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(71) Applicant: **Sinteco S.p.A.**
32013 Longarone (BL) (IT)

(72) Inventor: **D'Inca', Marco**
32100 Castion (BL) (IT)

(74) Representative: **Gonella, Mario et al**
Propria S.r.l.
Via della Colonna, 35
33170 Pordenone (IT)

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(54) **Apparatus for storing and supplying drugs**

(57) The present invention refers to an apparatus for storing and supplying drugs comprising a bearing frame (1) having a vertical extension and a longitudinal extension with respect to a supporting floor. The bearing frame (1) comprises at least a rack (10) formed by a plurality of levels arranged along the vertical extension of the bearing frame (1). Each of the levels of the rack (10) may contain a plurality of drug storing and supplying means (8, 9, 14) packed in a tape (15). The apparatus also comprises at least one movable structure (4) for separating and collecting said drugs, said movable structure (4) comprising one or more cutting units (24), each arranged at a respective level of the rack (10) and communicating with a conveyor (5). The movable structure (4) is designed to slide longitudinally with respect to the bearing frame (1) to separate by means of the cutting units (24) one or more portions of the tape (15) from the respective drug storing and supplying means (8, 9, 14). The portions of tape (15) are collected by the conveyor (5) and conveyed toward a collecting container (26).

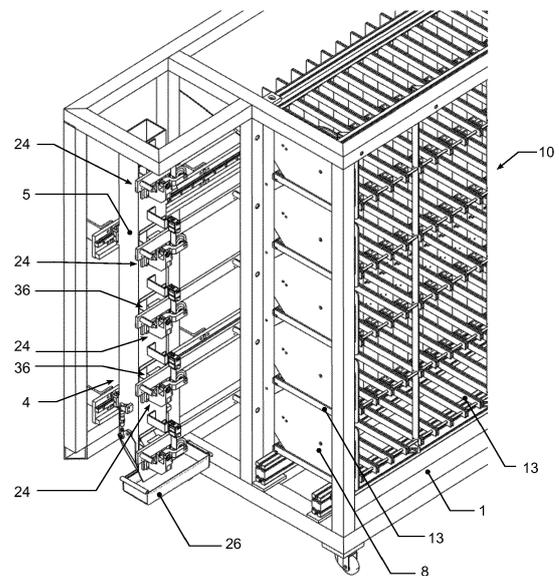


Fig. 7

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DescriptionTECHNICAL FIELD OF THE INVENTION

[0001] The present invention refers to an improvement in the devices for the conservation of medicines and the automatic composition of the prescriptions issued by medical personnel for each patient.

[0002] The invention makes it possible to carry out more effectively the daily operations and to simplify the mechanical devices that collect and supply the preparations.

BACKGROUND OF INVENTION

[0003] Health facilities, such as hospitals and homes for patients who are only partially self-sufficient or needing medical treatment, must constantly cope with the requirement of administering to the people in their care the drugs foreseen by their respective therapies.

[0004] In the state of the art are present some solutions that propose devices for obtaining the doses of drugs to assist the health-care personnel.

[0005] In particular, devices are available for the automatic distribution of units of product, such as drugs, food items, or more generally, objects of small size.

[0006] These systems include apparatuses capable of making available units of products individually stored and packed and other devices that can administer units that are packed individually but joined in continuous strips, or bands, and that must be separated when they are to be administered.

[0007] The apparatus described in US patent 3,131,830 is capable of distributing products of various nature; the mechanisms thereof collect a strip made up of individual portions from a container and feed it forward through the action of a driving roller. The dose to make available is made to protrude through a relative opening and separated from the continuous strip by a cutter.

[0008] The distributor described in US patent 3,131,830 is a first mechanism that distributes items, including drugs, packed in continuous strips but it does not have the capacity of managing and connecting with a centralized distribution control system.

[0009] US Patent 5,102,008 describes a device for administering medicines that have been packed individually in pockets created on a tape.

[0010] A first end of the tape is secured on a first power driven reel that feeds the tape initially wound on a second reel capable of rotating freely about a pin. The tape passes through an element capable of expelling the drug from the pocket so that it can be taken by the patient.

[0011] A preferred embodiment of the device consists of a medicine dispenser controlled by a microprocessor that, in a simple manner, assists the patient in following the therapy. This preferred embodiment is also provided with connections with the headquarters of the health unit for supervising the administration of the medication.

[0012] The device described above shares some purposes of the invention that will be presented later, although it does not achieve the operating capabilities, as it is designed essentially as a device for home use or for small health facilities.

[0013] US Patent 7,963,201 describes an apparatus and the methods for administering drugs designed to assist patients in following their therapies, with attention given to the quantities of drugs to take and to the times they should be taken. The apparatus described therein is provided with a plurality of cores to manage a plurality of drugs; each core is provided with an actuator connected to a feeding mechanism contained in the unit itself. The devices described can have an interface that allows the online connection with a computation unit for managing the supply on hand and supplying the drugs to the operators.

[0014] A problem with the apparatus described in US Patent 7,963,201 lies in the fact that it allows the management of only a limited number of products, exceeding which it is necessary to install more machines.

[0015] All the machines and devices described thus far do not achieve the optimal level of safety and of quality of the service required for the particularly delicate distribution of drugs in health units or hospitals, particularly in the case of large facilities.

SUMMARY OF THE INVENTION

[0016] The objective of the present invention is to overcome the limits and disadvantages of solutions currently available on the market, improving the speed with which the prescribed drugs are made available to the operators, eliminating the down times required for restocking the supplies and reducing the complexity of the mechanisms necessary for collecting the individual drug units.

[0017] The objective of the present invention is thus an apparatus for storing and dispensing drugs, hereafter referred to as "cabinet", provided with mechanisms that make it possible to implement the command signals received from a data processing unit, termed "server", on which is run a software capable of receiving the prescriptions of the drugs to administer and of programming the actions necessary for composing the contents required. The server, thanks to the information exchanged with the cabinets, can estimate the stock on hand and program the restocking from the suppliers.

[0018] The cabinet can hold within it packages from a plurality of drugs; said packages are made in accordance with the prior art, so as to be handled by mechanical devices installed in the cabinet. In response to the command signals sent by the server, the mechanical devices of the cabinet will dispense the units of each drug that make up a specific prescription so that a relative collecting device can pick them up and make them available to the operator who will then administer them.

[0019] The above-mentioned task and purposes, and others that will become more evident below, will be

achieved with an apparatus for storing and supplying drugs as defined in claim 1 and through a method for storing and supplying drugs as defined in claim 10.

BRIEF DESCRIPTION OF THE FIGURES

[0020] Further characteristics and advantages of the present invention will become more evident from the following description of a preferred embodiment, presented by way of non-limiting example, with reference to the accompanying figures, in which:

- figure 1 contains a perspective view of an apparatus for storing and supplying drugs according to the present invention, hereafter for conciseness also defined as "cabinet";
- figure 2 is a perspective view from above showing the directions of access to the cabinet depending on the operations to carry out;
- figure 3 illustrates the cabinet in a perspective view from a direction opposite the side of the previous figures;
- figure 3A is an enlarged detail of the cabinet of figure 3;
- figure 4 illustrates, in a perspective view from the same direction of figure 1, the cabinet of the previous figures provided with support racks for drug dispensing devices;
- figures 5A and 5B contain a perspective view, from above and from below respectively, of the drug dispensing devices of the previous figure;
- figure 6 illustrates a detail, in a perspective view, of a drug dispensing device;
- figure 7 is a perspective view of a detail of the cabinet in the idle position;
- figure 8 illustrates a detail, according to a side view with respect to the longitudinal extension of the cabinet, of the drug distribution, separation and collecting devices;
- figure 9 illustrates a detail of the lower part of the cabinet in a side view;
- figure 9A is a detail of figure 9.

DETAILED DESCRIPTION OF THE INVENTION

[0021] In the perspective view of figure 1 is shown a possible embodiment of a module of an apparatus for storing and supplying drugs of the present invention; in fact, the dimensions of the facility, or of the ward, could require particularly large dispensing cabinets, made up of a number of modules physically and logically connected to each other.

[0022] A module of an apparatus for storing and supplying drugs according to the present invention comprises a bearing frame 1 having a vertical extension and a longitudinal extension with respect to a supporting floor. The bearing frame 1 includes one or more storage compartments 2 suitable to hold at least one rack 10 formed

by a plurality of levels arranged along the vertical extension of the bearing frame 1. Each level is suitable to contain a plurality of drug storing and supplying means 8, 9, 14.

[0023] The bearing frame 1 of the cabinet also comprises at least one holding compartment 3, which, when at rest, houses a movable structure 4 for separating and collecting said drugs supplied by the storing and supplying means 8, 9, 14.

[0024] The bearing frame 1 is also associated with guiding and transport means that allow the movement of the movable structure 4 in the direction of the arrow "D", that include at least two guide profiles 7 fastened to the bearing frame 1 by relative brackets and containing the electrical wiring 31 to transmit the commands for sliding the movable structure 4, and a rack-and-pinion system 30 for transmitting the movement provided by a motor unit 6 fastened to the bearing frame 4, as is better exemplified in figure 3.

[0025] Advantageously, in the lower part of the bearing frame 1 are provided feet on which can be installed alternatively casters, wheels or other devices suitable to allow the cabinet to be easily moved in the various areas.

[0026] The operators can access the cabinet to collect the drugs, restock the unit or carry out maintenance work. The arrows in figure 2 show, respectively, the accessing areas to the cabinet for maintenance with "A", for collecting the drugs with "B", and for restocking the cabinet with "C". The accesses are suitably arranged on different sides of the cabinet so that operations of different nature do not interfere with each other and can also be carried out simultaneously.

[0027] In figure 4 can be seen the various racks 10 inserted in the storage bays 2 and essentially consisting of vertical uprights 11 and horizontal members 12 on which are mounted guide members 13. The racks 10 are suitable to contain the drug storage and supplying means, each of which includes a storage support 8 for the drugs, preferably packed on tape 15 wound on a coil 9, and a driving device 14 for supplying the drugs fastened to a respective vertical upright 11 facing the storage support 8 in the direction of unwinding the tape 15. The storage support 8 is associated with guide means, formed by an upper plate 16 and a lower plate 17, for threading the tape 15 therethrough.

[0028] The storage supports 8 supplying on a respective coil 9 are inserted in the rack 10 along the guide elements 13, with the free end of the tape 15 turned toward the driving device 14.

[0029] The details of a possible embodiment of the storage supports 8 and of the coils 9 are shown in Figures 5a, 5B and 6. The operator inserts the coil 9 on a pin 35 provided on the surface of the storage support 8; the operator then unwinds the tape in which are packed the drugs by an extent necessary to thread it through the plates 16 and 17 and will insert the storage support 8 in the rack 10 so that the upper edge and the lower edge of the storage support engage respectively the groove

of the guide element 13 of the upper level and of the guide element 13 of the lower level; each end of the plates 16 and 17 is suitably provided with a pair of side arms arranged "as a fork" so as to allow the passage of the drug unit encapsulated in the drug tape 15 through the gap formed in the central part of the plates 16, 17 and, at the same time, to guide its passage with the side arms.

[0030] Subsequently, the operator will engage the free end of the tape 15 in the driving device 14, which then will move it in the direction of the arrow E in response to a command signal from a prearranged control unit (not shown).

[0031] The driving devices 14 can if necessary be provided with presence detectors 34 (visible in fig. 8) in communication with the control unit to signal the end of the coil 9.

[0032] As exemplified in fig. 8, the driving device 14 comprises two or more rollers suitable to drive the drug tape 15 forward; advantageously, two pairs of rollers are provided: an upper pair indicated with numeral 18 and a lower pair indicated with 19; the latter is driven by an actuator 20, such as for example a step-by-step motor, controlled by the control unit in response to the signals transmitted by the server on the basis of the prescription of the drug to be dispensed. The two pairs of rollers 18 and 19 are opposed to each other so as to apply to the drug tape 15 a pinching pressure sufficient to drive it forward under the action of the pair of rollers 19. The arrangement in pairs of rollers makes it possible to guarantee the linear and symmetrical feeding movement of the tape 15 without the occurrence of asymmetrical forward movements of an edge of the tape 15 with respect to the opposite edge.

[0033] Advantageously, the driving device may also include a pivoting blade 33 hinged and pushed in position by suitable spring means so as to allow the passage of encapsulated drugs of different cross section by making the flat surface of the drug tape 15 adhere to the fixed blade 21.

[0034] The conveyor 5 is formed from a hollow body, preferably of rectangular cross section, on which, as can be seen in the perspective drawing of Fig. 7, an opening 36 is formed at each level of the racks 10.

[0035] The conveyor 5 is provided with means for separating a dose of drug from the drug tape 15, comprising a cutting unit 24, which includes a first cutting element 22 such as a preferably circular blade, and a connecting element 23, such as a chute, communicating with the conveyor 5 through the opening 36 to transfer the dose of drug separated from the drug tape 15 in the hollow body of the conveyor 5. The term dose defines, in the present description, one or more units of a specific drug.

[0036] Advantageously, the separating means may include a bar-code reader 29 to verify the effective correspondence of the drug required on the basis of the prescription data to the drug supplied by the driving device 14 and ready for collection.

[0037] In the lower part of the conveyor 5 are mounted

drug collecting means, shown in figure 9, comprising a drug discharge gate 25 movable between a closed position, in which the drugs carried in the hollow body of the conveyor 5 are collected on the bottom of the gate 25, and an open position, shown in figure 9a, in which the gate 25 discharges the collected drugs into a relative collecting container 26; the gate 25 is thus hinged to the conveyor 5 by means of pins 28 and moved by a piston 27 which, on a signal from the control unit, controls the opening and closing of said gate 25.

[0038] Advantageously, to make the separation of the portion of tape 15 more reliable and effective, one or more bars 32 arranged at different heights around the central area of the bearing frame 1, can be connected to the bearing frame 1, each bar supporting a second cutting member 21, such as a fixed linear blade protruding from the bar 32 and extending substantially along the entire length of the bar 32 itself. The second cutting members 21 are arranged so as to be facing the first cutting members 22 and cooperating with the same.

[0039] The innovative structure of the drug storing and supplying apparatus described above, in particular the movable structure 4 that slides parallel to the longitudinal extension of the bearing frame 1 along the guide profiles 7 and comprises the conveyor 5 and the cutting units 24, possibly cooperating with the second fixed cutting members 21, makes it possible to achieve the initially foreseen purposes and advantages, consisting principally in the speed of collecting the drugs and in the constructive simplification of the structure.

[0040] In fact, on the basis of the processed data contained in a specific prescription and entered by the operator through a terminal, the server communicates to the control unit which driving devices 14 to activate to dispense the doses of drugs indicated in the prescription; at the completion of this step, the control unit actuates the motor unit 6 which drives the sliding movement of the conveyor 5 from the holding compartment 3 along the storage bays 2 of the bearing frame 1. During this transfer, the circular blades 22 of the cutting units 24 installed on the conveyor 5 slide along the corresponding fixed blades 21, thus separating by cutting in a single operating stroke the portions of tape 15 protruding from the driving units 14 and containing the prescribed doses of drug; the doses separated from the drug tape 15 fall into the chutes 23 and are conveyed, through the hollow body of the conveyor 5, toward the bottom of the gate 25 where they are collected.

[0041] At the end of the operating cutting stroke, the conveyor 5 returns to the idle position in the holding compartment 3; the conveyor 5 can return to the initial position through a return run or position itself in a second holding compartment located, at the end of the operating run, from the opposite side the with respect to the initial position. In any case, the control unit actuates the piston 27 to control the opening of the gate 25 and discharge the doses of drugs collected in the collecting container 26. From this moment, the operator may collect the con-

tents of the container 26 and administer the medication to the patient needing it.

[0042] Advantageously, the portions of tape 15 protruding from the driving devices 14 are held in an optimal position for cutting the tape with the pivoting blade 33.

[0043] From the above, it is evident how in a single operating cutting stroke the conveyor 5 is capable of separating, conveying and collecting all the different selected drugs, both in terms of type and quantity, from the server on the basis of the specific prescription and supplied by the driving devices 14, reducing significantly the collecting times for the operator.

[0044] A further advantage lies in the simplified structure of the cabinet, and in particular of the conveyor 5 and the cutting units 24 mounted on it, which makes it possible to limit both the number of moving devices and the quantity and range of movements of the operating devices. The reduced complexity implies a smaller possibility of malfunctions and breakages, which translates into smaller operating costs and a greater reliability of the apparatus.

[0045] Naturally, the present invention is amenable to many applications, modifications or variants without thereby departing from the scope of patent protection, as defined by claims 1 and 10.

[0046] Moreover, the materials and equipment used to implement the present invention, as well as the shapes and dimensions of the individual components, may be the most suitable to meet the specific requirements.

Claims

1. Apparatus for storing and supplying drugs comprising a bearing frame (1) having a vertical extension and a longitudinal extension in respect to a supporting floor, said bearing frame (1) comprising at least a rack (10) formed by a plurality of levels arranged along the vertical extension of said bearing frame (1), each level of said rack (10) being adapted to house a plurality of drug storing and supplying means (8, 9, 14) packed in a tape (15), and at least a movable structure (4) for separating and collecting said drugs, **characterized in that** said movable structure (4) comprises one or more cutting units (24) each arranged at a respective level of said rack (10) and communicating with a conveyor (5), said movable structure (4) being adapted to longitudinally slide in respect to said bearing frame (1) to separate one or more portions of said tape (15) from the respective drug storing and supplying means (8, 9, 14) by means of said cutting units (24), said one or more portions of tape (15) being collected from said conveyor (5) to be conveyed toward a collecting container (26).
2. Apparatus for storing and supplying drugs as in claim 1, wherein each said cutting units (24) comprises a first cutting member (22) adapted to separate one or more portions of tape (15) from said storing and supplying means (8, 9, 14) and a transfer member (23) communicating with said conveyor (5) to transfer said one or more portions of tape (15) towards said conveyor (5).
3. Apparatus for storing and supplying drugs as in claim 2, wherein at least a second cutting member (21) is associable to said bearing frame (1), said second cutting member (21) being adapted to cooperate with a respective first cutting member (22) to cut a corresponding portion of tape (15) when said movable structure (4) slides in respect to said bearing frame (1).
4. Apparatus for storing and supplying drugs as in claim 2, wherein said first cutting member (22) is a circular blade driven in rotation by the sliding motion of said movable structure (4).
5. Apparatus for storing and supplying drugs as in claim 1, wherein collecting means (25) of said drugs are mounted at the lower end of said conveyor (5), said collecting means (25) being movable between a closed position, for collecting said portions of tape (15) each containing a dose of drug, and an open position to delivery said portions of tape (15) into said collecting container (26).
6. Apparatus for storing and supplying drugs as in claim 1, wherein each said drug storing and supplying means (8, 9, 14) comprises a storage support (8) adapted to receive a coil (9) of said tape (15) and a driving device (14) adapted to supply a portion of said tape (15).
7. Apparatus for storing and supplying drugs as in claim 6, wherein each said storage supports (8) provided with a respective coil (9) are adapted to be removably housed into said rack (10) at suitable guide members (13).
8. Apparatus for storing and supplying drugs as in claim 6, wherein each said driving devices (14) are fastened to said rack (10) so as to face a respective storage support (8) along the unwinding direction of said coil (9).
9. Apparatus for storing and supplying drugs as in claim 1, wherein said movable structure (4) is slidable along suitable guide profiles (7) arranged on said bearing frame (1) to perform, starting from a rest position, an operative run for separating and collecting said one or more portions of said tape (15) along the longitudinal extension of said bearing frame (1).
10. Method for storing and supplying drugs **character-**

ized in that it comprises the steps of:

- housing one or more storage supports (8) of drugs packed in a tape (15) into suitable guide members (13) of a rack (10) formed by one or more levels and engaging the free end of each said tapes (15) with a respective driving device (14); 5
- supplying a portion of said tape (15) containing one or more drug units from said one or more driving devices (14) selected on the basis of an appropriate prescription; 10
- actuating a sliding motion of a movable structure (4) along a longitudinal direction in respect to said rack (10), said movable structure (4) comprising one or more cutting units (24) each arranged at a respective level of said rack (10) and a conveyor (5) communicating with said one or more cutting units (24); 15
- separating one or more respective portions of said tape (15) from said driving devices (14) by means of said one or more cutting units (24); 20
- conveying through said conveyor (5) said one or more portion of said tape (15) towards a collecting container (26). 25

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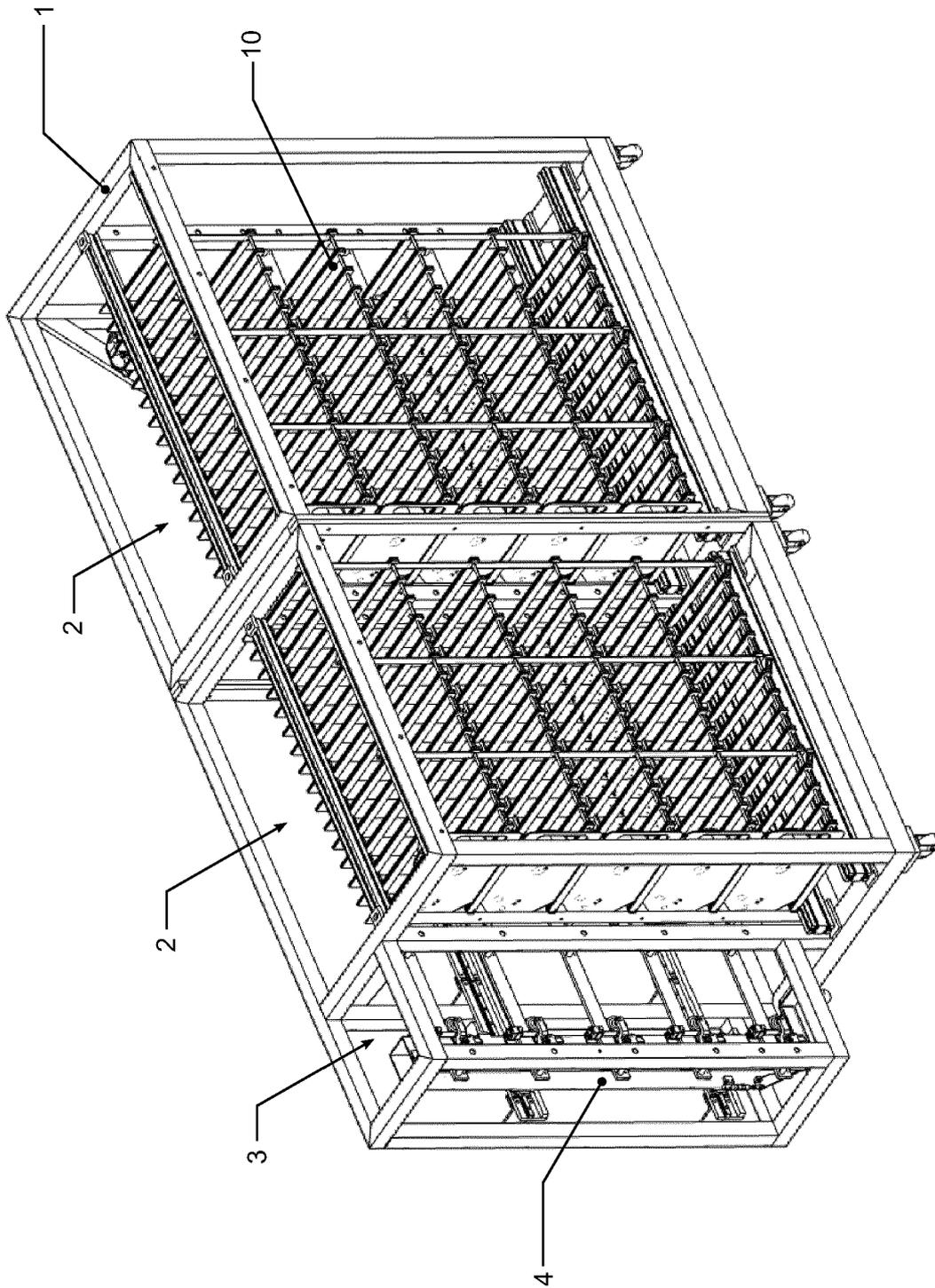


Fig. 1

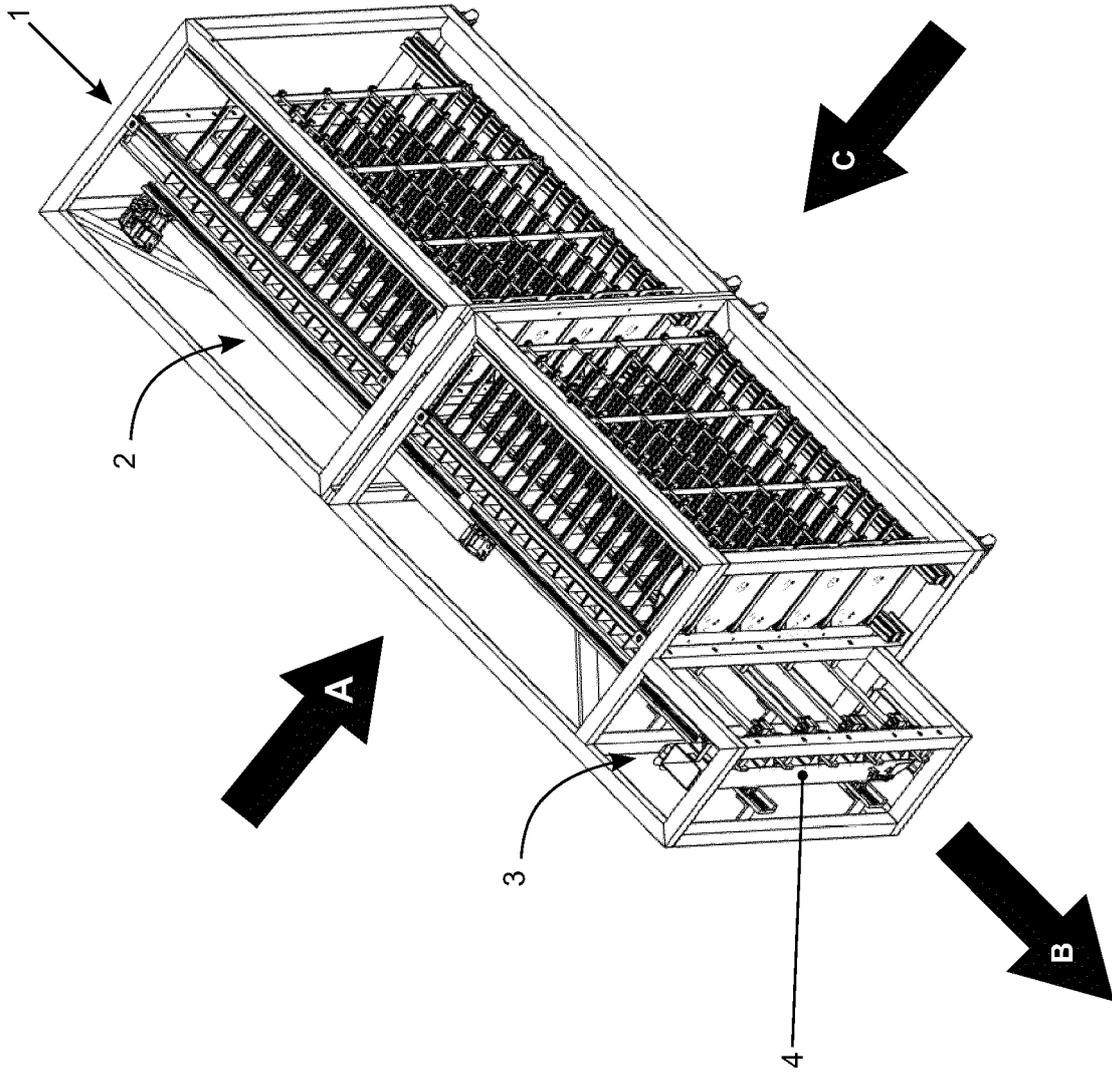


Fig. 2

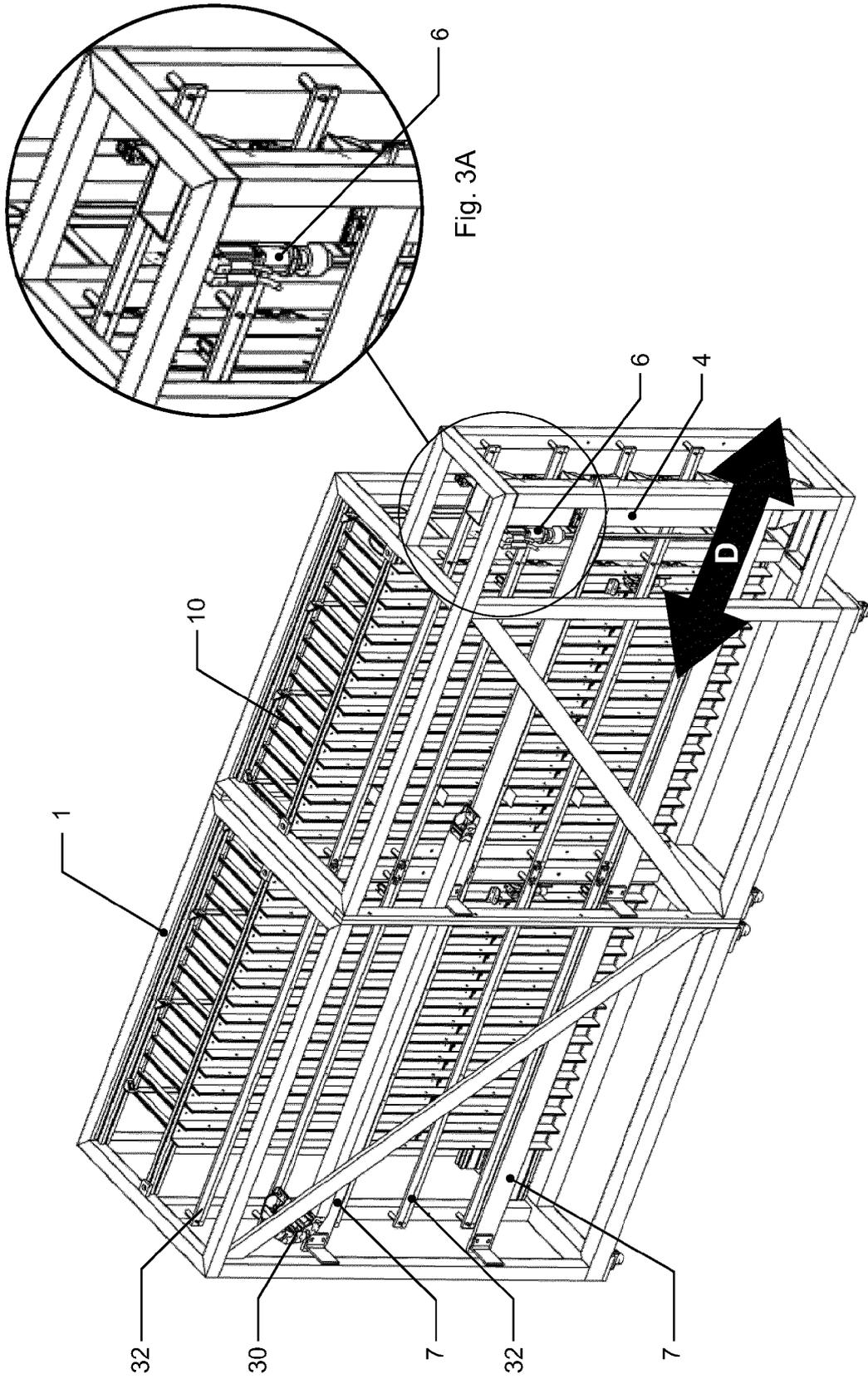


Fig. 3A

Fig. 3

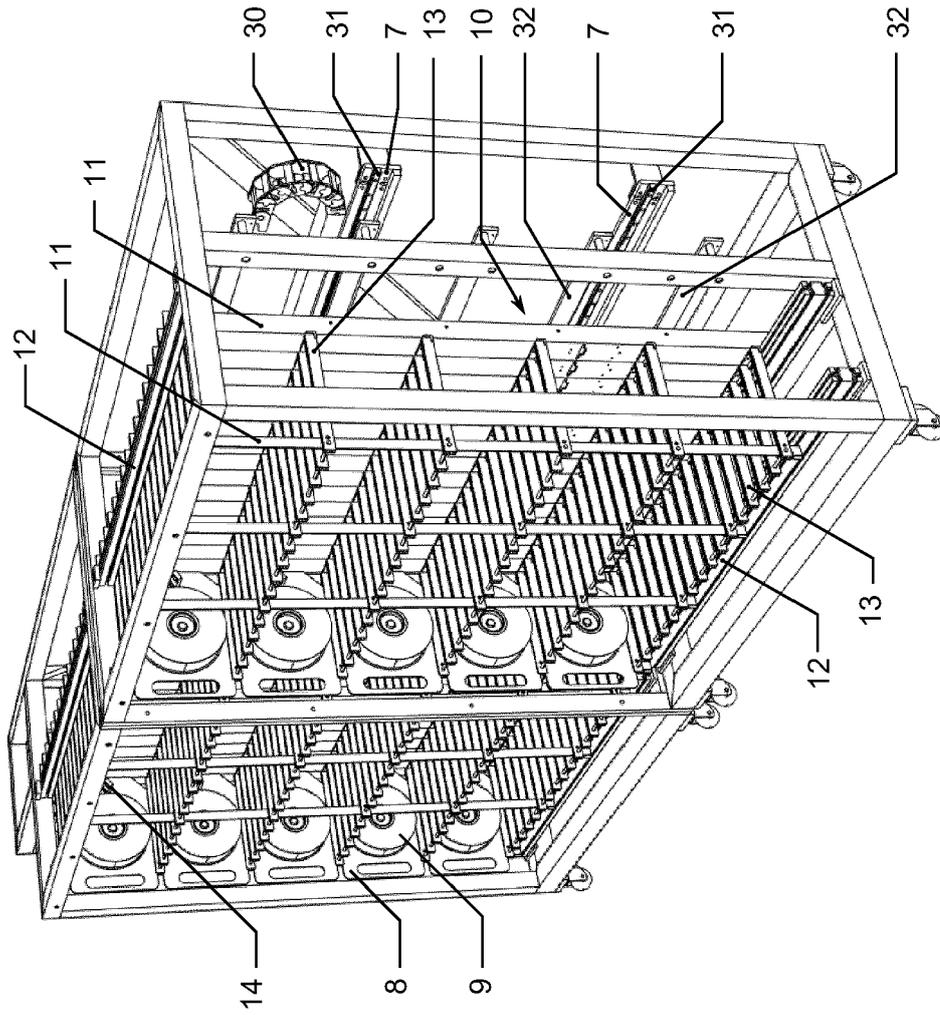


Fig. 4

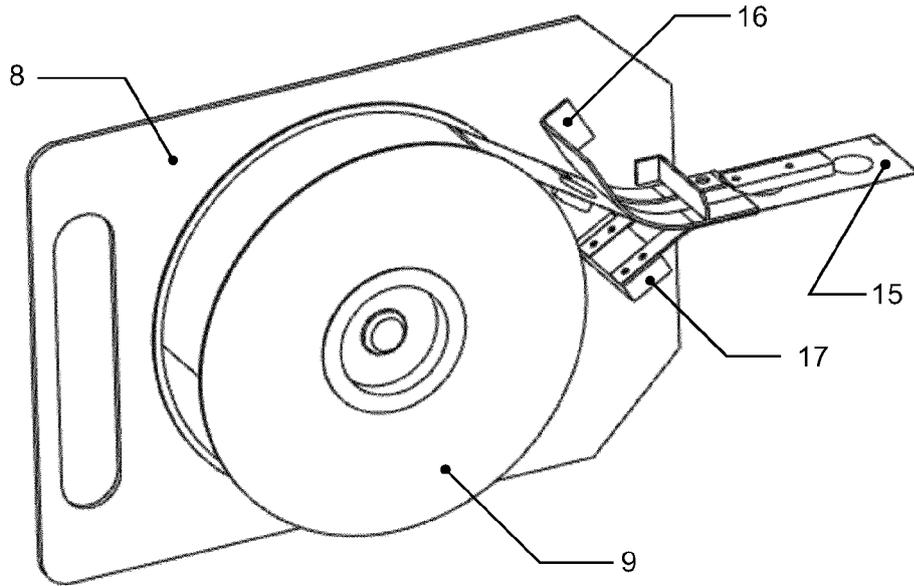


Fig. 5A

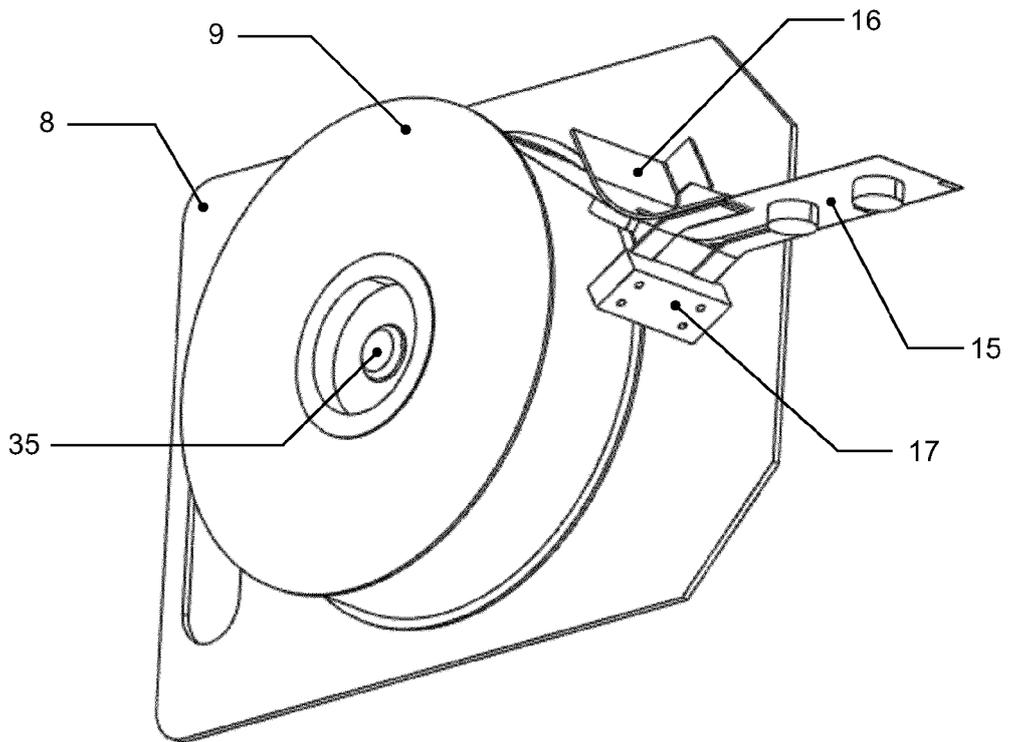


Fig. 5B

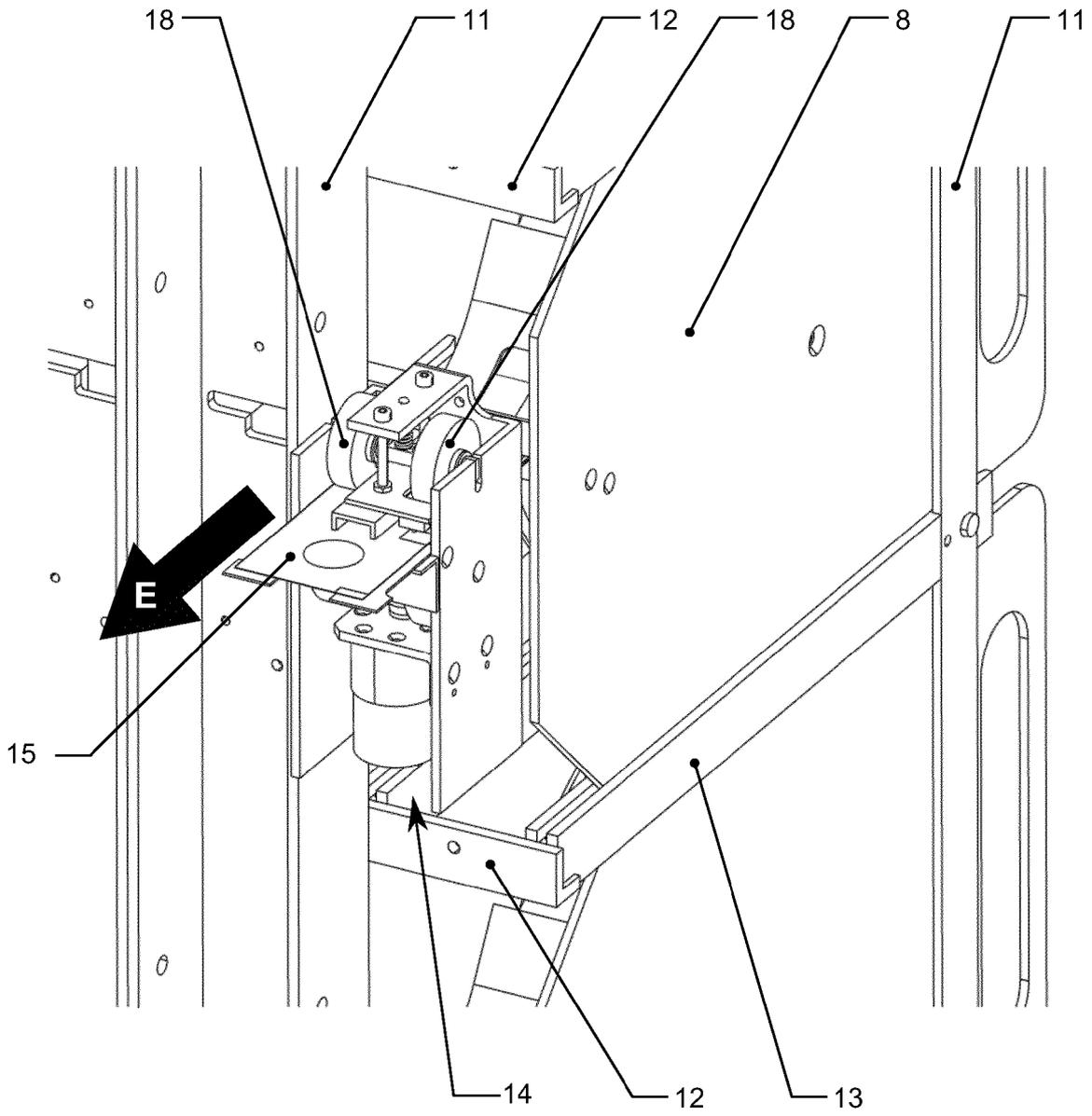


Fig. 6

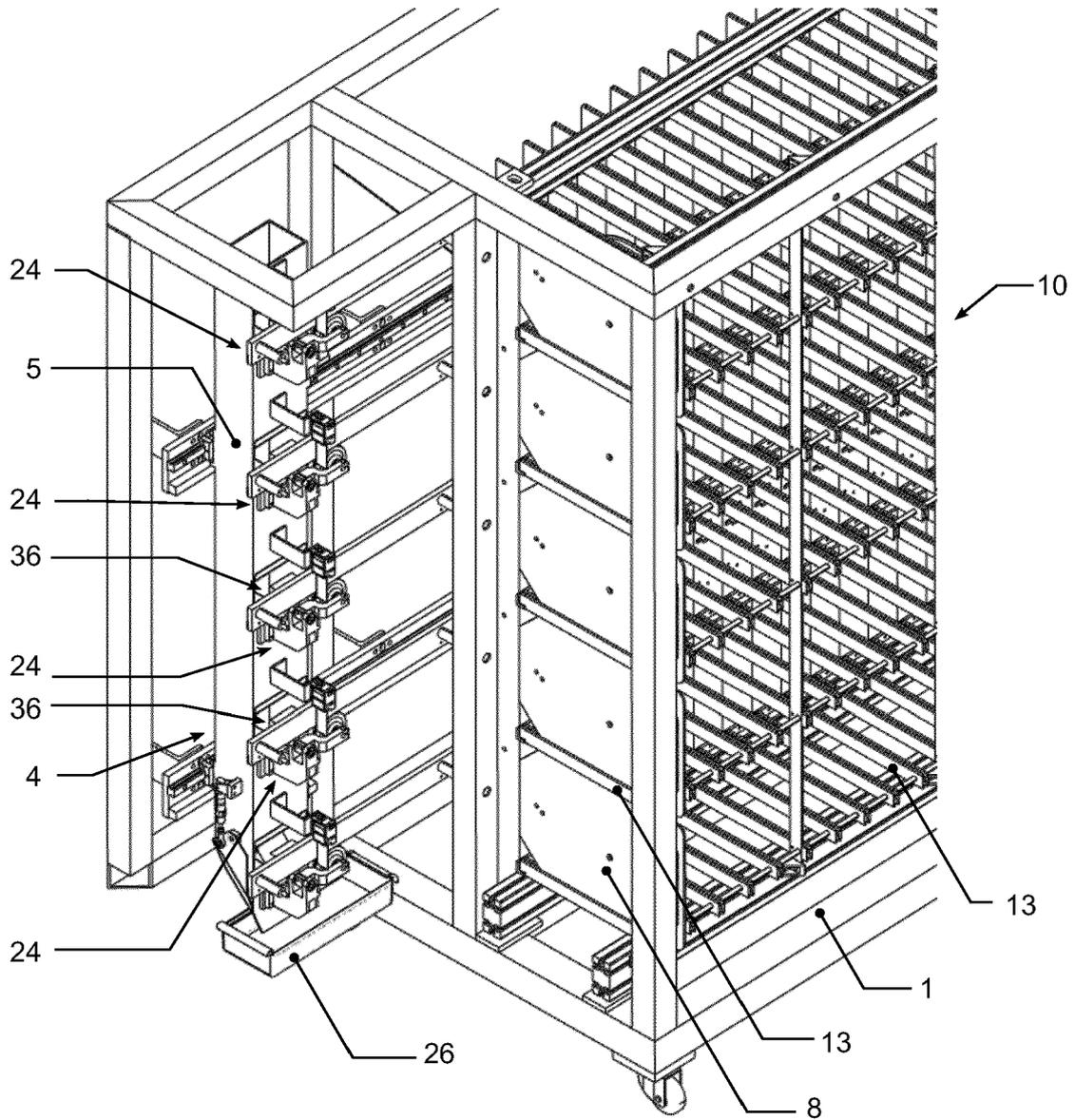


Fig. 7

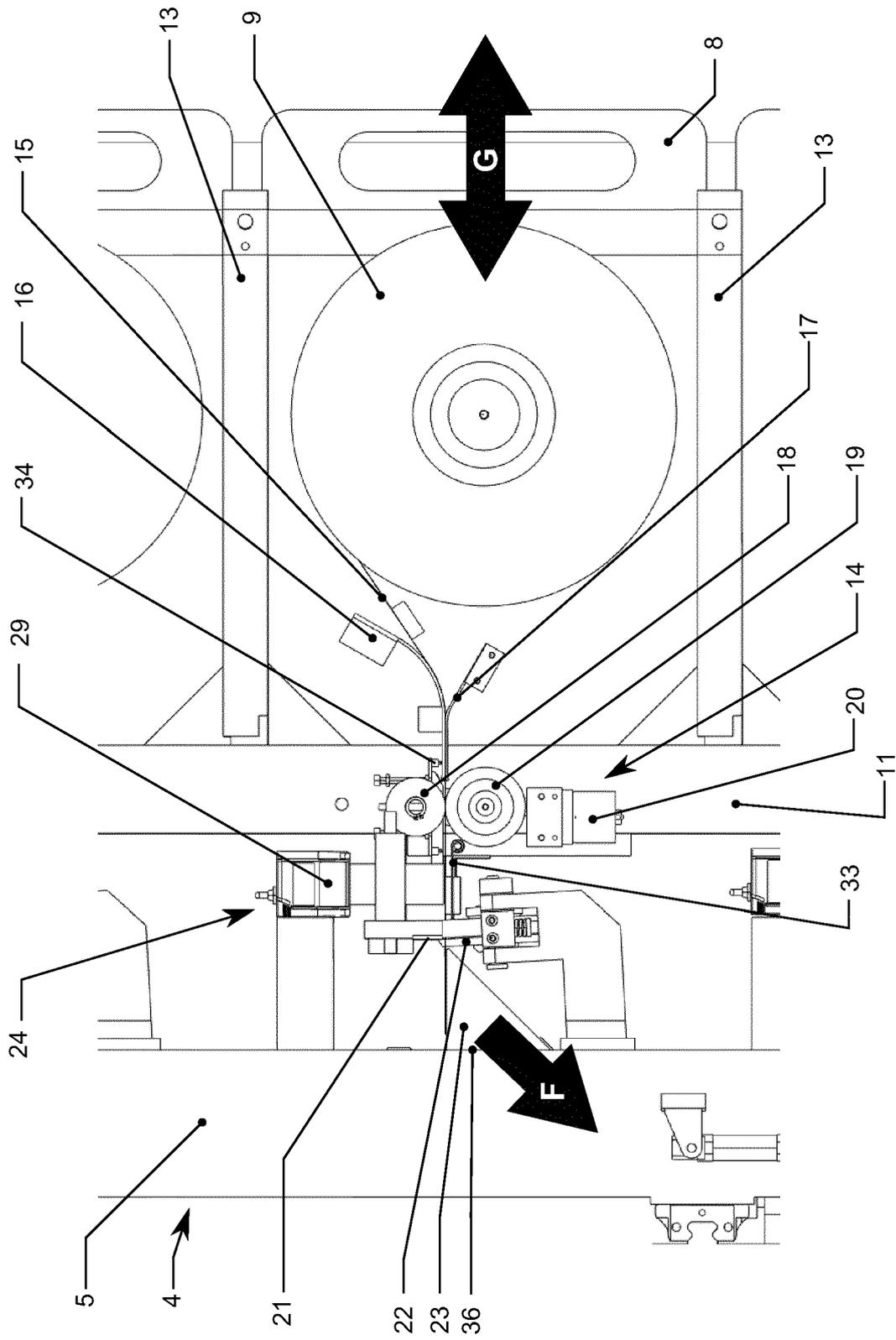


Fig. 8

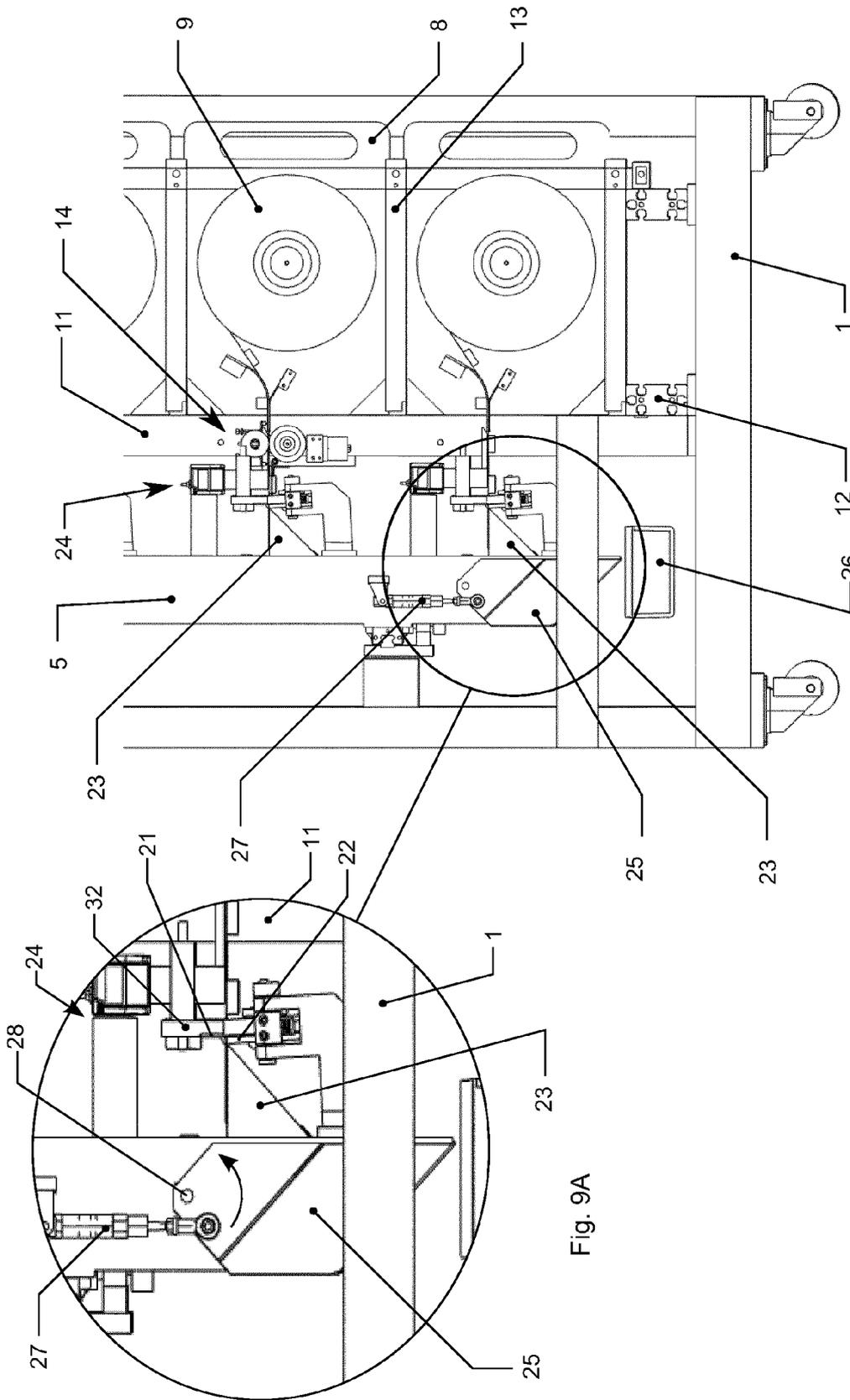


Fig. 9

Fig. 9A



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