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This application was filed on 22-02-2021 as a divisional application to the application mentioned under INID code 62.

(54) **STORAGE AND PICKING SYSTEM**

(57) Problem

The problem to be solved is to provide a storage and picking system particularly suitable for the delivery of dry goods and packaged grocery store items.

Solution

The problem is solved by a storage and picking system comprising at least one stacker crane mobile within the storage and picking system. The storage and picking system comprises shelving units containing magazines, which are accessible by the crane. The storage and picking system comprises a pickup terminal accessible from outside the storage and picking system and a path running alongside the shelving units. The magazines comprise a slide rail slidably guided along the magazine, a pusher slide mounted on the slide rail and a restraint affixed to a front end of the slide rail.

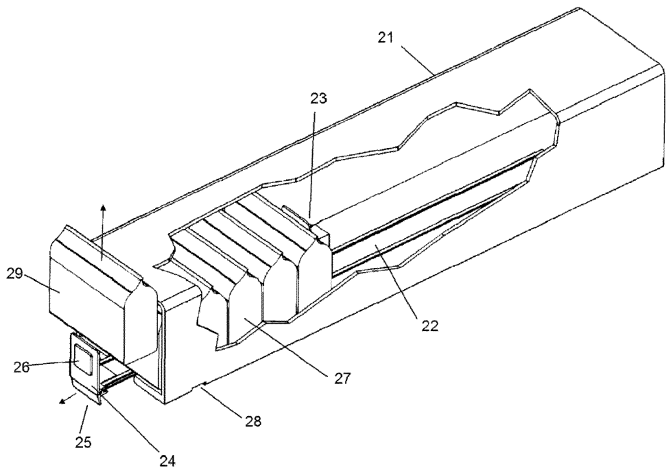

Fig. 2

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Description

Technical Field

[0001] The invention relates to a storage and picking system as per the preamble of Claim 1 and to a method for delivering an item from a storage and picking system as per the preamble of Claim 13.

Background Art

[0002] In distribution, logistics, and supply chain management, by automated storage and retrieval system (AS/RS) is meant any computer-controlled system for automatically placing and retrieving loads from defined storage locations. Such storage and picking systems are commonly employed where storage density is important because of space constraints.

[0003] A crucial component of a storage and picking system is its socalled storage and retrieval machine. In that context, a fixed-aisle machine is generally referred to as a "stacker crane". The mast or masts of such crane support a carriage on which unit loads are carried. In a conventional system, one or more shuttles or telescopic extraction devices are attached to the carriage to retrieve items.

[0004] Traditional storage machines of this type are described, for instance, in MANLEY, Charles E., et al. Materials Handling Handbook. 2nd edition. Edited by KULWIEC, Raymond A.. New York: John Wiley & Sons, 1985. ISBN 0471097829. p.589-652.

[0005] A recently emerging technology based on wire- or cable-driven manipulators is evaluated in SALAH, Bashir, et al. Design and simulation based validation of the control architecture of a stacker crane based on an innovative wire-driven robot. Robotics and Computer-Integrated Manufacturing. 2017, vol.44, p.117-128.

[0006] EP1541064B1 discloses an article display apparatus for articles which are arranged one behind the other on a shelf, comprising a capacitive sensor unit for detecting the position of an article slide and its distance to a front stop of the shelf.

Summary of invention

[0007] The invention as claimed is hereinafter disclosed in such a way that the technical problem with which it deals can be appreciated and the solution can be understood.

Technical Problem

[0008] The problem to be solved is to provide a storage and picking system particularly suitable for the delivery of dry goods and packaged grocery store items.

Solution to Problem

[0009] According to the invention, a storage and picking system according to claim 1 and a method according to claim 13 is proposed.

[0010] Further embodiments of the invention are described with regard to claims 2 to 12 and 14.

[0011] According to one embodiment, a mobile magazine comprises a slide rail slidably guided along the magazine, a pusher slide mounted on the slide rail and a restraint affixed to a front end of the slide rail. The pusher slide and the restraint are biased toward each other. The mobile magazine comprises a catch affixed to the restraint. In one embodiment, the mobile magazine comprises an identification tag for identifying packaged goods contained in the mobile magazine. In one embodiment, the mobile magazine comprises a notch for retaining the mobile magazine within a shelving unit.

[0012] According to one embodiment, a storage and picking system comprises at least one stacker crane mobile within the storage and picking system and shelving units containing mobile magazines as descried above. According to one embodiment, the shelving units grouped in coherent temperature zones, which are available across the storage and picking system. In one embodiment, the shelving units are accessible by the crane. According to one embodiment, the storage and picking system further comprises a pickup terminal which is accessible from outside the storage and picking system. In one embodiment, a first goods issuing mechanism is arranged between a path running alongside the shelving units and the terminal.

[0013] According to one embodiment, in the storage and picking system the shelving units are mobile.

[0014] According to one embodiment, the storage and picking system comprises a second goods issuing mechanism arranged between the path and a dispatch zone.

[0015] According to one embodiment, the first goods issuing mechanism or the second goods issuing mechanism comprise a chute.

[0016] According to one embodiment, the storage and picking system comprises divider walls betwixt the temperature zones and sliding gates in the divider walls. The path runs through the gates.

[0017] According to one embodiment, the storage and picking system comprises a track defining the path. The crane comprises a mast bound to the track and a carriage slidably guided along the mast.

[0018] According to one embodiment, the carriage comprises a tray for receiving the goods, a raising mechanism recessed complementarily to the catch and sloping toward the tray and an extendible hook for engaging the catch.

[0019] According to one embodiment, a mobile will-call store comprises a vehicle carrying a storage and picking system. The terminal is accessible from outside the vehicle. A computation and communications unit is electronically connected to the crane. A heating and air conditioning unit is provided for maintaining a storage temperature of the goods. According to one embodiment, a photovoltaic system is located at the top the vehicle.

[0020] According to one embodiment, use of the storage and picking system is rendered as follows: The mast moves along the track to one of the shelving units. The carriage slides along the mast to one of the magazines. The hook extends and engages the catch of the respective magazine. The hook retracts by the depth of an item contained in the magazine such that the rail projects beyond and the item protrudes from the magazine. The raising mechanism raises the item above the restraint such that the item slides down the raising mechanism onto the tray. The hook presses the rail back into the magazine. The crane delivers the item to the first goods issuing mechanism.

Advantageous effect of invention

[0021] Use of the proposed storage and picking system permits vendors to drastically reduce their customers' waiting time between placement of a purchase order and pickup or delivery of the ordered items.

[0022] Due to its improved storage density, a system as per the invention may be advantageously implemented as a fully automated interactive vending kiosk or mobile will-call store. The latter embodiment allows for round-the-clock pickup, thus lifting the store's restriction to traditional opening hours.

[0023] For instance, a will-call store in the form of a parked and unmanned cargo van may offer an assortment of between 300 and 1,000 commodities grouped in up to four cooling zones. Located in a public parking lot or on private or factory premises, such a will-call store would be able to place goods at a caller's disposal within 30 seconds. To this end, its fleet operator may take orders by smartphone, whereupon the buyer is directed to the nearest van, which dispenses the ordered items automatically upon call.

[0024] In the alternative form of a subsidiary distribution center, the storage and picking system permits vendors to narrow down the predicted time frame for individual deliveries. Designed for both pickup and delivery, an exemplary store of this type could keep in stock between 2,000 and 10,000 items arranged in three cooling sections across between 250 and 1,500 square meters of floor space. Suitable sites may be found in urban areas, railroad stations, etc., allowing for a 30-minute delivery in addition to automated goods issue within some 60 seconds. Such stores may easily integrate additional facilities such as a coffee bar or even deli counter for perishable items.

Brief description of drawings

[0025]

Figure 1 is a first perspective view of a mobile magazine.

Figure 2 is a second perspective view of the magazine.

Figure 3 is a plan view of a first storage and picking system.

Figure 4 is a plan view of a second storage and picking system.

Figure 5 is a perspective view of a third storage and picking system.

Figure 6 is a perspective view of a mobile will-call store.

Figures 7 to 10 are perspective views illustrating a process of goods issue.

Description of embodiments

[0026] Figure 1 shows a mobile magazine 11 comprising a slide rail 12 slidably guided along the magazine, a pusher slide 13 mounted on the slide rail 12, and a restraint 14 affixed to a front end thereof, the pusher slide 13 and the restraint 14 being biased toward each other.

[0027] The mobile magazine 11 comprises a catch 15 affixed to the restraint 14, an identification tag 16 for identifying packaged goods 17 contained in the magazine 11, and a notch 18 for retaining the magazine 11 within a shelving unit. In this context, the term "identification tag" is used in a broad meaning, encompassing various means such as a barcode, quick response (QR) code, or radio-frequency identification (RFID) tag.

[0028] In a corresponding perspective, Figure 2 shows how an item 29 among the packaged goods 27 is extracted from the magazine 21. In this process, the slide rail 22 projects beyond and the item 29 protrudes correspondingly from the front end of the magazine 11, the pusher slide 23 moving forward by an equal distance. The item may thus be raised above the restraint 24 for extraction. During this process, the magazine's housing is secured in place by a bar (not depicted) engaged with the notch 28.

[0029] It is well understood that the magazine 11, while depicted as a shaft in the figures at hand, may as well take the form of a shelf, tube, carton, or similar container without departing from the scope of the invention.

[0030] Figure 3 shows a first storage and picking system 31 comprising a stacker crane 32 moving back and forth between eight shelving units 33 containing mobile magazines 34, the units being grouped in three coherent temperature zones 35 across the storage and picking system. A pickup terminal 36 is accessible from outside the storage and picking system, wherein a path 37 runs alongside the shelving units up to a goods issuing mechanism 38 arranged next to the terminal.

[0031] Figure 4 shows a more expansive second storage and picking system 41. This system, in addition to its stacker cranes 42, temperature zones 43, multi-branched path 44, ten shelving units 45 populated with mobile magazines, and goods issuing mechanism 46, features a second goods issuing mechanism 47. While the first mechanism is arranged next to the customer pickup terminal 48, the second mechanism borders on a dispatch zone 49 for deliverymen and sales clerks. In such arrangement, the stacker cranes 42 may communicate via sliding contacts or wirelessly, especially if battery-powered. Suitable algorithms may be gathered from the emerging field of swarm robotics, allowing for individual cranes to be added to or removed from the scenario as needed.

[0032] Figure 5 shows a third storage and picking system 51 for use in a mobile will-call store. Here, the stacker crane 52 comprises a carriage 53 slidably guided along a mast bound to a track 54 that defines the crane's path. Also, the four shelving units 55, each containing seven layers of magazines 56, are equipped with rolling frames, allowing the units to be moved outside their store for replenishing. The system is partitioned by two divider walls 57 betwixt the temperature zones, wherein the track proceeds through a sliding gate 58 in each wall unto a chute 59 leading to the pickup terminal.

[0033] The exterior view of Figure 6 shows a mobile will-call store 61 in the form of a cargo van carrying the storage and picking system 62, its pickup terminal 63 accessible from outside the vehicle through a graphical user interface. A computation and communications unit 64 near the van's tailboard electronically connects the interface to the crane, while a heating and air conditioning unit 65 serves to maintain an adequate storage temperature inside the cargo bay. These and other systems are supplied with electricity by a photovoltaic system 66 atop the vehicle. Further roof structures may be conceived, such as a docking platform for unmanned aerial shuttles that deliver shopping baskets to customers as an alternative to personal pickup. Additional variants of the will-call may take the form of a trailer, freight container, or similar.

[0034] Figures 7 through 10 give an account of the stacker crane's interaction with a mobile magazine 71. As may be gathered from the drawings, the crane's mast 72 supports a carriage 73 that, for receiving the goods, in turn comprises a tray 74 to which an adjacent raising mechanism 75 is sloped. Once the mast 72 has moved along its track to the shelving unit housing that magazine, the carriage 73 slides along the mast 72 to match its height. Next, the carriage's hook 76 extends and engages the catch 15, 25 of the respective magazine 71, then retracts by the depth of an item 78 among the packaged goods 77, allowing the item 78 to be extracted as has been described above referencing Figure 2. To this end, the raising mechanism 75, which is recessed complementarily to the catch 15, 25 of the magazine, raises the item 78 above the restraint 14, 24 such that it slides down the raising mechanism 75 onto the tray 74. Now, the hook 76 presses the slide rail 12, 22 back into the magazine 71, whereupon the crane delivers the item 78 to the goods issuing mechanism.

[0035] In an alternative embodiment (not depicted), the magazine and its slide rail are aligned vertically such that the latter's front end is indeed located at the bottom of the apparatus, the goods being stacked upon the restraint affixed at its lowest point. In such embodiment, the pusher slide is biased toward the restraint simply by gravity. To dispense an item, a mobile mechanism beneath allows the restraint - for instance, by releasing a snap joint - to drop or glide downward by the item's depth or height, respectively, instead of actively pulling the item out via the catch as in the horizontal embodiment described above. Now, a feeder, functionally corresponding to the raising mechanism 75 of Fig. 7, would

push the item horizontally off the restraint before the restraint - and hence the packaged goods stacked thereupon - are pushed back into the magazine, allowing the snap joint to reengage.

[0036] In a vertical arrangement of this kind, the magazines may thus be used quite similarly to their horizontal equivalents. Depending on the envisaged application, the basic horizontal layout depicted in the figures however avoids any friction or compression issues associated with upright orientation of the device.

Industrial applicability

[0037] The invention may be applied, inter alia, throughout the retail industry.

Reference signs list

[0038]

11, 21, 34, 56, 71	Mobile magazine
12, 22	Slide rail
13, 23	Pusher slide
14, 24	Restraint
15, 25	Catch
16, 26	Identification tag
17, 27, 77	Packaged goods
18, 28	Notch
29, 78	Item (to be extracted)
31, 41, 51, 62	Storage and picking system
32, 42, 52	Stacker crane
33, 45	Shelving unit
35, 43	Temperature zones
36, 48	Pickup terminal
37, 44	Path
38	(First) goods issuing mechanism
46	First goods issuing mechanism
47	Second goods issuing mechanism
49	Dispatch zone
53, 73	Carriage
54	Track
55	Shelving unit
57	Divider wall
58	Sliding gates
59	Chute
61	Mobile will-call store
63	Pickup terminal
64	Computation and communications unit
65	Air conditioning unit
66	Photovoltaic system
72	Mast
74	Tray
75	Raising mechanism
76	Hook

Claims

1. Storage and picking system (31, 41, 51, 62) comprising at least one stacker crane (32, 42, 52) mobile within the storage and picking system (31, 41, 51, 62), shelving units (33, 45, 55) containing magazines (11, 21, 34, 56, 71) accessible by the crane (32, 42, 52), a pickup terminal (36, 48, 63) accessible from outside the storage and picking system (31, 41, 51, 62), a path (37, 44) running alongside the shelving units (33, 45, 55), **characterized in that** the magazines (11, 21, 34, 56, 71) comprising a slide rail (12, 22) slidably guided along the magazine (11, 21, 34, 56, 71), a pusher slide (13, 23) mounted on the slide rail (12, 22), a restraint (14, 24) affixed to a front end of the slide

rail (12, 22), the pusher slide (13, 23) and the restraint (14, 24) biased toward each other, and a catch (15, 25) affixed to the restraint (14, 24), and
in that the stacker crane (32, 42, 52) further comprises an extendible hook (76) for engaging the catch (15, 25) and for retracting the slide rail (12, 22) such that the slide rail (12, 22) projects beyond the magazine (11, 21, 34, 56, 71).

2. Storage and picking system (31, 41, 51, 62) according to claim 1, **characterized in that** the extendible hook (76) of the stacker crane (32, 42, 52) is for retracting the slide rail (12, 22) including the restraint (14, 24) and the pusher slide (13, 23) and the packaged goods (17, 29, 27, 77, 78) contained between the restraint (14, 24) and the pusher slide (13, 23).

3. Storage and picking system (31, 41, 51, 62) according to claims 1 or 2, **characterized in that** a track (54) defines the path (37, 44), the crane (32, 42, 52) comprising a mast (72) bound to the track (54) and a carriage (73) slidably guided along the mast (72).

4. Storage and picking system (31, 41, 51, 62) according to claim 3, **characterized in that** the carriage comprises a tray (74) for receiving the goods (17, 27, 77), a raising mechanism (75) recessed complementarily to the catch (15, 25) and sloping toward the tray (74) and the extendible hook (76) for engaging the catch (15, 25), wherein, after the retraction of the slide rail (12, 22) including the packaged goods (17, 27, 77), the raising mechanism (75) is for raising an item (29, 78) above the restraint (14, 24) such that the item (29, 78) slides down the raising mechanism (75) onto the tray (74).

5. Storage and picking system (31, 41, 51, 62) according to any one of claims 1 to 4, **characterized in that** a first goods issuing mechanism (46) is arranged between the path (37, 44) and the terminal (36, 48, 63) and particularly a second goods issuing mechanism (47) is arranged between the path (37, 44) and a dispatch zone (49).

6. Storage and picking system (31, 41, 51, 62) according to any one of claims 1 to 5, **characterized in that** the first goods issuing mechanism (46) and/or second goods issuing mechanism (47) comprises a chute (59).

7. Storage and picking system (31, 41, 51, 62) according to any one of claims 1 to 6, **characterized in that** the magazine (11, 21, 34, 56, 71), in particular the restraint (14, 24), comprises an identification tag (16, 26) for identifying packaged goods (17, 27, 77) contained in the magazine (11, 21, 34, 56, 71).

8. Storage and picking system (31, 41, 51, 62) according to any one of claims 1 to 7, **characterized in that** the magazine (11, 21, 34, 56, 71) comprises a notch (18, 28) for retaining the magazine (11, 21, 34, 56, 71) within a shelving unit (33, 45, 55) by a bar.

9. Storage and picking system (31, 41, 51, 62) according to any one of claims 1 to 8, **characterized in that** the shelving units (33, 45, 55) are grouped in coherent temperature zones (35) across the storage and picking system (31, 41, 51, 62).

10. Storage and picking system (31, 41, 51, 62) according to claim 9, **characterized in that** the storage and picking system (31, 41, 51, 62) comprises divider walls (57) betwixt the temperature zones (35) and sliding gates (58) in the divider walls (57), wherein the path (37, 44) runs through the gates (58).

11. Mobile will-call store (61) comprising a vehicle carrying a storage and picking system (31, 41, 51, 62) according to any one of claims 1 to 10, **characterized in that** the terminal (36, 48, 63) is accessible from outside the vehicle, the vehicle comprises a computation and communications unit (64) electronically connected to the crane (32, 42, 52) and a heating and air conditioning unit (65) for maintaining a storage temperature of the goods (17, 27, 77).

12. Mobile will-call store (61) according to claim 11, **characterized in that** the shelving units (55) are equipped with rolling frames and are mobile.

13. Method for delivering an item from a storage and picking system, comprising the steps:

- moving a mast (72) along a track (54) to at least one shelving unit (33, 45, 55) comprising at least one magazine (11, 21, 34, 56, 71),
- sliding a carriage along the mast (72) to one of the magazines (11, 21, 34, 56, 71),
- extending a hook (76) and engaging a catch (15, 25) of the respective magazine (11, 21, 34, 56, 71) with the

hook (76),
- retracting the hook (76) by the depth of an item (29, 78) contained in the magazine (11, 21, 34, 56, 71) such that a slide rail (12, 22) of the magazine (11, 21, 34, 56, 71) projects beyond and the item (29, 78) protrudes from the magazine (11, 21, 34, 56, 71),
- raising by a raising mechanism (75) the item (29, 78) above a restraint (14, 24) such that the item (29, 78) slides down the raising mechanism (75) onto a tray (74),
- pressing back the slice rail (12, 22) by the hook (76) back into the magazine (11, 21, 34, 56, 71), and
- delivering the item (29, 78) by a crane (32, 42, 52) to a first goods issuing mechanism (46).

14. Method for delivering an item from a storage and picking system according to claim 1, wherein the step of retracting the hook (76) by the depth of an item (29, 78) contained in the magazine comprises retracting the hook (76) such that the slide rail (12, 22) of the magazine (11, 21, 34, 56, 71), including the restraint (14, 24) and the pusher slide (13, 23) and the packaged goods (17, 29, 27, 77, 78) contained between the restraint (14, 24) and the pusher slide (13, 23) are retracted.

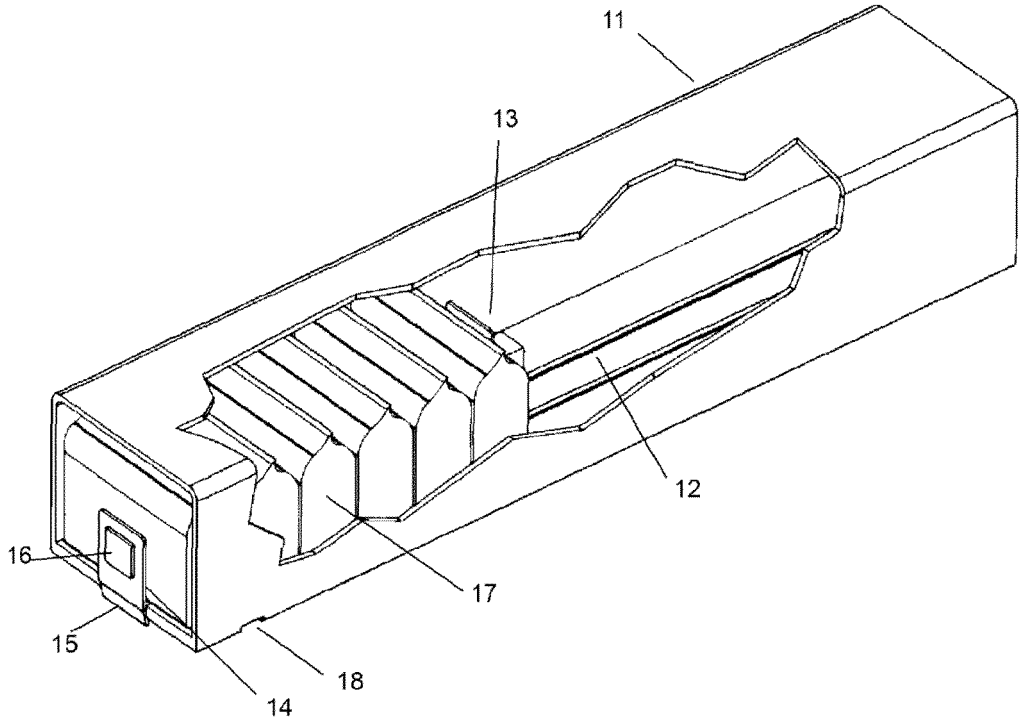

Fig. 1

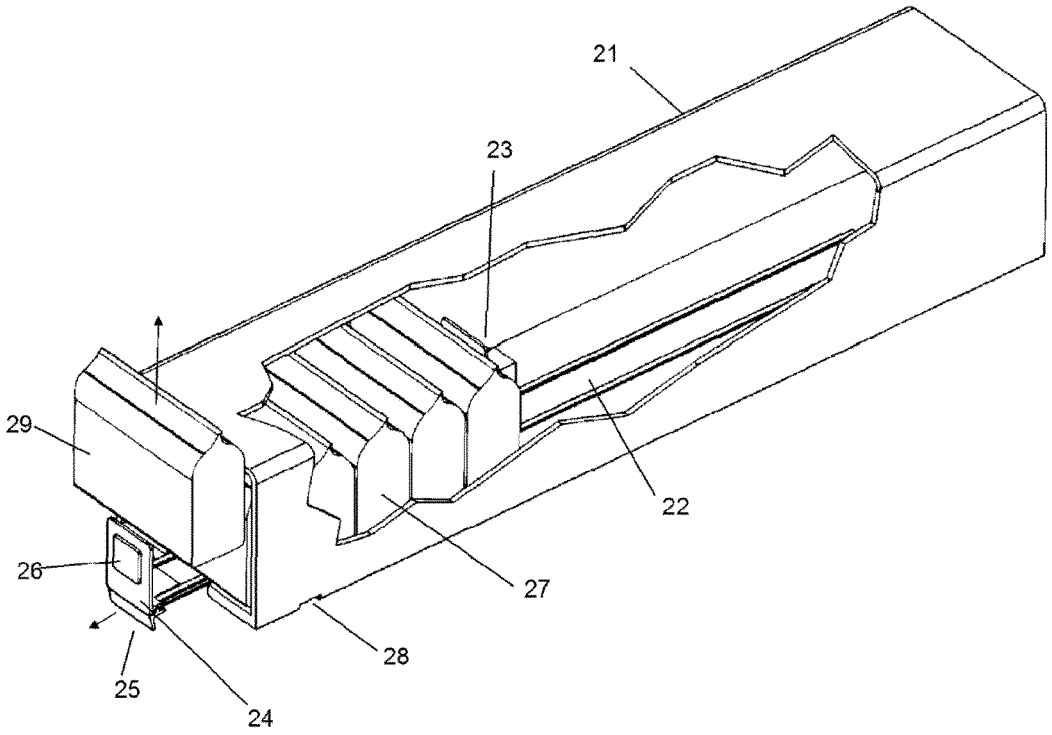

Fig. 2

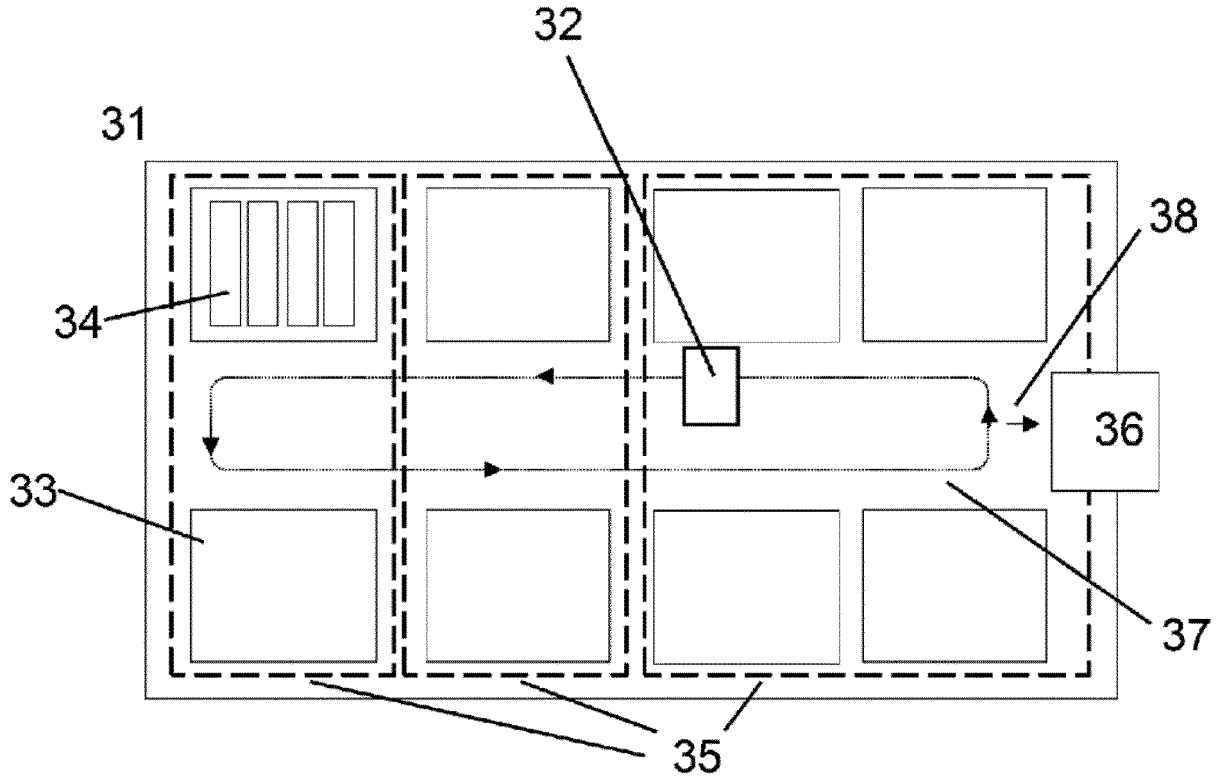

Fig. 3

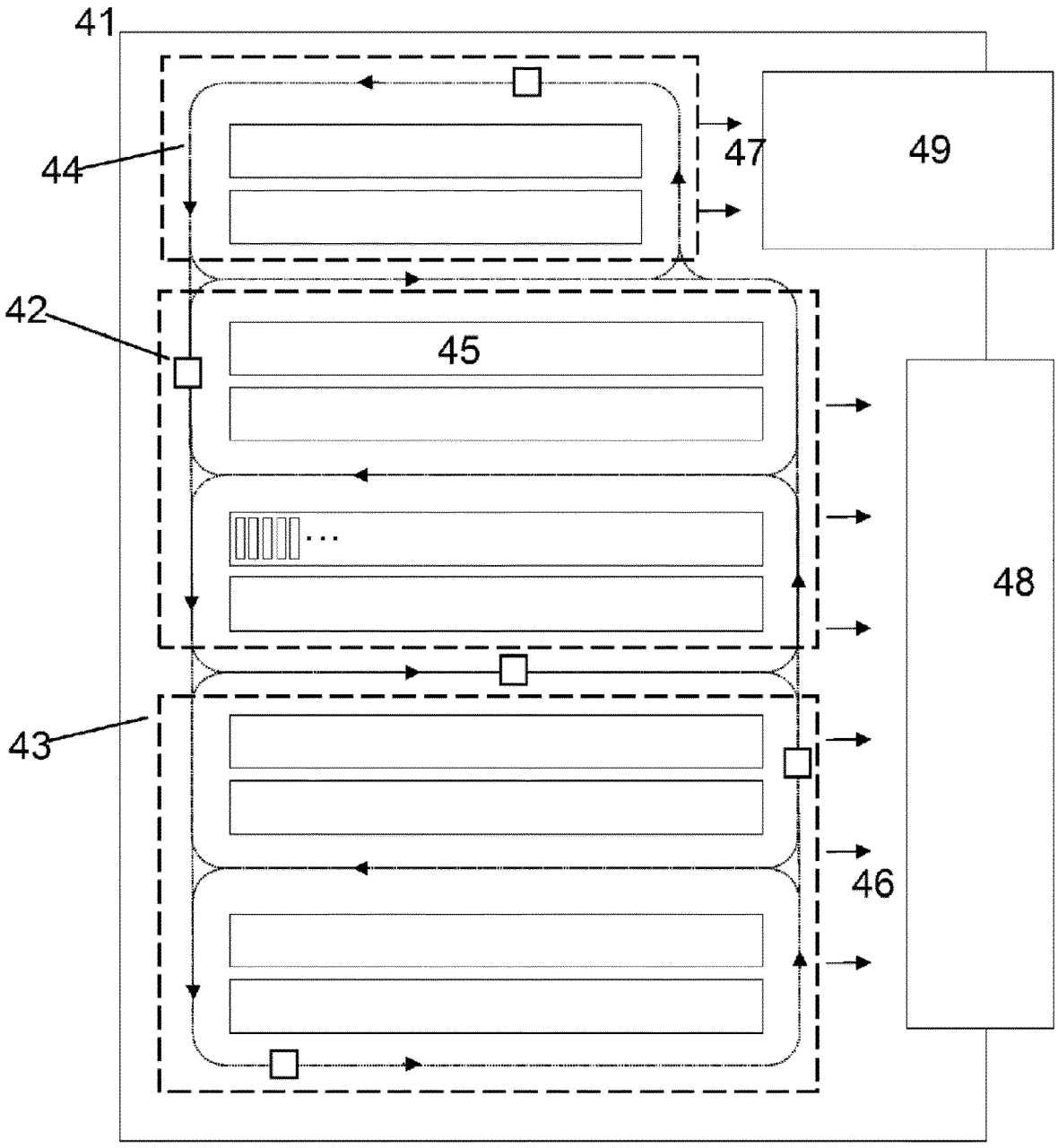

Fig. 4

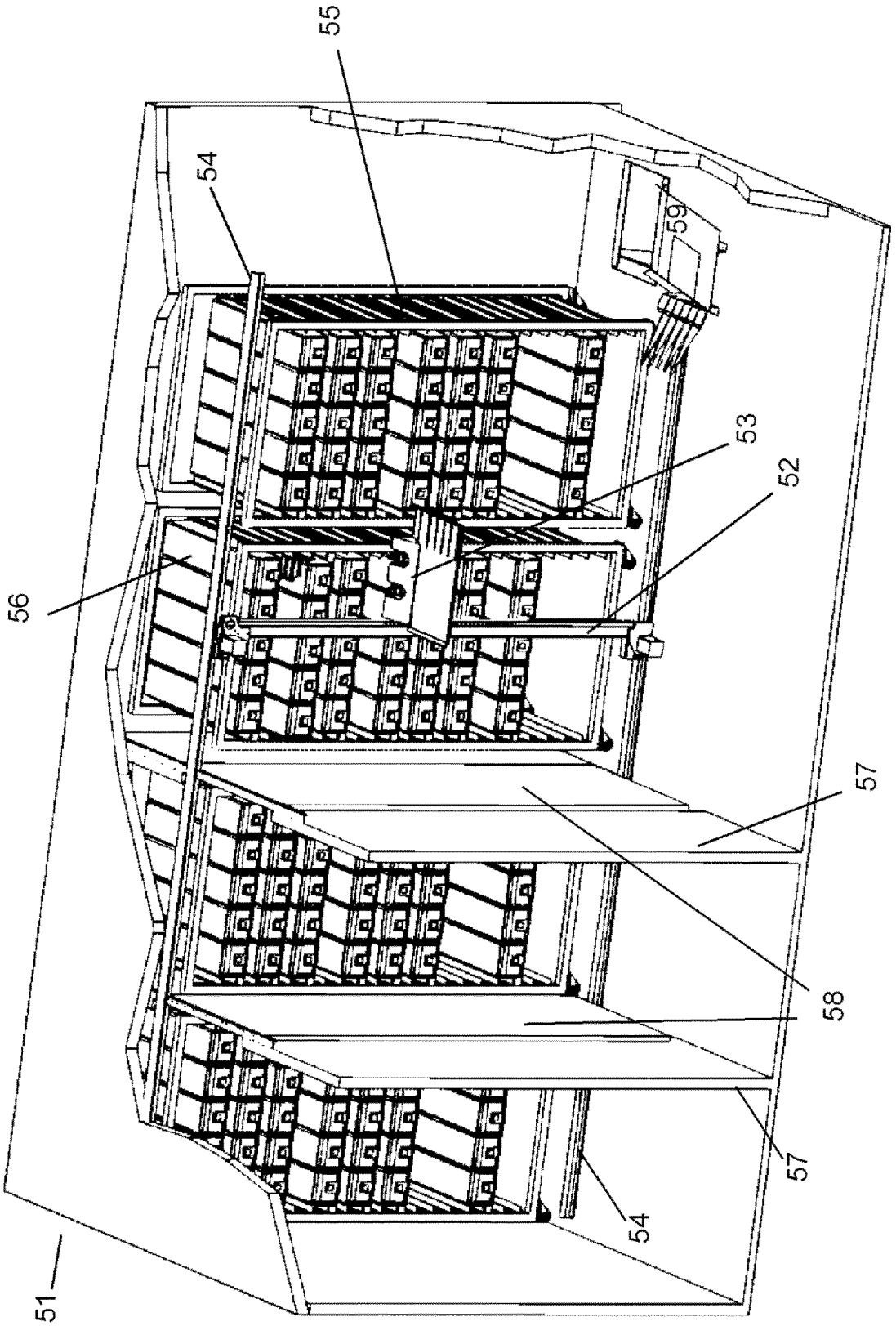

Fig. 5

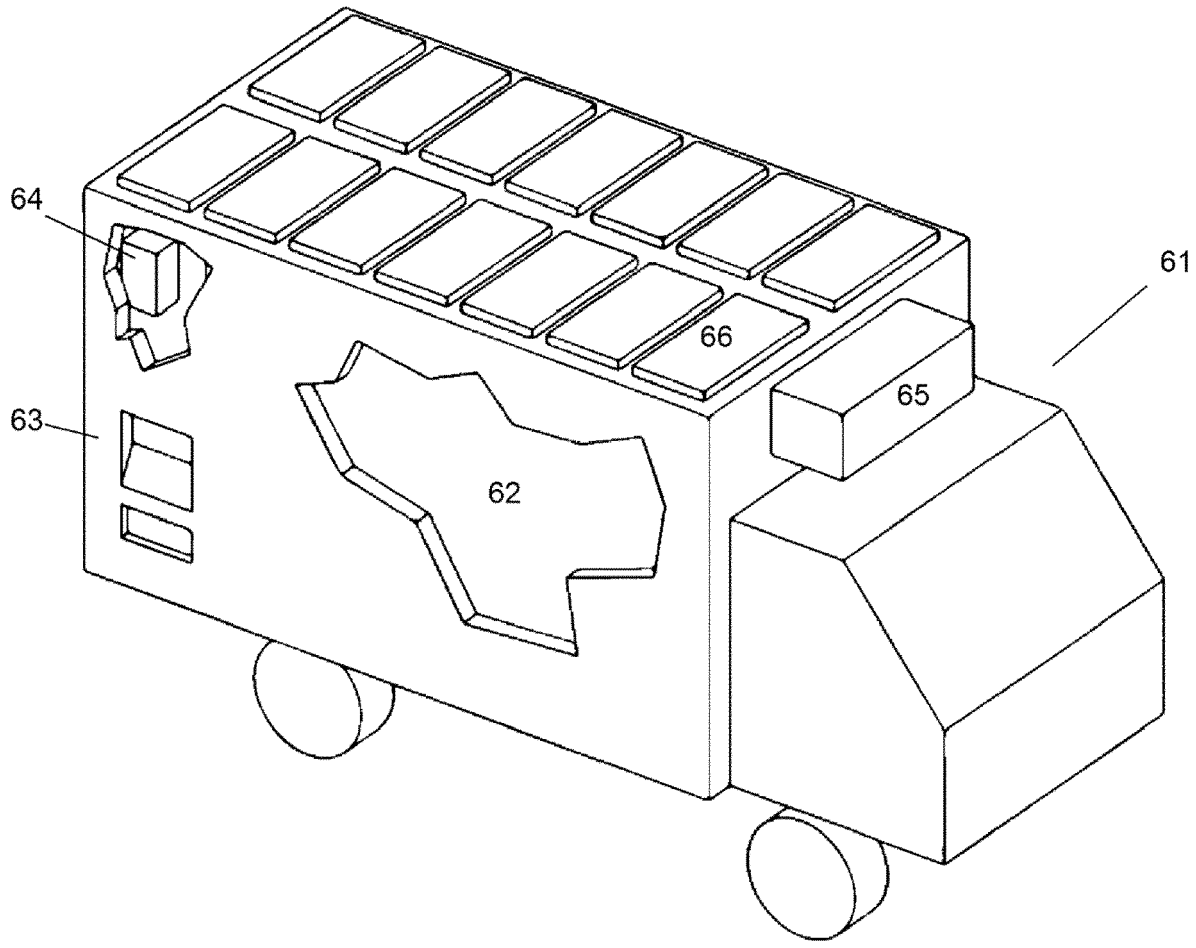

Fig. 6

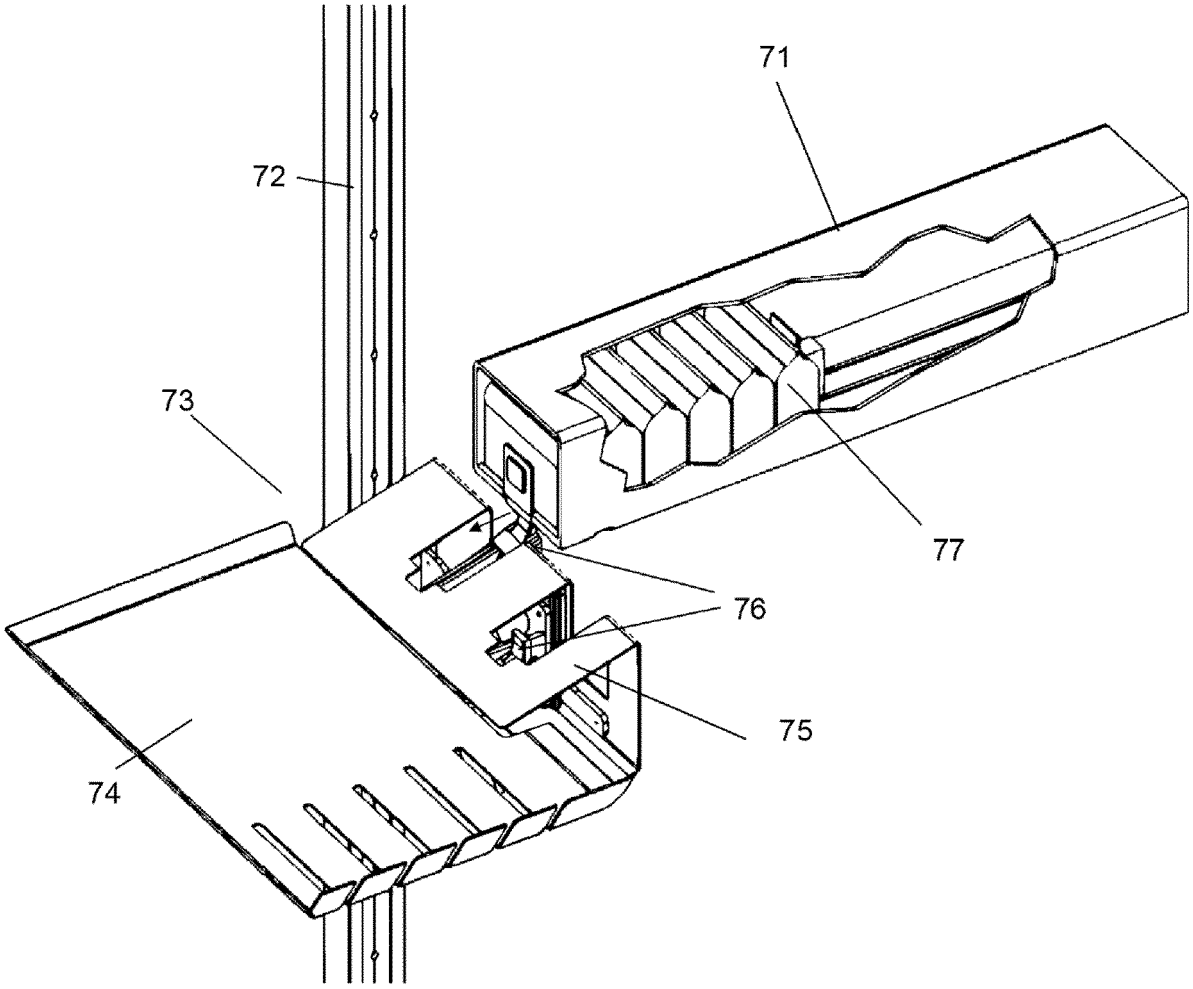

Fig. 7

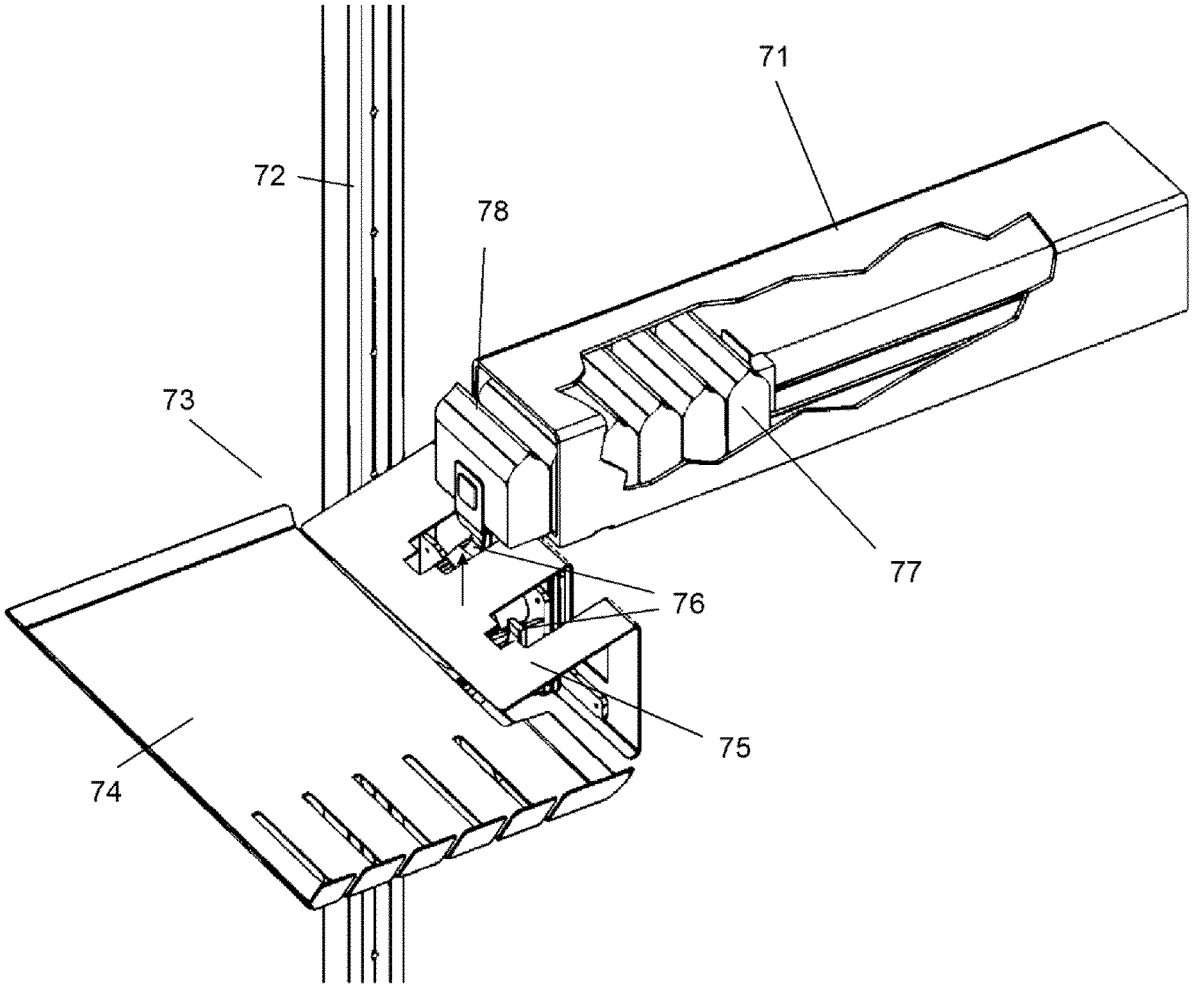

Fig. 8

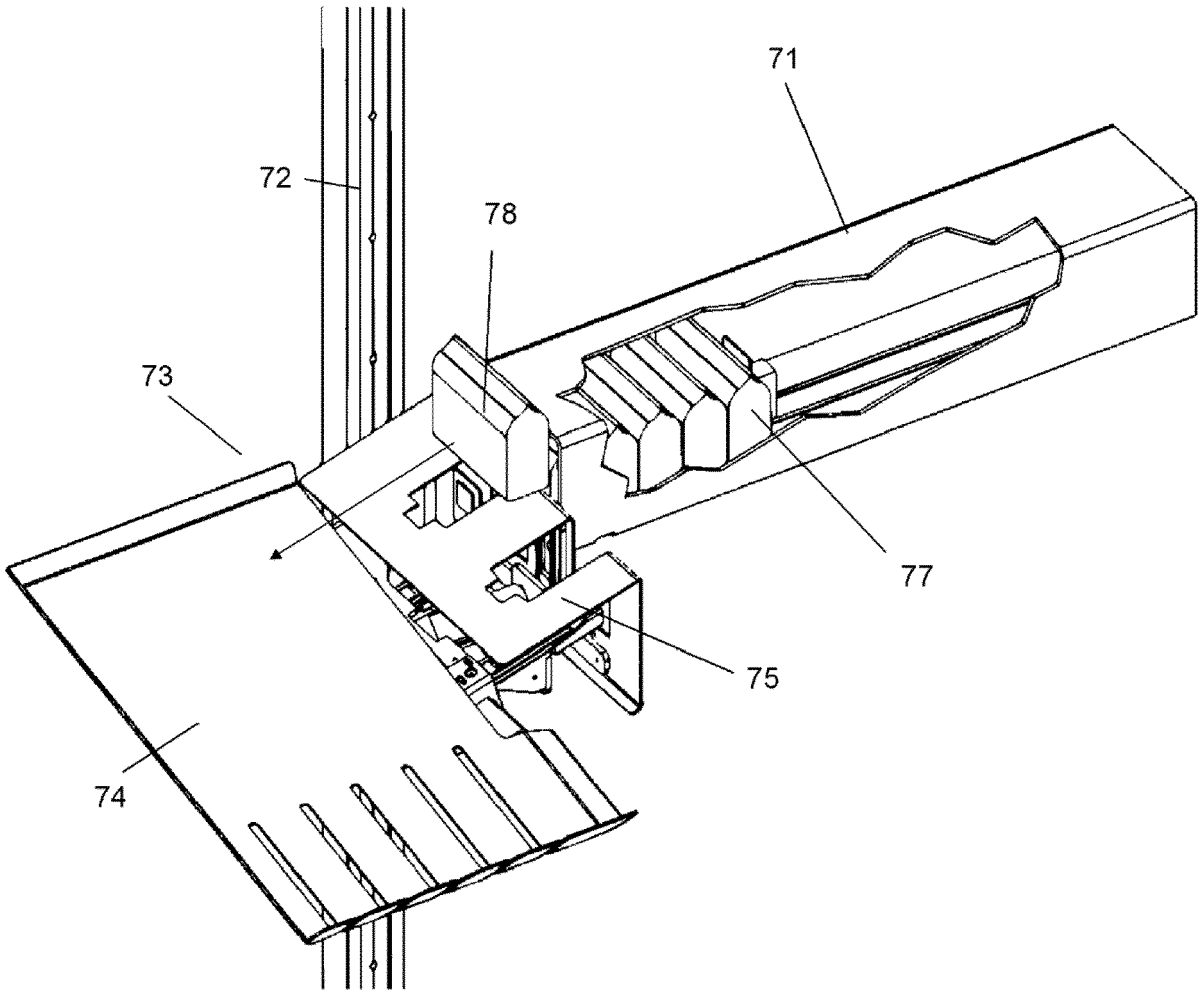

Fig. 9

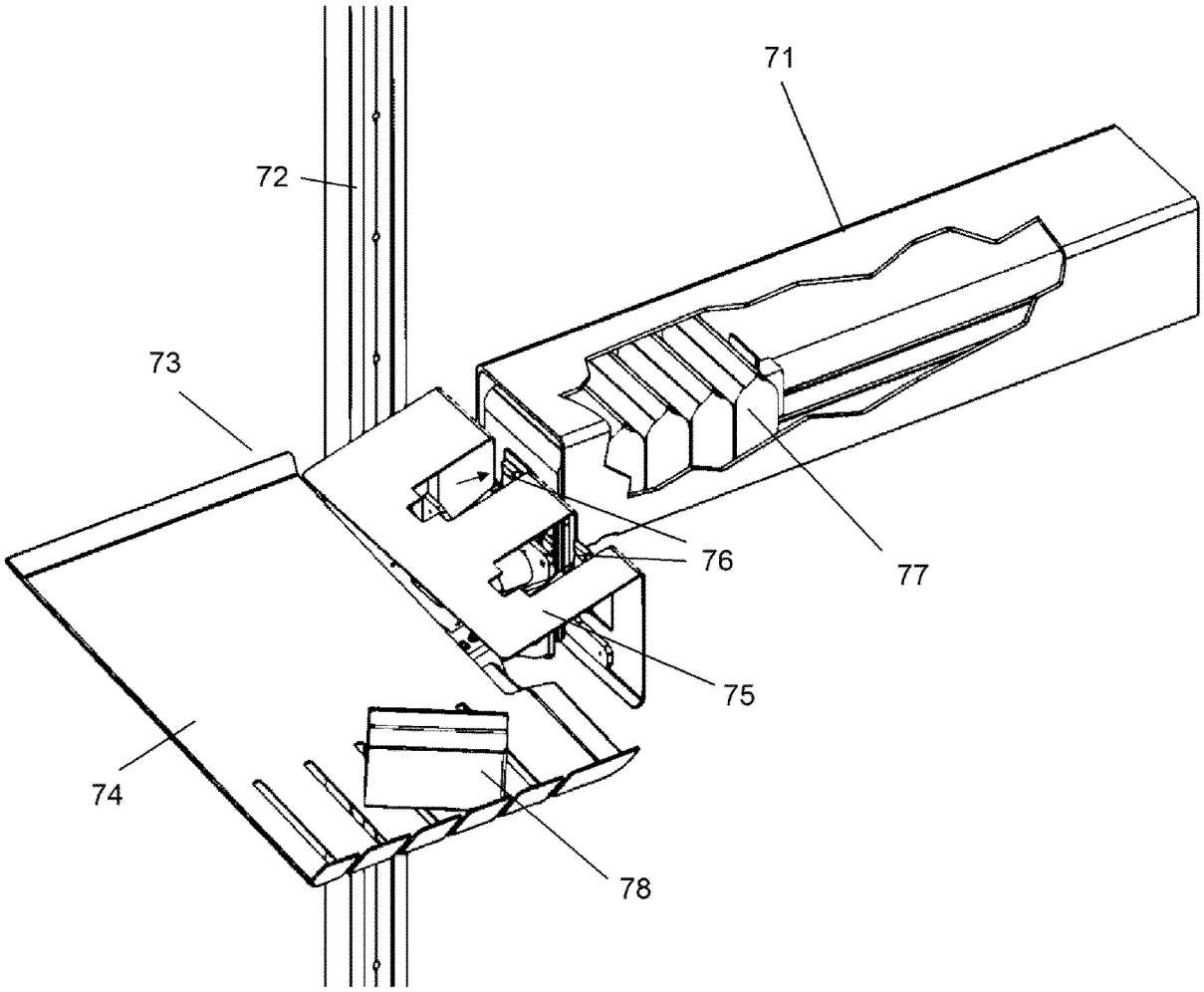

Fig. 10

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EUROPEAN SEARCH REPORT

Application Number
EP 21 15 8545

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	US 5 499 707 A (STEURY RUDY [US]) 19 March 1996 (1996-03-19) * abstract; figures * * column 3, line 26 - column 10, line 44 *	1-14	INV. A47F1/12 G07F9/10 G07F11/04 G07F11/16
A	US 2005/067426 A1 (HOLDWAY JOHN BARRETT [US] ET AL) 31 March 2005 (2005-03-31) * abstract; figures * * paragraphs [0060] - [0077] *	1-14	G07F11/22 G07F11/42
A	EP 2 363 841 A1 (AUTOMATED RETAIL CONCEPTS B V [NL]) 7 September 2011 (2011-09-07) * abstract; figures * * paragraphs [0019] - [031.] *	1-14	
A	WO 02/35484 A1 (JYPA AUTOMAATIO OY [FI]; SANTALA PAULI [FI]) 2 May 2002 (2002-05-02) * abstract; figures *	1-14	
A	US 6 755 322 B1 (HERZOG HETTIE J [US] ET AL) 29 June 2004 (2004-06-29) * abstract; figures *	1-14	TECHNICAL FIELDS SEARCHED (IPC) A47F G07F
A	EP 1 186 266 A1 (WARNER LAMBERT CO [US]) 13 March 2002 (2002-03-13) * abstract; figures *	1-14	
A	WO 2007/130528 A2 (CHIRNOMAS MUNROE [US]) 15 November 2007 (2007-11-15) * abstract; figures *	1-14	
A	US 7 316 328 B2 (YUYAMA SHOJI [JP] ET AL) 8 January 2008 (2008-01-08) * abstract; figures *	1-14	

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	29 April 2021	Breugelmans, Jan

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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