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(54) **VENDING MACHINE**

(57) A vending machine comprises a store space (1), a confectioning zone (2), a shopping basket (3), an issuing chamber (4), and a control unit (5). At least the store space (1) and the confectioning zone (2) are enclosed in a thermostatic housing (6). The store space (1) may consist of first store space (1A) and second store space (1B) located on opposite sides of the confectioning zone (2). The store space (1) is divided into compartments (10) each having essentially vertical side walls (11). At least one compartment (10) has an essentially horizontal belt conveyor (12) consisting of a driving roller (13) ended with a slave gear (14), an idle roller (15), an endless belt (16) and a belt tensioner (17). The confectioning zone (2) has a movable confectioning unit (20) comprising a frame (21) movable in horizontal direction X along the front side of the store space (1), and a platform (22) movable on the frame (21) in vertical direction Z in front of the store space (1). The platform (22) is equipped with at least one actuator (23) fitted with a master gear (24) capable of meshing with the slave gear (14). The actuator (23) is coupled with the master gear (24) through an endless toothed belt (29) and is controlled by the control unit (5). The platform (22) is movable in horizontal direction Y perpendicular to direction X towards the front side of the store space (1) to mesh the master gear (24) with the slave gear (14) and back to release the meshing. The basket (3) for collecting items supplied from the store space (1) is fixed on the platform (22). The movements of the frame (21) in horizontal direction X, and of the platform (22) in directions Y and Z are executed by the X-actuator (25), Y-actuator (26), and Z-actuator (27) respectively, controlled by the control unit (5). Servo motors may be used for the actuators (23, 25, 26, 27). The master gear (24) and the slave gear (14) may be double helical gears. At least one compartment (10) is equipped with an auger conveyor (18). The basket (3) has an openable bottom (31) to release the collected items into the issuing chamber (4). The issuing chamber (4) may have an openable bottom (41) to release the collected items into the repository in case of cancelled confectioning.

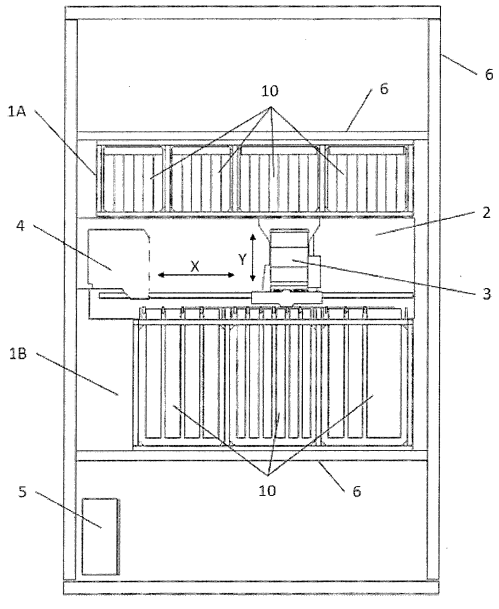

Fig.3

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Description

[0001] The present invention relates to a vending machine which can be used indoors and outdoors for self-service shopping of packaged commodities, in particular ready-made food products packaged in bags, boxes, cans, bottles, etc. Unpackaged items may also be sold as long as their shape or size does not block the device.

[0002] Most of commonly used vending machines are based on auger and/or belt conveyors operating in a step-wise manner where one step means delivery of a single item if the payment was internally confirmed in a checking module. In more sophisticated apparatuses a buyer can select several products from a menu displayed on a touch screen while paying once. When the list of selected items is ended and a transaction of payment completed, the products are delivered one by one to a dispensing compartment or a drawer which then may be opened only after completing the entire operation.

[0003] In the known vending appliances each auger or belt conveyor is set in motion by its own motor being a part of the conveyor. The conveyors are often tiled side by side, several in one cassette thus making the standardized modules easy to arrange in the vending device. The cassettes may be stacked in larger modules. Whether separate or arranged in the module every conveyor has its own motor. In consequence, each motor must be separately driven and controlled from the control unit. The proposed invention offers different approach to the paradigm of driving individual conveyors.

[0004] The technical problem of transporting the purchased commodity from the conveyor into a dispensing chamber is solved in various ways. In smaller machines the item is dropped and directed into the dispensing chamber or drawer by gravity, directly or on a chute. In bigger vending appliances this may require additional driving of the item by specialized units.

[0005] Chinese utility model application CN210377657 U (Henan Huiquhuina Intelligent Tech. Co. Ltd., CN; publ. 2020-04-21) discloses a cassette comprising a number of the belt conveyors to be applied in a vending machine. The cassette has a base body with sliding rails fixedly connected to its two sides, and is connected to first motor which is arranged on rear side of the base body. An output shaft of first motor is in transmission connection with a screw rod which penetrates through a fixed block mounted to the underside of the cassette, and is in threaded connection with the fixed block. Plurality of baffles are fixed to the base body at intervals which divide the interior of the base body into a plurality of material conveying units. In each unit a conveying frame is fixed to the base body, conveying belts are arranged on the conveying frames, and driving mechanisms comprising second motors are correspondingly driving the conveying belts. A push plate is mounted on each conveying belt.

[0006] According to another Chinese utility model application CN209842769 U (Ningbo Jiayin Intelligent Tech. Co. Ltd., CN; publ. 2019-12-24) numerous conveyors are arranged in rows, side by side, on a number of levels in a thermally insulated store space. The conveyors are fitted with plates pushing the selected item into a cargo basket which is movable in vertical direction along a vertical column. The latter is movable horizontally on rails and is arranged in front of the conveyors. The basket carries an item from the belt conveyor to the pick-up window where it can be taken out by the buyer. The store space is separated from the pick-up window by a thermo-insulating wall preventing leakage of chilled air.

[0007] A pre-orderable vending machine that includes main cabinet, storage compartment, a push frame, a lift push table, and a storage tray is proposed in Chinese utility model application CN206460556 U (Yan Fuying, CN; publ. 2017-09-01). The board of the machine is divided into upper and lower layers, each layer of the main cabinet is provided with brackets. The bracket is provided with a number of slide rails, a rotating shaft, a receiving plate, and a motor on one side of the bracket. The main cabinet is provided with a number of glass doors. Its right side is connected with the auxiliary cabinet which is provided with a number of speakers and a pick-up port, and is also provided with a number of lifting and pushing platforms.

[0008] Still another Chinese utility model application CN210466543 U (Yibao International Tech Beijing Co. Ltd., CN; publ. 2020-05-05) discloses a vending machine which comprises a main machine frame and a thermo-insulated goods storage cabinet. This cabinet comprises a plurality of goods channels extending from the rear to the front of the cabinet. Pushing devices are arranged in the goods channels. Each pushing device comprises a screw which is rotatably arranged on the partition plate along the channel, and a power device which drives the screw. A pushing element cooperating with the screw and slidably mounted on the partition plate is used for pushing the goods to the place of receipt of goods.

[0009] Japanese patent document JPH02163896 A (Fuji Elecric Co. Ltd., JP; publ. 1990-06-25) describes a vending appliance which is equipped with the endless belt conveyors. Tension is applied to the belt with horizontal rollers. A driving device is connected to at least one of the rollers. Plural locking parts are formed on the surface of the belt on which the commodities are to be placed. Alternatively, the auger conveyors are installed in the machine. The selected product is carried down from the conveyor to the pick-up place either on a chute or on a transporting basket.

[0010] If shopping procedure is realized according to a pre-set shopping list the selected items may be stacked one by one in the basked which is moved from one conveyor to another and finally delivered into the dispensing chamber or drawer. Such a solution has been adopted in the proposed invention but the basket has been modified to enable shopping of large quantities whose total volume may overpass that of the basket itself. The invented basket is suitable for both small requests of one

or a few items, and large shopping of dozens of commodities.

[0011] To the best knowledge of the inventors, to date there have not been proposed any solution where dispensing of requested items according to previously compiled shopping list could be invalidated by the buyer during delivering of subsequent products into the shopping basket if the payment was confirmed. The only reported solutions describe annulation of single-item purchases.

[0012] For example according to British patent GB695867 A (Communication Engineering PTY Ltd., AU; publ. 1953-08-19) a deposit must be inserted in a vending machine before articles for purchase may be selected. The selected articles are delivered only when further money is inserted to bring the total amount inserted up to the total price of the articles. An order is cancelled and the money inserted, less the deposit, returned when a refund button is pressed. The deposit is also returned if the total price of any articles selected does not exceed it, or if the means for collecting the deposit has been made ineffective by a control preset by the proprietor. Should the customer wish to cancel his order he presses a button connected mechanically to return the inserted coins less the deposit if it has already been discharged.

[0013] In a vending machine described in another British patent GB1086127 A (Omron Tateisi Electronics Co., JP; publ. 1967-10-04) pressing of a "cancel" push-button after insertion of money but before pressing any other button causes refund.

[0014] The proposed vending machine significantly changes this state of play through enabling the purchaser to cancel buying even if all selected items have been all delivered into the dispensing drawer but still not withdrawn from there. The proposed solution makes buying in the vending machine more alike making shopping in a regular store where the customer may change his decision before, during, and even after payment. Thus the proposed device is more customer-friendly.

[0015] A vending machine according to the invention comprises a store space, a confectioning zone, a shopping basket, an issuing chamber, and a control unit. At least the store space and the confectioning zone are situated in a housing which is preferably maid of thermoinsulating composite panels. Other components may be located outside the thermostatic housing.

[0016] The store space may be divided into two sectors: first store space and second store space located on opposite sides of the confectioning zone. In exemplary embodiment first store space is equipped with the belt conveyors while second store space is equipped with the auger conveyors. The term "auger" shall be understood here as a helix made of rigid metal or plastic. The helix pitch and diameter are adjusted to dimensions of the items to be conveyed.

[0017] The store space is divided into compartments each having essentially vertical side walls (baffles). At least one compartment has an essentially horizontal belt conveyor consisting of a driving roller ended on one side with a slave gear, an idle roller, an endless belt, and a belt tensioner. Several belt conveyors can be fixed side by side in a common standardized cassette.

[0018] According to the invention the belt conveyor is not fitted with its own motor but is set in motion with an external actuator which is mounted on the basket platform described below. This actuator is provided with a master gear meshing with the slave gear of the belt conveyor.

[0019] The idea of motorless belt conveyors leads to elimination of dozens or hundreds of motors and their wiring. As a result total cost of the conveyors is significantly reduced, as well as the maintenance costs. Also a risk of failure and total weight of the conveyors are decreased.

[0020] The confectioning zone has a movable confectioning unit comprising a frame movable in horizontal direction X along the front side of the store space, and a platform movable on the frame in vertical direction Z in front of the store space.

[0021] In a simplified version of the invented vending machine, applicable mainly for large items, the store space may consist of a vertical stack of individual conveyors, one for each level. In this case the frame of the confectioning unit does not move in horizontal direction X and is permanently attached to the machine housing. Only the platform is movable on the frame in vertical direction Z.

[0022] As was mentioned above, the platform is equipped with at least one actuator fitted with a master gear capable of meshing with the slave gear mounted on the driving roller of the belt conveyor. This actuator drives the conveyor and is controlled by the control unit. To avoid axial force exerted on the driving roller the double helical gears are recommended for the tandem of the master gear and the slave gear. However, regular toothing of both wheels may be applied too. It is recommended the gears are printed in a 3D printer by additive manufacturing.

[0023] The actuator mounted on the platform to drive the conveyor is coupled with the master gear through an endless toothed belt.

[0024] Apart from Z-movement, the platform is also movable in horizontal direction Y perpendicular to direction X. The Y-movement towards the front side of the store space enables meshing the master gear with the slave gear to make the belt moving. Reverse Y-movement of the platform releases the meshing which makes the belt still.

[0025] The basket for collecting items supplied from the store space is fixed to the platform. The basket may have an openable bottom to release the collected items into an issuing chamber or an issuing drawer.

[0026] Also the issuing chamber/drawer may have an openable bottom to release the collected items into the repository in case of cancelled confectioning. Cancellation of confectioning may be requested by the buyer who decided to give up shopping, or may result from unex-

pected system failure or blocking of goods in the machine.

[0027] The movements of the frame in horizontal direction X, and of the platform in directions Y and Z are executed by the X-actuator, Y-actuator, and Z-actuator respectively, which are controlled by the control unit.

[0028] In preferred embodiment all actuators are servo motors. Alternatively, the actuators are stepper motors. A combination of servo motors and stepper motors can be used taken specific design of particular components. The X-, Y- and Z-actuators may be fitted with pinions cooperating with racks.

[0029] In one variant of the vending machine at least one compartment of the store space is equipped with the auger conveyor. The augers can differ in pitch and diameter as the dimensions of transported items may differ considerably.

[0030] According to one embodiment, the auger conveyor is rotated by a built-in motor which is controlled by the control unit, and is wired directly to this unit.

[0031] In a recommended embodiment the built-in motor is controlled by the control unit through a connector mounted on the platform. In that case the motor is wired to the connector instead of being wired to the control unit. Only the connector is wired directly to the control unit. This reduces wiring of the machine and makes maintenance cheaper and easier.

[0032] The connector is activated when the basket platform gets close to the auger conveyor by its horizontal displacement in direction Y, the same as in the described above turning on/off of the belt conveyor. When the connector is activated the control unit turns on/off the motor of the auger conveyor.

[0033] In alternative solution the auger conveyor is motorless. Instead, it is fitted with the slave gear connected to a simple transmission mechanism transmitting torque to the auger. The transmission mechanism may have an endless toothed belt extending from the front to the rear of the auger conveyor. The slave gear is rotated by the actuator mounted on the platform through the master gear in the same manner as described above for the belt conveyor. This may be the same actuator to drive the belt conveyor or the auger conveyor, or the latter may be driven by second actuator mounted on the platform and fitted with its own master gear.

[0034] Alike in the case of the motorless belt conveyors, the total price and weight, maintenance time and risk of failure are reduced.

[0035] The recommended embodiments of the invention are illustrated on the drawings where:

Fig. 1 shows schematic top view of the vending machine having two separate store spaces;

Fig. 2 shows schematic top view of the machine having one combined store space;

Fig. 3 shows the embodiment from Fig. 1 in more detail;

Fig. 4 shows the confectioning unit comprising vertical frame movable horizontally along top and bottom rails fixed to the housing in the confectioning zone;

Fig. 5 shows a cassette comprising the belt conveyors;

Fig. 6 shows the basket having openable bottom and the mechanism driving the conveyor;

Fig. 7 shows the basket from Fig. 6 in another view;

Fig. 8 shows the issuing chamber with opened pick-up door;

Fig. 9 shows the side view of the issuing chamber fitted with openable bottom;

Fig. 10 shows the basket on the platform in front of the store space consisting of the auger conveyors and a row of the belt conveyors at the bottom;

Fig. 11 shows the platform with the basket and the connector pushed against the auger conveyor;

Fig. 12 shows the platform with the basket and the meshing mechanism pushed against the belt conveyor;

Fig. 13 shows details of the belt conveyor and its belt tensioner;

Fig. 14 shows details of the torque transmission mechanism from the actuator to the belt driving roller.; and

Fig. 15 shows details of the torque transmission mechanism from the actuator to the auger conveyor.

[0036] According to the preferred embodiment a vending machine comprises a store space (1), a confectioning zone (2), a shopping basket (3), an issuing chamber (4), and a control unit (5). The store space (1) is divided into compartments (10) each having essentially vertical side walls (11), wherein at least one compartment (10) has an essentially horizontal belt conveyor (12) consisting of a driving roller (13) ended with a slave gear (14), an idle roller (15), an endless belt (16) and a belt tensioner (17).

[0037] The store space (1) and the confectioning zone (2) are enclosed in a thermo-insulating and thermostatic housing (6). In one realization of the vending machine the store space (1) consists of first store space (1A) and second store space (1B) located on opposite sides of the confectioning zone (2). Fig. 3 illustrates the embodiment where both first and second store spaces have the belt

conveyors and the auger conveyors. However, first store space (1A) may be equipped with the belt conveyors (12) only while second store space (1B) may be equipped entirely with the auger conveyors (18).

[0038] The confectioning zone (2) has a movable confectioning unit (20) comprising a frame (21) movable in horizontal direction X along the front side of the store space (1), and a platform (22) movable on the frame (21) in vertical direction Z in front of the store space (1). The frame (21) may have two vertical rails as shown in Fig. 4. In case of bigger vending machines dedicated for selling large numbers of items, especially heavy commodities, the frame may have four or more pillars moving on two or more horizontal rails. Such a solution reduces the moment of power exerted by the basket platform upon vertical rails.

[0039] The platform (22) is equipped with at least one actuator (23) fitted with a master gear (24) capable of meshing with the slave gear (14). The actuator (23) is controlled by the control unit (5). The platform (22) is movable in horizontal direction Y perpendicular to direction X towards the front side of the store space (1) to mesh the master gear (24) with the slave gear (14) and back to release the meshing. The basket (3) for collecting items supplied from the store space (1) is fixed on the platform (22).

[0040] The movements of the frame (21) in horizontal direction X, and of the platform (22) in directions Y and Z are executed by the X-actuator (25), Y-actuator (26), and Z-actuator (27) respectively, controlled by the control unit (5).

[0041] The actuator (23) is coupled with the master gear (24) through an endless toothed belt (29). The master gear (24) and the slave gear (14) are double helical gears.

[0042] The actuators (23, 25, 26, 27) are servo motors. In alternative embodiment, the actuators (23, 25, 26, 27) are stepper motors. The actuators (25, 26, 27) may be fitted with pinions cooperating with racks.

[0043] At least one compartment (10) is equipped with an auger conveyor (18) which is rotated by a built-in motor (19) controlled by and wired directly to the control unit (5).

[0044] In the improved embodiment the auger conveyor (18) is rotated by the built-in motor (19) controlled by the control unit (5) through a connector (28) mounted on the platform (22). The motor (19) is wired directly to said connector (28).

[0045] In another embodiment the auger conveyor (18) is rotated by the actuator (23) mounted on the platform (22) through the master gear (24) and the slave gear (14) connected to a transmission mechanism of the auger conveyor (18). The transmission mechanism has an endless toothed belt (29) extending along the auger and driving its rear end through additional gears.

[0046] The basket (3) has an openable bottom (31) to release the collected items into the issuing chamber (4). The issuing chamber (4) may have an openable bottom (41) to release the collected items into the repository in case of cancelled confectioning.

List of references

[0047]

1	store space
1A	first store space
1B	second store space
10	compartment
11	side wall of the compartment / baffle between compartments
12	belt conveyor
13	driving roller
14	slave gear
15	idle roller
16	endless belt
17	belt tensioner
18	auger conveyor
19	motor of the auger conveyor
2	confectioning zone
20	confectioning unit
21	frame
22	platform
23	actuator for the belt/auger conveyor
24	master gear
25	X-actuator
26	Y-actuator
27	Z-actuator
28	connector
29	toothed belt
3	basket
31	openable bottom of the basket
4	issuing chamber
41	openable bottom of the issuing chamber
5	control unit
6	housing

Claims

1. A vending machine comprising a store space (1), a confectioning zone (2), a shopping basket (3), an issuing chamber (4), and a control unit (5), **characterized in that** the store space (1) is divided into compartments (10) each having essentially vertical side walls (11), wherein at least one compartment (10) has an essentially horizontal belt conveyor (12) consisting of a driving roller (13) ended with a slave gear (14), an idle roller (15), an endless belt (16) and a belt tensioner (17), **and in that** the confectioning zone (2) has a movable confectioning unit (20) comprising a frame (21) movable in horizontal direction X along the front side of the store space (1), and a platform (22) movable on the frame (21) in vertical direction Z in front of the store space (1), wherein the platform (22) is equipped with at least one actuator (23) fitted with a master gear (24) capable of

meshing with the slave gear (14), the actuator (23) being controlled by the control unit (5), **and in that** the platform (22) is movable in horizontal direction Y perpendicular to direction X towards the front side of the store space (1) to mesh the master gear (24) with the slave gear (14) and back to release the meshing, **and in that** the basket (3) for collecting items supplied from the store space (1) is fixed on the platform (22), **and in that** the movements of the frame (21) in horizontal direction X, and of the platform (22) in directions Y and Z are executed by the X-actuator (25), Y-actuator (26), and Z-actuator (27) respectively, controlled by the control unit (5).

2. The vending machine according to claim 1, **characterized in that** the master gear (24) and the slave gear (14) are double helical gears.

3. The vending machine according to claim 1 or 2, **characterized in that** the actuator (23) is coupled with the master gear (24) through an endless toothed belt (29).

4. The vending machine according to any of claims 1 to 3, **characterized in that** the actuators (23, 25, 26, 27) are servo motors.

5. The vending machine according to any of claims 1 to 3, **characterized in that** the actuators (23, 25, 26, 27) are stepper motors.

6. The vending machine according to any of preceding claims, **characterized in that** the actuators (25, 26, 27) are fitted with pinions cooperating with racks.

7. The vending machine according to any of preceding claims, **characterized in that** at least one compartment (10) is equipped with an auger conveyor (18).

8. The vending machine according to claim 7, **characterized in that** the auger conveyor (18) is rotated by a built-in motor (19) controlled by and wired directly to the control unit (5).

9. The vending machine according to claim 7, **characterized in that** the auger conveyor (18) is rotated by a built-in motor (19) controlled by the control unit (5) through a connector (28) mounted on the platform (22), and **in that** the motor (19) is wired to the connector (28).

10. The vending machine according to claim 7, **characterized in that** the auger conveyor (18) is rotated by the actuator (23) mounted on the platform (22) through the master gear (24) and the slave gear (14) connected to a transmission mechanism of the auger conveyor (18), preferably comprising an endless toothed belt (29).

11. The vending machine according to any of preceding claims, **characterized in that** the basket (3) has an openable bottom (31) to release the collected items into the issuing chamber (4).

12. The vending machine according to any of preceding claims, **characterized in that** the issuing chamber (4) has an openable bottom (41) to release the collected items into the repository in case of cancelled confectioning.

13. The vending machine according to any of preceding claims, **characterized in that** the store space (1) consists of first store space (1A) and second store space (1B) located on opposite sides of the confectioning zone (2).

14. The vending machine according to claim 13, **characterized in that** first store space (1A) is equipped with the belt conveyors (12) while second store space (1B) is equipped with the auger conveyors (18).

15. The vending machine according to any of preceding claims, **characterized in that** at least the store space (1) and the confectioning zone (2) are enclosed in a thermostatic housing (6).

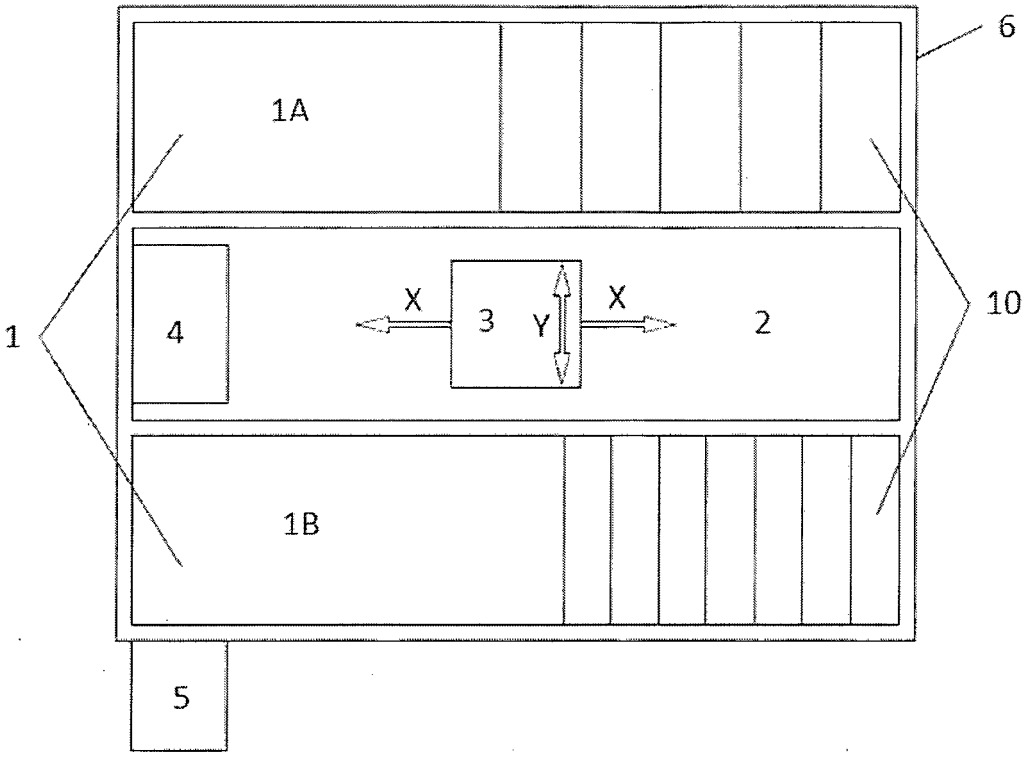

Fig.1

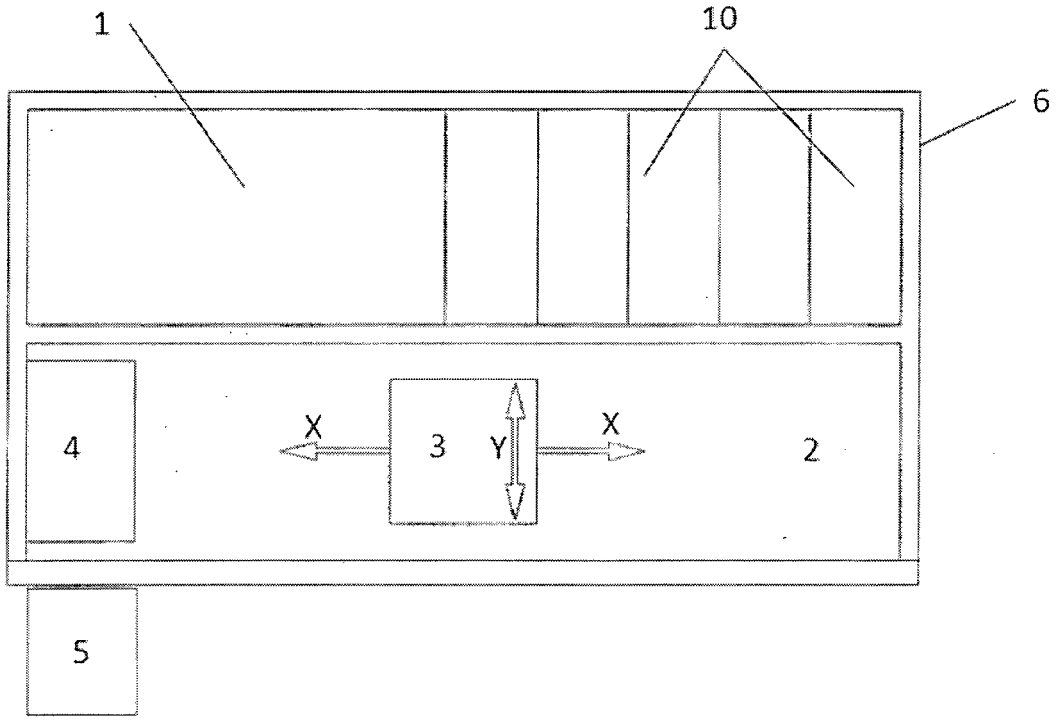

Fig.2

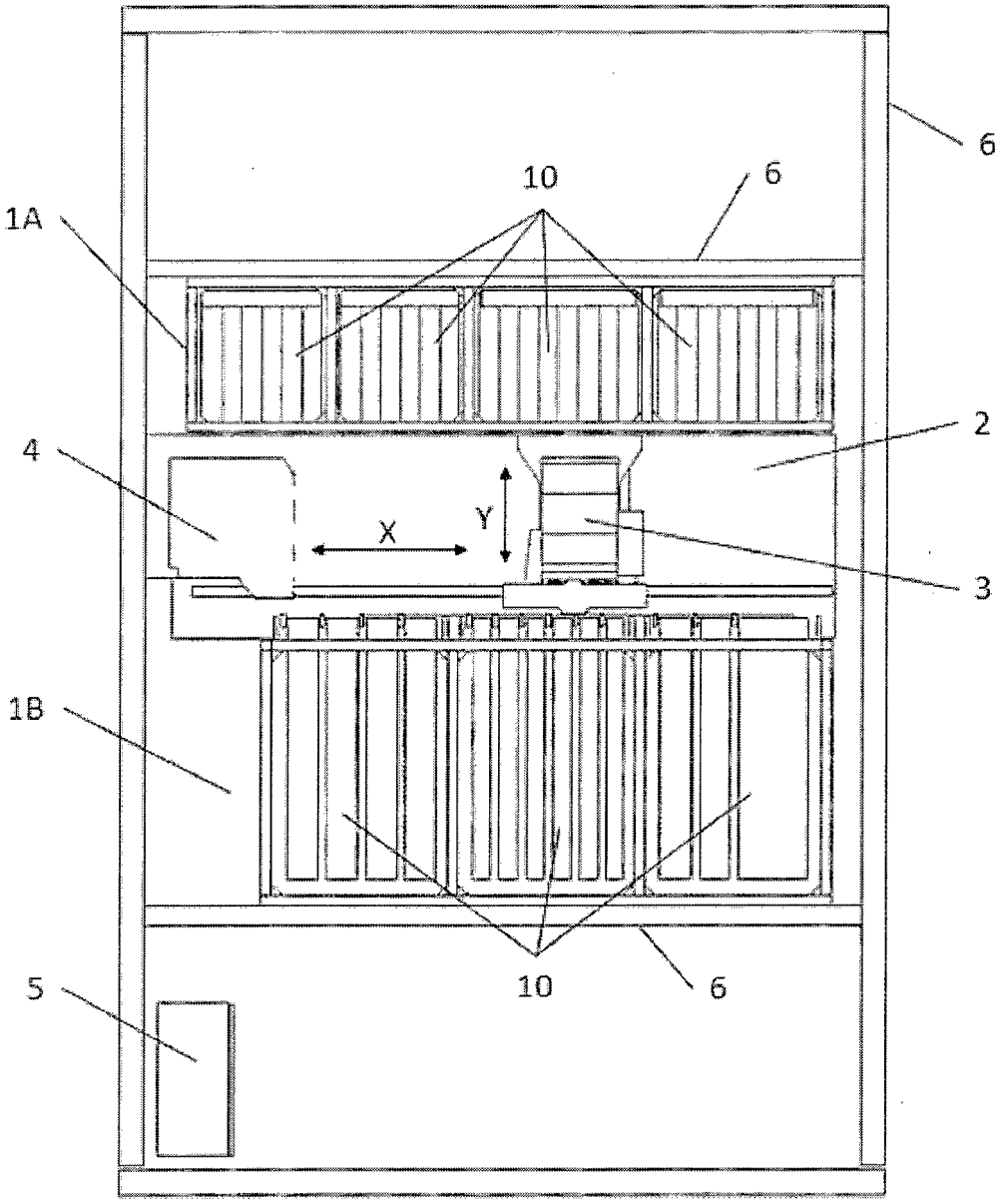

Fig.3

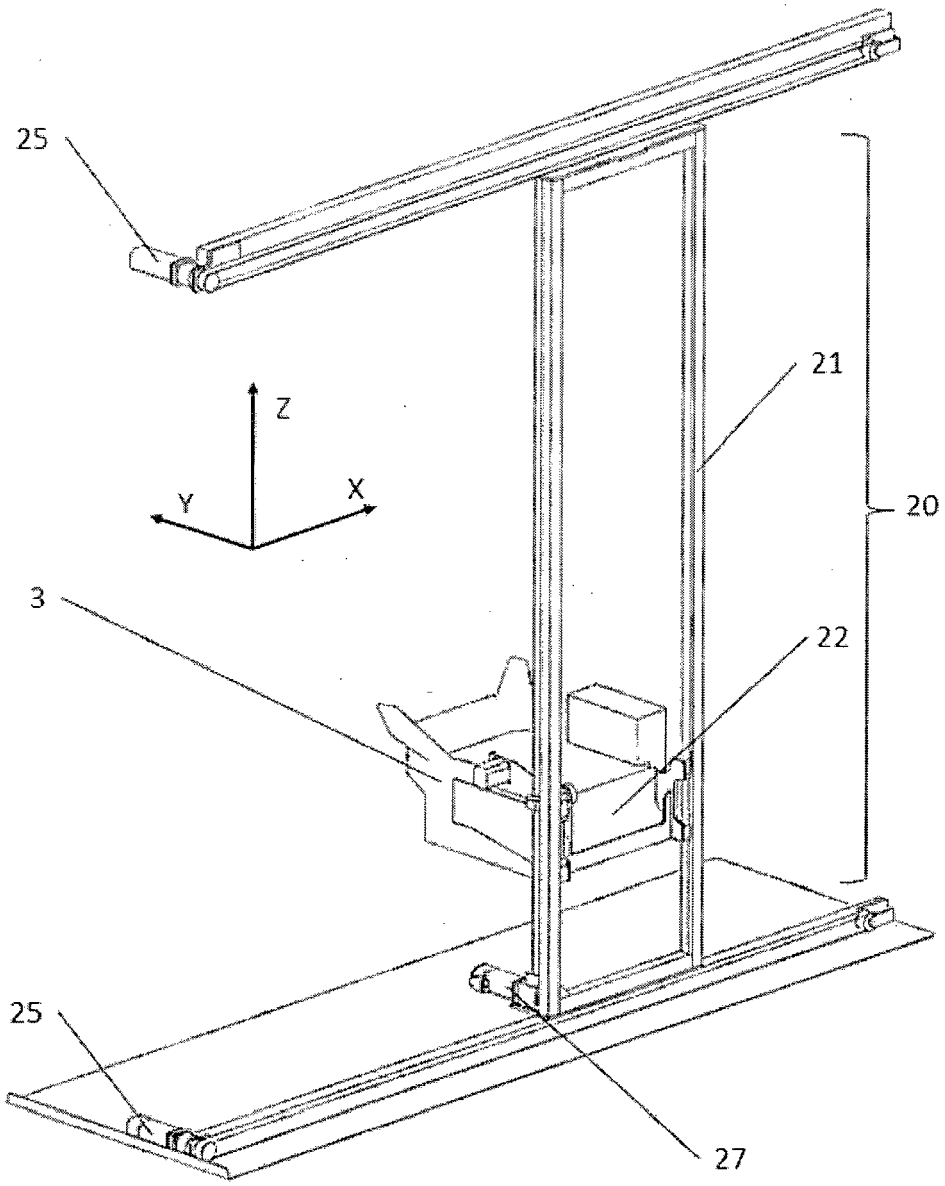

Fig.4

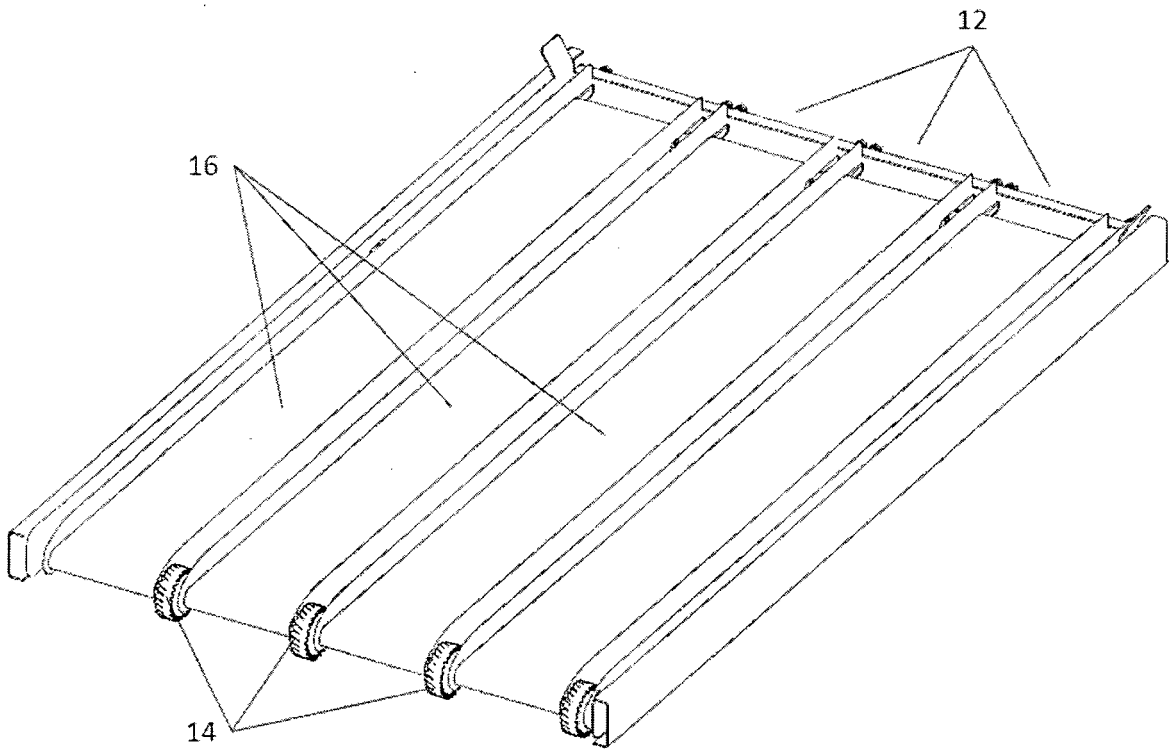

Fig.5

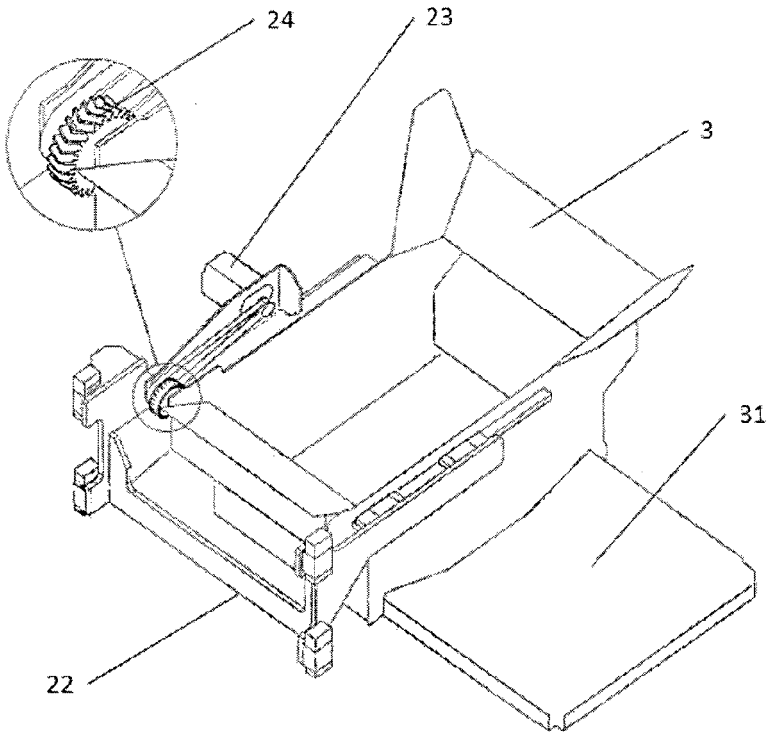

Fig.6

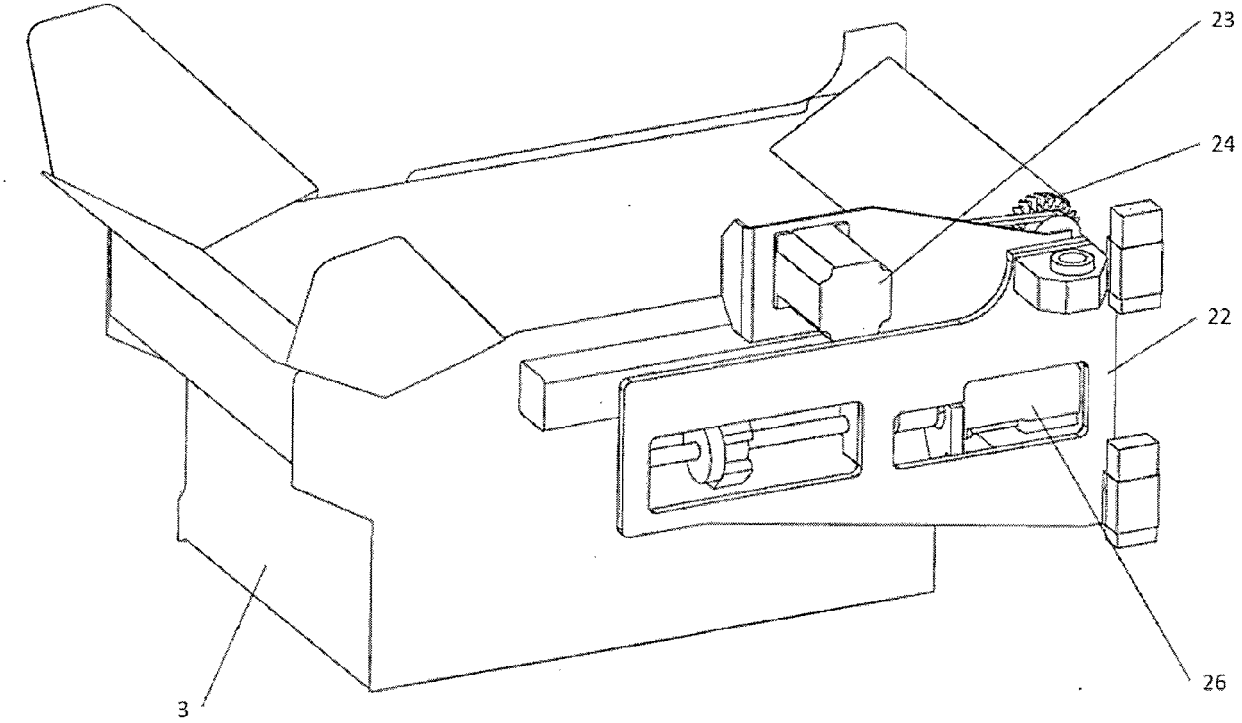

Fig.7

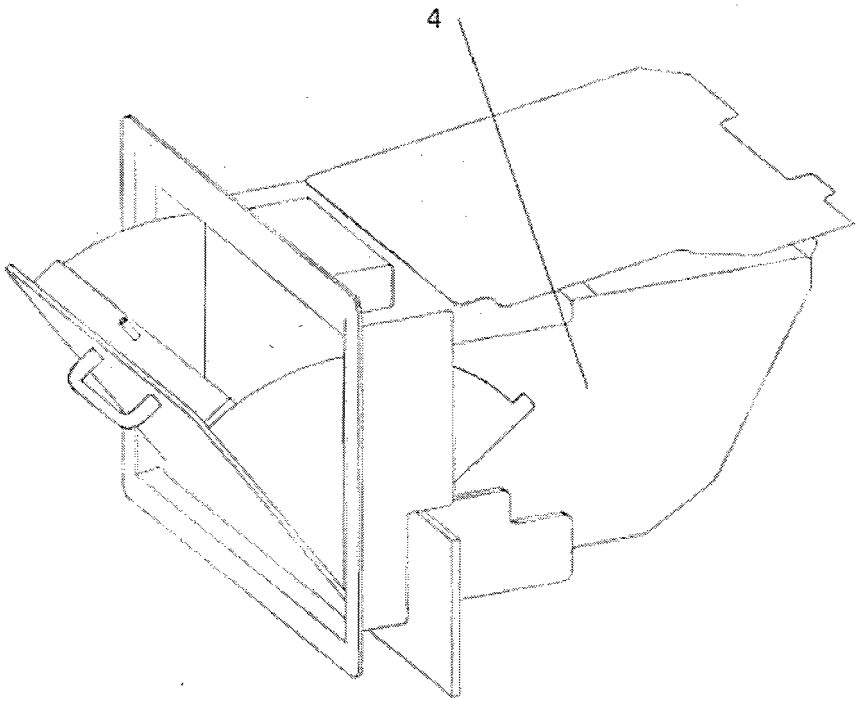

Fig.8

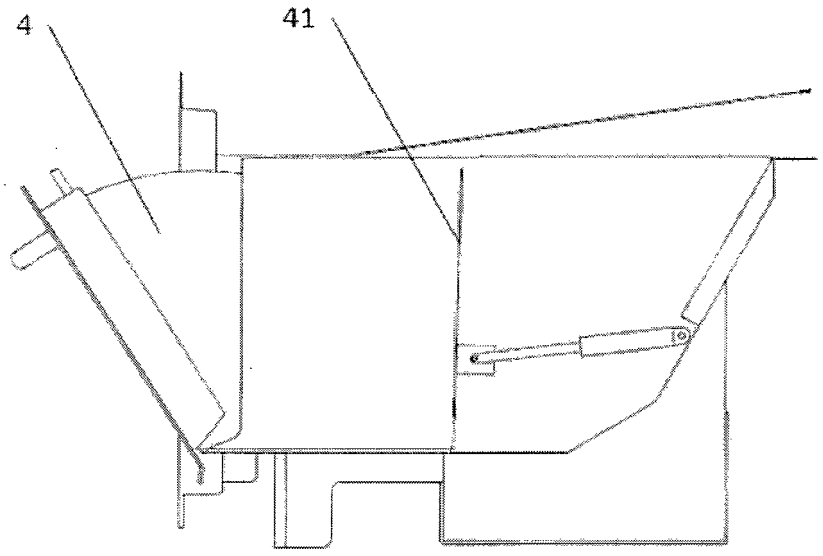

Fig.9

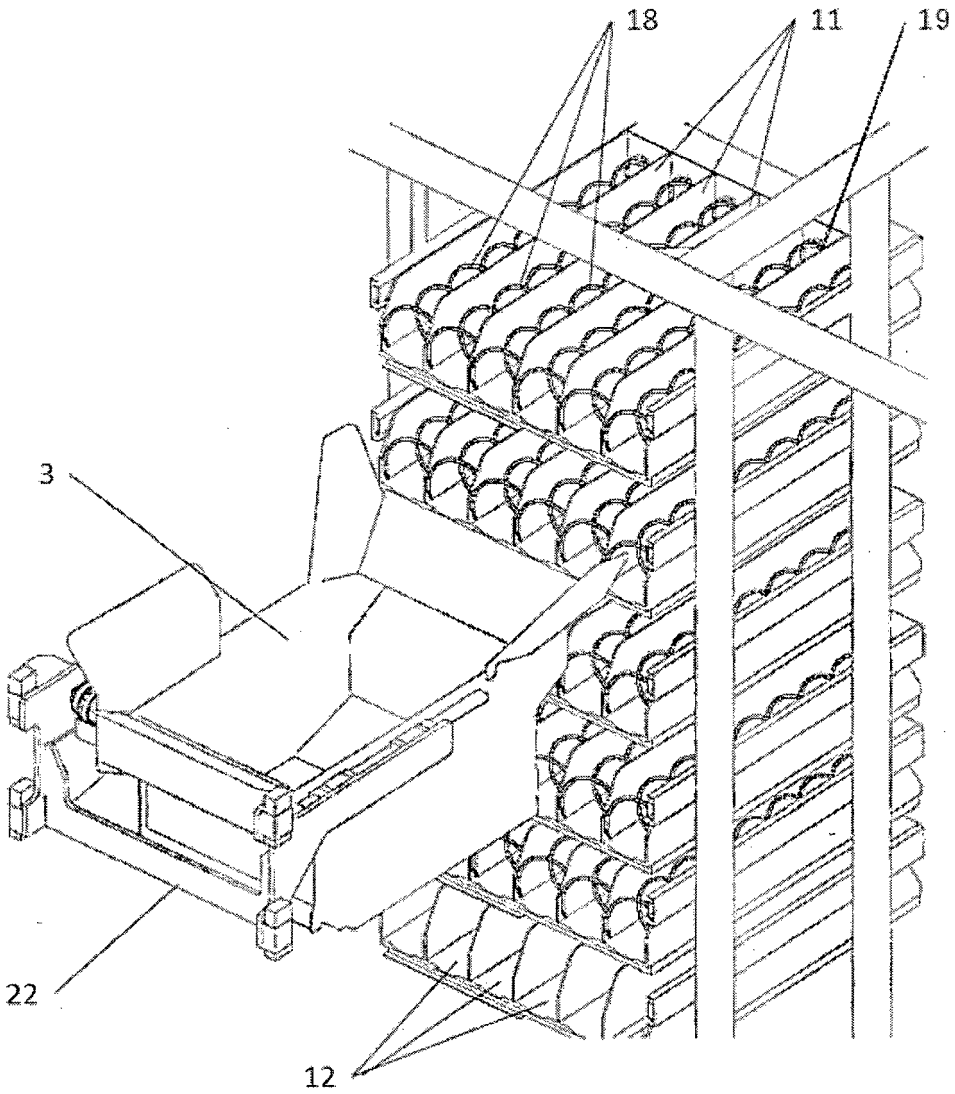

Fig.10

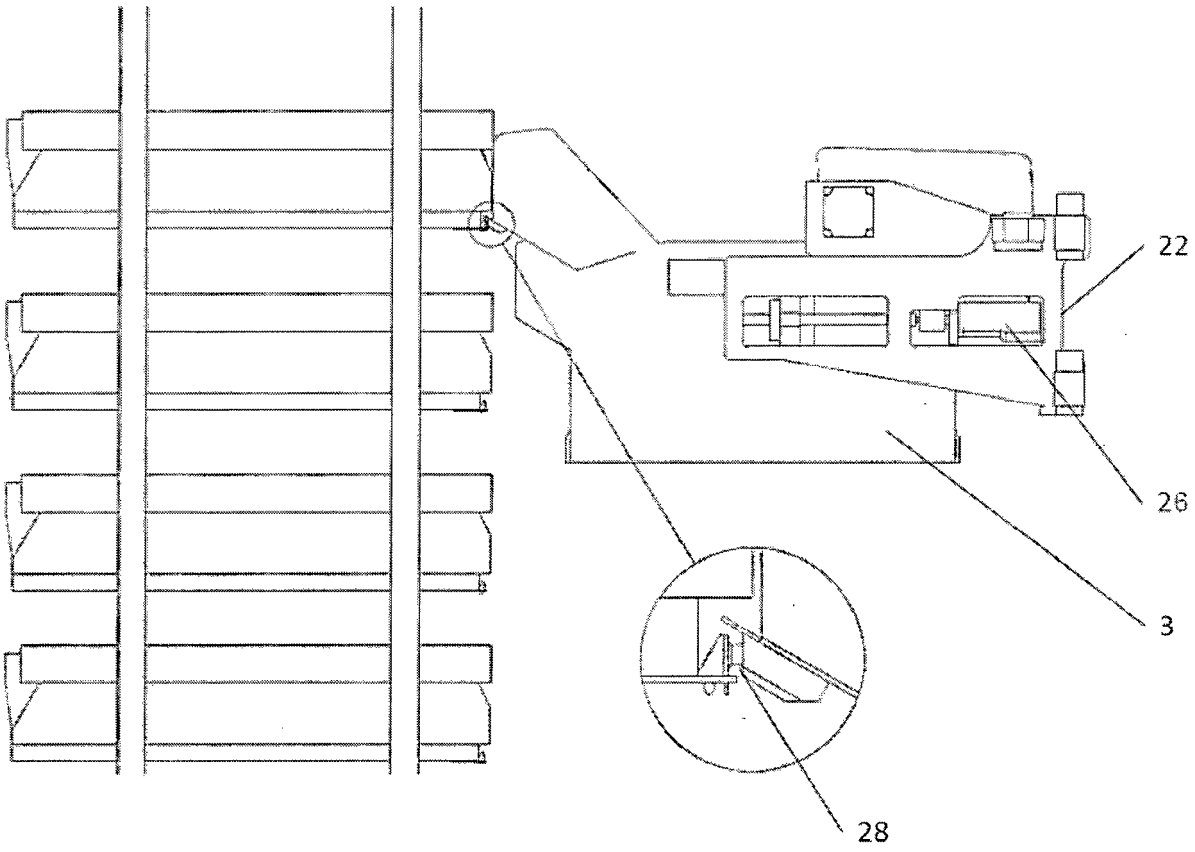

Fig.11

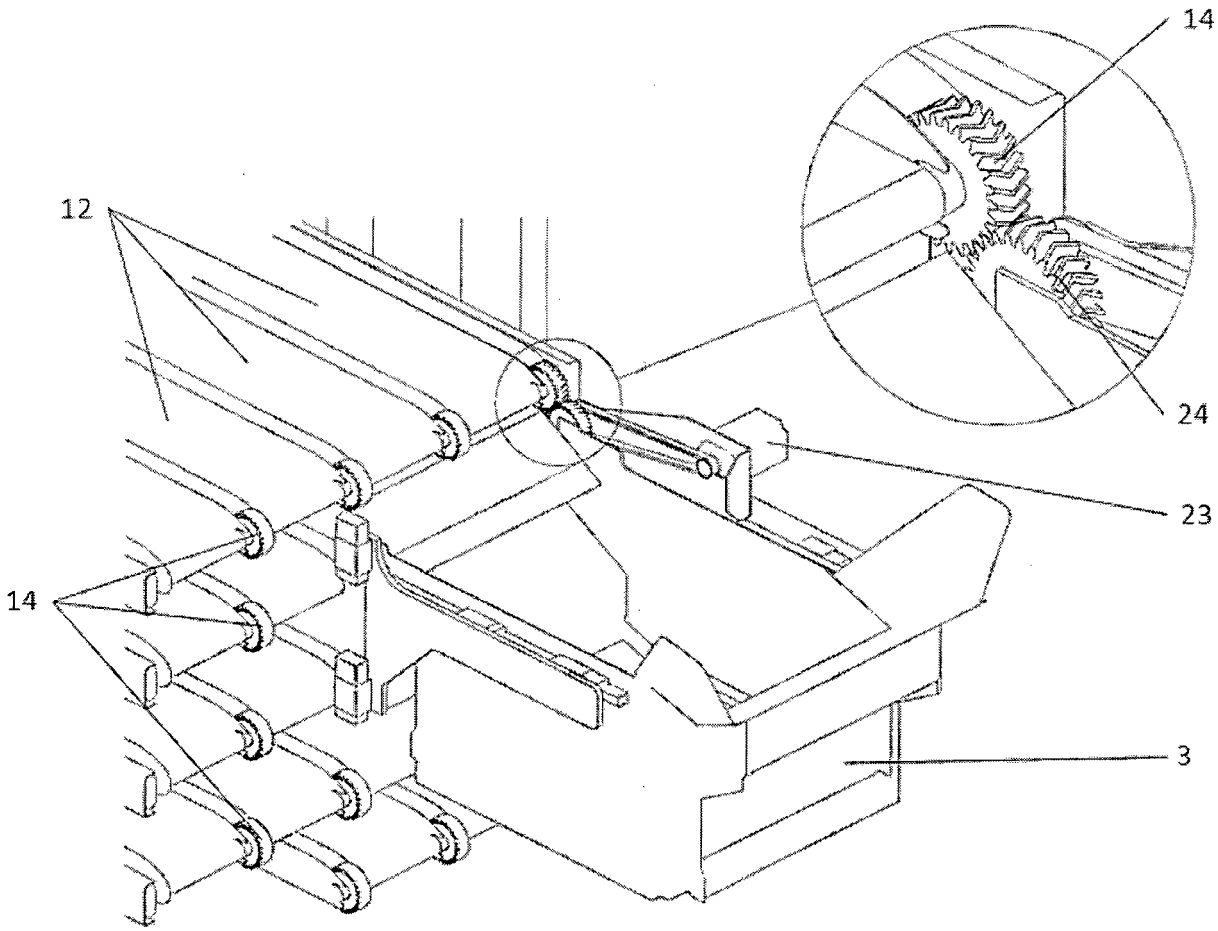

Fig.12

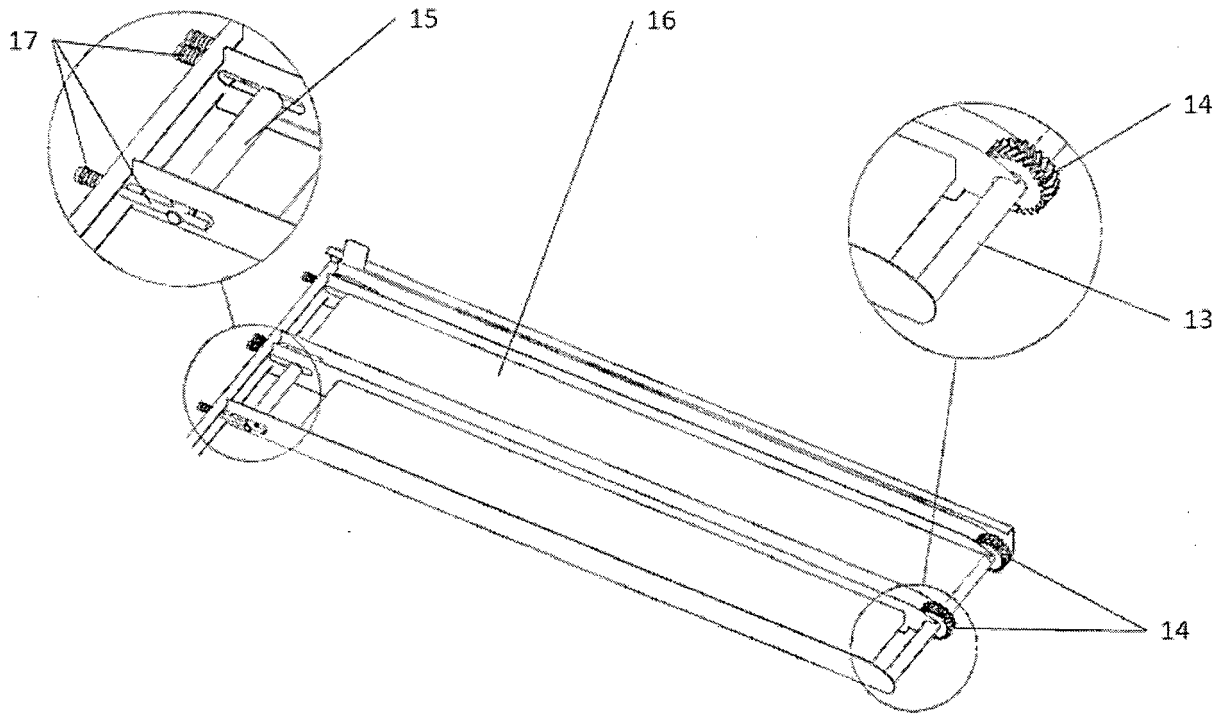

Fig.13

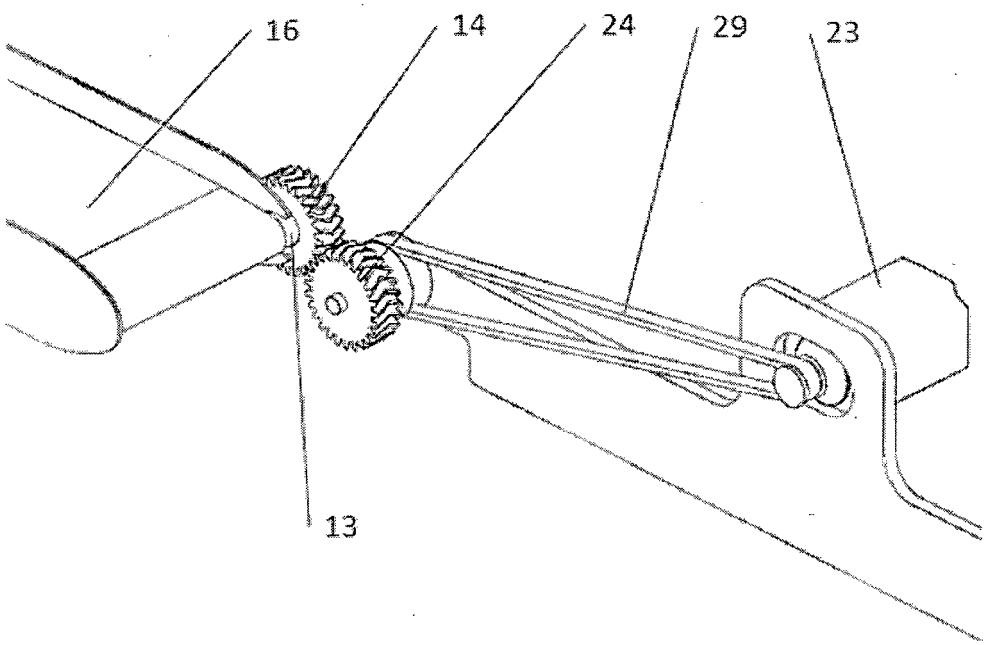

Fig.14

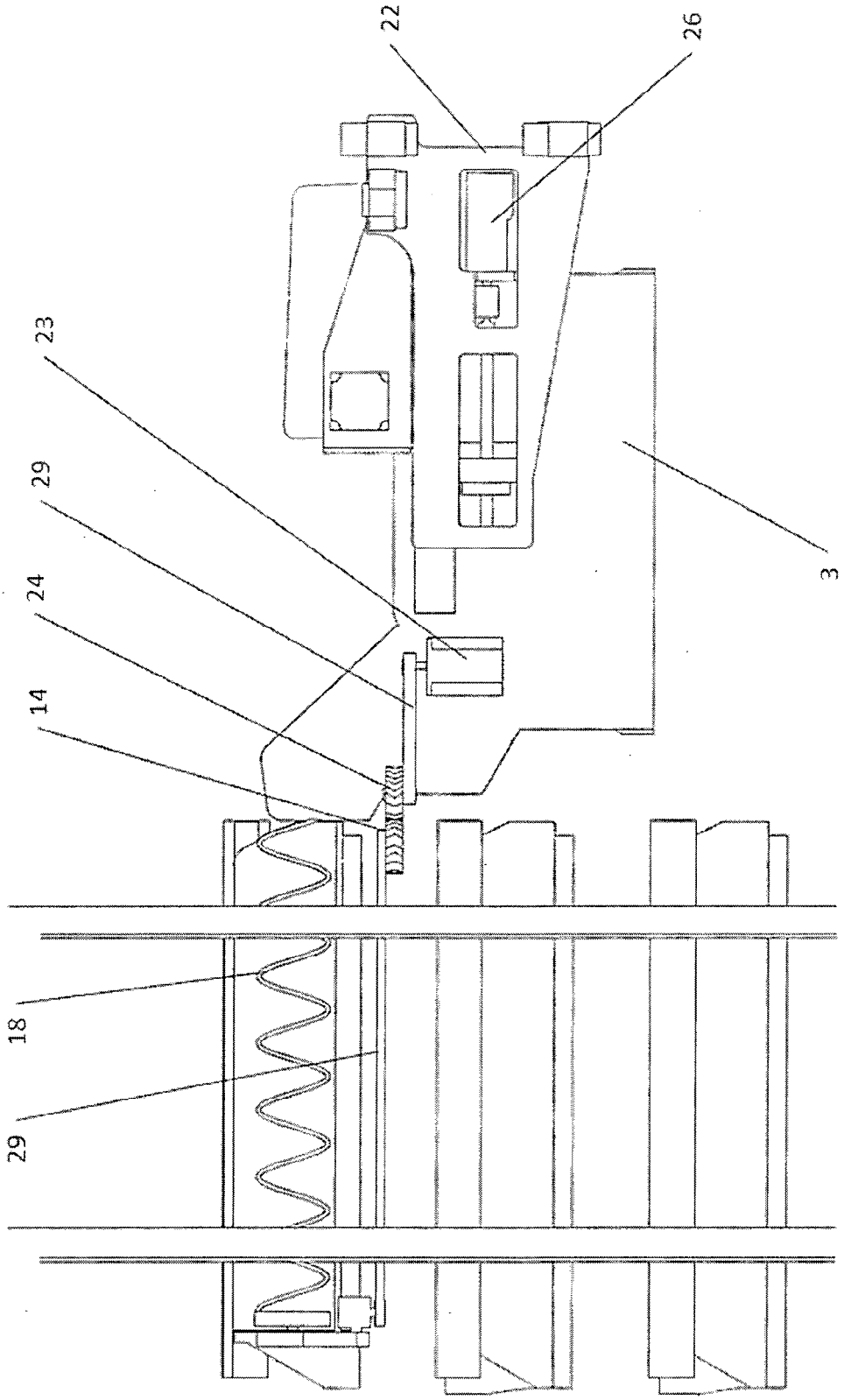

Fig.15

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EUROPEAN SEARCH REPORT

Application Number
EP 22 46 0019

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 2020/334940 A1 (LIU KAI [CN] ET AL) 22 October 2020 (2020-10-22) * the whole document *	1-15	INV. G07F11/10 G07F11/16 G07F11/32 G07F11/42 G07F11/58
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TECHNICAL FIELDS SEARCHED (IPC)

G07F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	1 September 2022	Verhoef, Peter

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