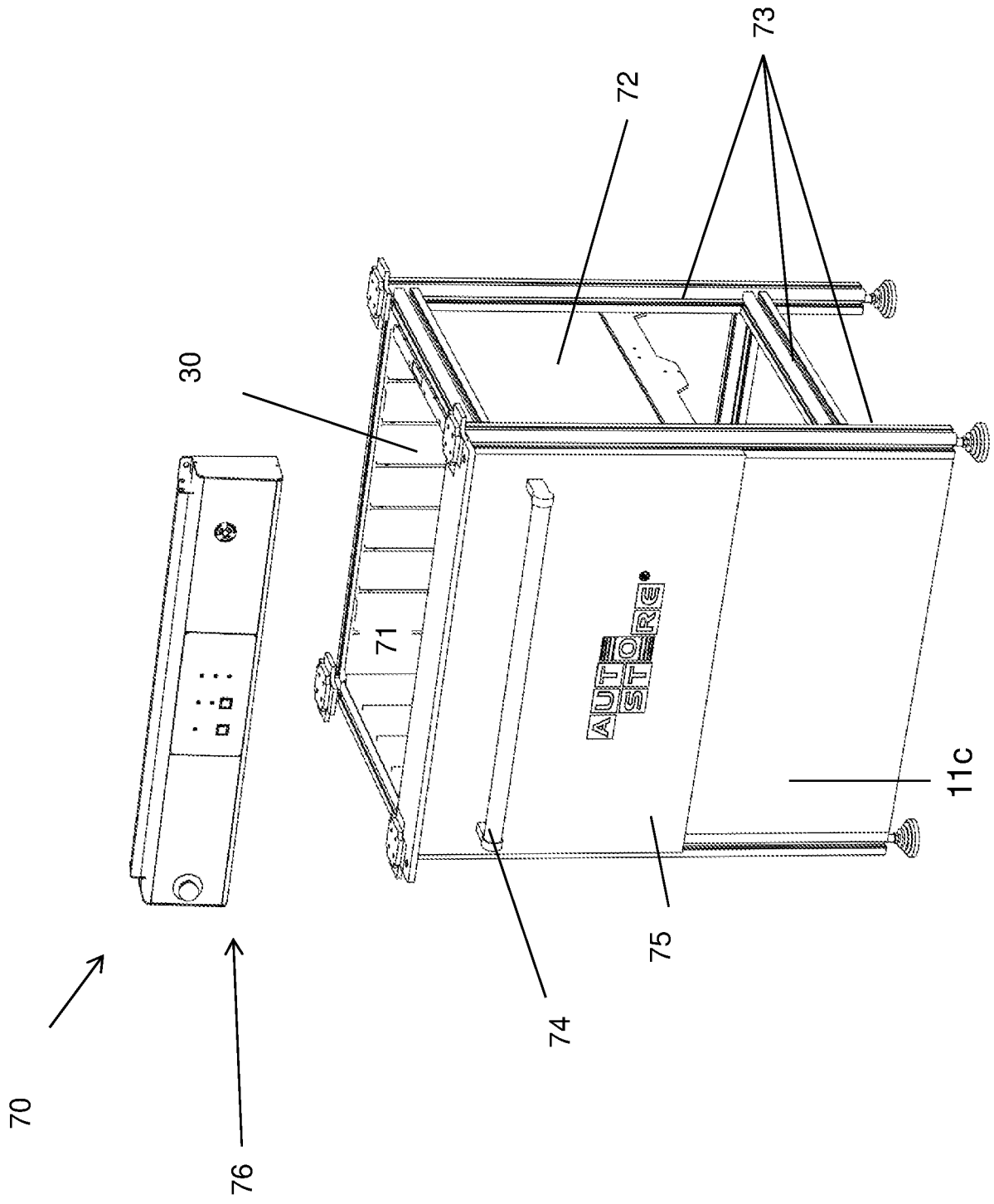


Fig. 3

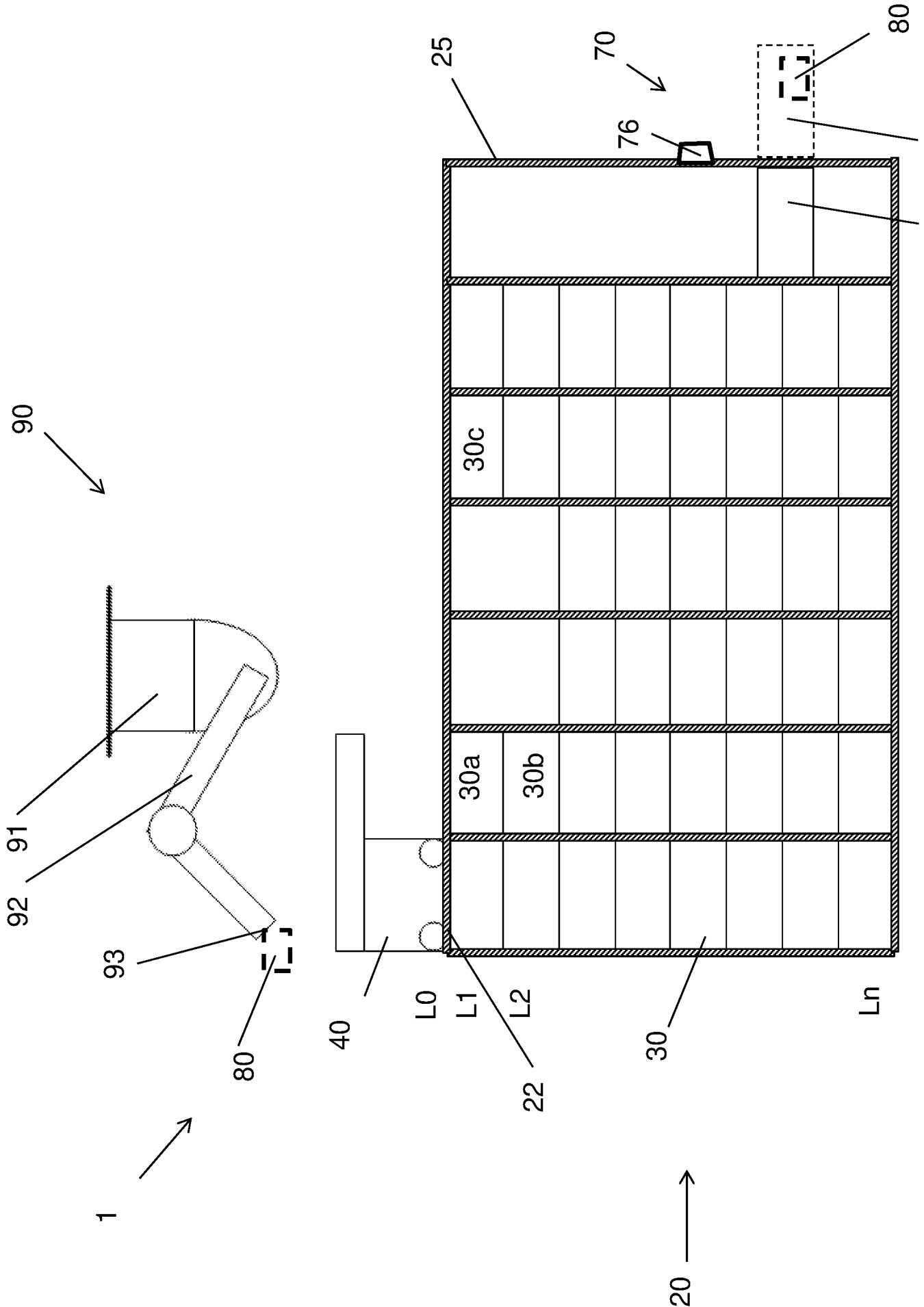


Fig. 6