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(54) **AUTOMATIC DISPENSER OF PELLETS, FIREWOOD AND BIOFUEL IN GENERAL FOR RESIDENTIAL HEATING SYSTEMS**

(57) The invention relates to an automatic dispenser of pellets, firewood and biofuel in general for residential heating systems comprising a storage unit for a plurality of packages of pellets and firewood and other biofuel forming the product, positioned in orderly stacks on pallets or stillages, a front wall having at least one panel, provided with means for selecting the type and quantity of product desired and means for paying the amount due for the desired product selected, and with an opening for

dispensing and delivering outside the product selected, and also comprising, in the storage unit, a depalletizer designed to pick at least one package of the product from the stacks and to transport it to a release position, and means designed to convey the product from the release position, inside the storage unit, to the outside; there being provided a software for managing the storage unit, the orderly stacks of product and for controlling the depalletizer.

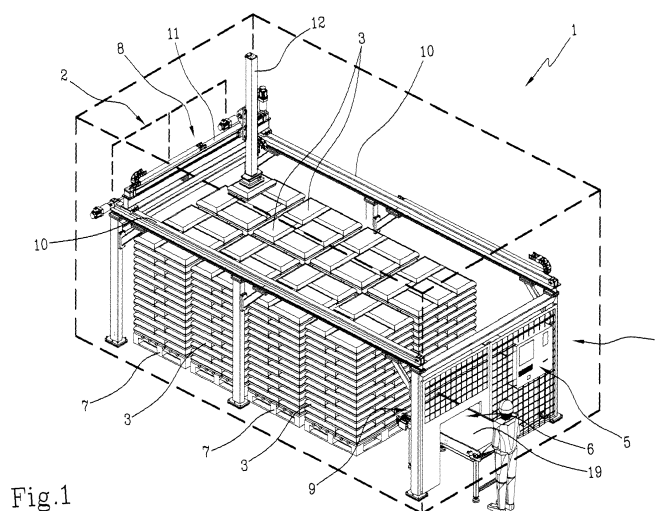


Fig.1

## Description

**[0001]** This invention relates to an automatic dispenser of pellets, firewood and biofuel in general, packaged in bags, boxes or sacks, for residential heating systems and/or for systems for making hot water, such as stoves, fireplaces and boilers.

**[0002]** Wooden pellets are a fuel obtained from sawdust which is dried and then compressed in the shape of small cylinders with a diameter of a few millimetres, typically 6-8 mm. Due to the pressing, the calorific value of the pellet is approximately double with respect to wood, volume but not weight being the same. Pellets are used as fuel for latest generation stoves, in place of wood stumps. With respect to traditional stoves, this involves a series of ecological and energy type improvements, and of the type for managing the heating system.

**[0003]** Among the environmental and economical advantages, it is worth noting how the production of pellets is not strictly associated with cutting down whole trees: indeed they can be produced from several waste materials such as woodworking sawdust and processing waste, which in this manner are exploited as widely consumed fuel. Moreover, in terms of the environment and the use of renewable fuels, the household use is more frequent of wood logs or stumps or other solid-type biofuel derived from biomasses of plant or animal origin.

**[0004]** When intended for household use, these fuels are usually packaged in bags, cardboard boxes or plastic material sacks or mesh bags, in particular the latter for wood logs or stumps, usually for weight quantities in the range of approximately 15 kg each.

**[0005]** Currently, the household supplying of this fuel occurs at specific warehouses or supermarkets or large hardware or home supply stores. In some cases, the specialised supplier may provide the supply at the home, but this generally occurs for significant quantities requested beforehand in good time.

**[0006]** No other ways, methods or tools are currently known with which the user can procure an adequate quantity of this fuel for his/her own residential heating system and/or system for making hot water, such as stoves, fireplaces and boilers. Multiple types of automatic dispensers of various types of products are known, small automatic dispensers also exist of pellets, charcoal briquettes or the like, of the type and size of drink or beverage dispensers, which contain a few units of small packages in the range of 5 kg, which can be picked individually by opening specific drawers, which are useful for small stoves or for household barbecues, but which are not suitable for dispensing significant quantities of the products at hand, required for the heating systems.

**[0007]** The problem connected with this procurement system lies in the fact that often the user realises his/her supplies are finished late in the evening, when heating is more necessary and when the usual suppliers are normally closed, or on holidays, thus causing the user to search for suppliers open exceptionally.

**[0008]** Another problem is that the user, not being able or wanting to take advantage of home delivery, who goes to the suppliers normally intends purchasing several packages of product, which are heavy individually, and usually must transfer them from a shelf to a cart, from the cart to the cash desk, and then to his/her motor vehicle left in a car park, often far from the store, which involves significant effort and hard work, in particular for women and older people.

**[0009]** It is therefore the aim of the invention to overcome the above-mentioned drawbacks by providing an automatic dispenser of pellets, firewood and biofuel in general, packaged in bags, boxes or sacks, which can be dispensed in several units of product, which can be operated and therefore accessible to the user 24/7, including holidays, and which can be installed outside of the usual suppliers and also in other easily accessible spaces, such as for example, petrol pumps or parking zones, in any case areas which are easy to access with his/her own motor vehicle in such a way as to be able to stop it behind or close to the automatic dispenser.

**[0010]** These and other aims are substantially achieved by an automatic dispenser of pellets, firewood and biofuel in general for residential heating systems, as described below and expressed in one or more of the appended claims.

**[0011]** Further features and advantages of the present invention are more apparent from the detailed description below of a preferred, but non-exclusive, embodiment of the automatic dispenser according to this invention.

**[0012]** The description is provided below with reference to the accompanying drawings, which are also non-limiting and provided by way of example only, in which:

- Figure 1 is a schematic perspective view of an automatic dispenser according to the invention;
- Figure 2 is a perspective view of the depalletizer according to the invention;
- Figure 3 is a schematic view of a detail of an automatic dispenser according to the invention;
- Figure 4 is a different embodiment of the detail from Figure 3.

**[0013]** With reference to Figure 1, the numeral 1 generically denotes, with a dashed line, a closed storage unit, defining the external structure of the automatic dispenser according to the invention, made of continuous sheet or partly of mesh to facilitate exchanging the air inside it. The storage unit 1 is equipped with at least one closeable door 2, denoted again with a dashed line and preferably positioned at the back of the storage unit 1, or on its side, for loading therein a plurality of packages 3 of pellets or firewood or other biofuel forming the product and for inspecting and servicing mechanisms. For that purpose, two doors 2 can be provided, one suitable for loading and unloading the products and the other (not illustrated for simplicity in the drawings) for inspecting and internal maintenance. To display the sizes and over-

all dimensions of the storage unit 1, it can be compared to a normal container. The storage unit 1 has a front wall 4 equipped with at least one panel 5, equipped with at least means for selecting the type and quantity of product desired and with means for paying the amount due for the desired product selected, like an automatic dispenser of known type. The front wall 4 is also equipped with an opening 6 for dispensing outside and delivering the product selected.

**[0014]** The packages 3 of pellets or firewood or other biofuel, in the form of bags, boxes or sacks, are positioned inside the storage unit in predefined positions, in orderly and homogeneous stacks of product, which then facilitates, as described below, the recognition of the position and of the presence of the various types of product for the automatic picking thereof.

**[0015]** Suitably, the stacks of packages 3 of product are positioned on several pallets or stillages 7 so as to facilitate loading and unloading the storage unit 1 using forklifts or lift trucks.

**[0016]** According to the invention, the automatic dispenser comprises a depalletizer 8 inside the storage unit 1, designed to pick, from the stacks, at least one package 3 of the product selected by the user on the panel 5, and to transport it to a release position 9. The depalletizer 8 may be of the robotic arm type, which is more technically complex and cumbersome (not illustrated for simplicity in the drawings), or advantageously of the Cartesian type illustrated in detail in Figure 2.

**[0017]** The Cartesian depalletizer 8 comprises a pair of tracks 10 positioned longitudinally on opposite sides of the storage unit 1 at a height which is greater than the maximum height provided for the orderly and homogeneous stacks of product, a crosspiece 11 which moves on the tracks along an axis X, a gripper rod 12 engaged movable along the crosspiece 11 according to an axis Y and movable vertically with respect to the crosspiece 11 according to an axis Z. The gripper rod 12 is provided at the lower end thereof with a head 13 provided with removable members 14 for gripping at least one of the packages 3 of product, which are adapted to transfer the package of product from the grip position to the release position 9 (Figures 3 and 4) by moving the gripper rod 12 and the crosspiece 11 along the axes Z, Y and X (Figure 2). Naturally, there are motor means for the movements (not shown for simplicity in the drawings).

**[0018]** The gripper members 14 are preferably formed by one or more suction means 15 and these are advantageously connected to members for creating the vacuum in them, for example a simple vacuum pump, to facilitate and ensure the firm grip and transport of the package 3 of product with the vacuum created inside the suction cup.

**[0019]** Moreover, the one or more suction means 15 are associated with a pincer gripper 16 to facilitate and ensure the firm grip and transport of the package 3 of product also when it is not suitable for being safely gripped with the suction means, for example in the case

of wood logs or stumps usually packaged in mesh sacks.

**[0020]** The invention comprises a software for managing the storage unit and the orderly and homogeneous stacks of product, according to a predetermined position mapping of the stacks and of the type of product, and for acquiring the selection of the type and quantity of product desired and selected by the user using a keyboard on the panel 5. The software also provides acquiring the corresponding payment, and controlling the depalletizer 8 to move it along the axes X, Y and Z toward a position of picking a package 3 of product and from there, toward the release position 9 of the product. The software saves the position coordinates of each individual product, to then pick the next product through a precise sequential list of positions, and may be provided with a remote control system for exchanging data on the remaining product availability and on the status of regular functionality of the whole system, and possibly the acquisition/transfer of the images detected by safety cameras. Sensor devices can be provided, designed to detect the stacks still having packages 3 of product and those with no product.

**[0021]** Figures 3 and 4 show the outward dispensing opening 6 of the storage unit 1 of the package 3 of product released in the position 9 by the depalletizer 8.

**[0022]** The dispensing opening 6 is provided with means 17 adapted to convey the product from the release position 9, inside the storage unit 1, to the outside, through the opening. Advantageously, closing and safety means 18 of the dispensing opening 6 are provided to prevent access inside the storage unit 1, from the outside through the opening.

**[0023]** The means 17 designed to convey the product, according to a first embodiment shown in Figure 3, are formed by a conveyor belt 19 having a portion thereof inside the storage unit 1 subjected to the release position 9 of the product, and an external portion thereof useful for the user to take the product.

**[0024]** According to a different embodiment shown in Figure 4, the means 17 designed to convey the package 3 of product are formed by a hopper or slide element 20 designed to receive the product by gravity in the release position 9, and to convey it outside by gravity through the dispensing opening 6.

**[0025]** Advantageously, the means 17 designed to convey the product from the release position 9, inside the storage unit, to the outside, are provided with sensor devices (not shown for simplicity in the drawings), for example pressure sensors for detecting the presence of the package 3 of product, connected with the software and designed to reveal thereon the presence of the product released, to enable/disable the closing and safety means 18, and to detect the product outside being taken by the user in order to activate a new pick, transfer and release cycle of another product. The embodiment of the invention described is purely by way of non-limiting example, modifications and variations being possible without in any case departing from the protective scope of the appended claims; more specifically, like the unitary

weight of the individual packages 3 of product, any material and shape may be used provided it is suitable for the aim.

## Claims

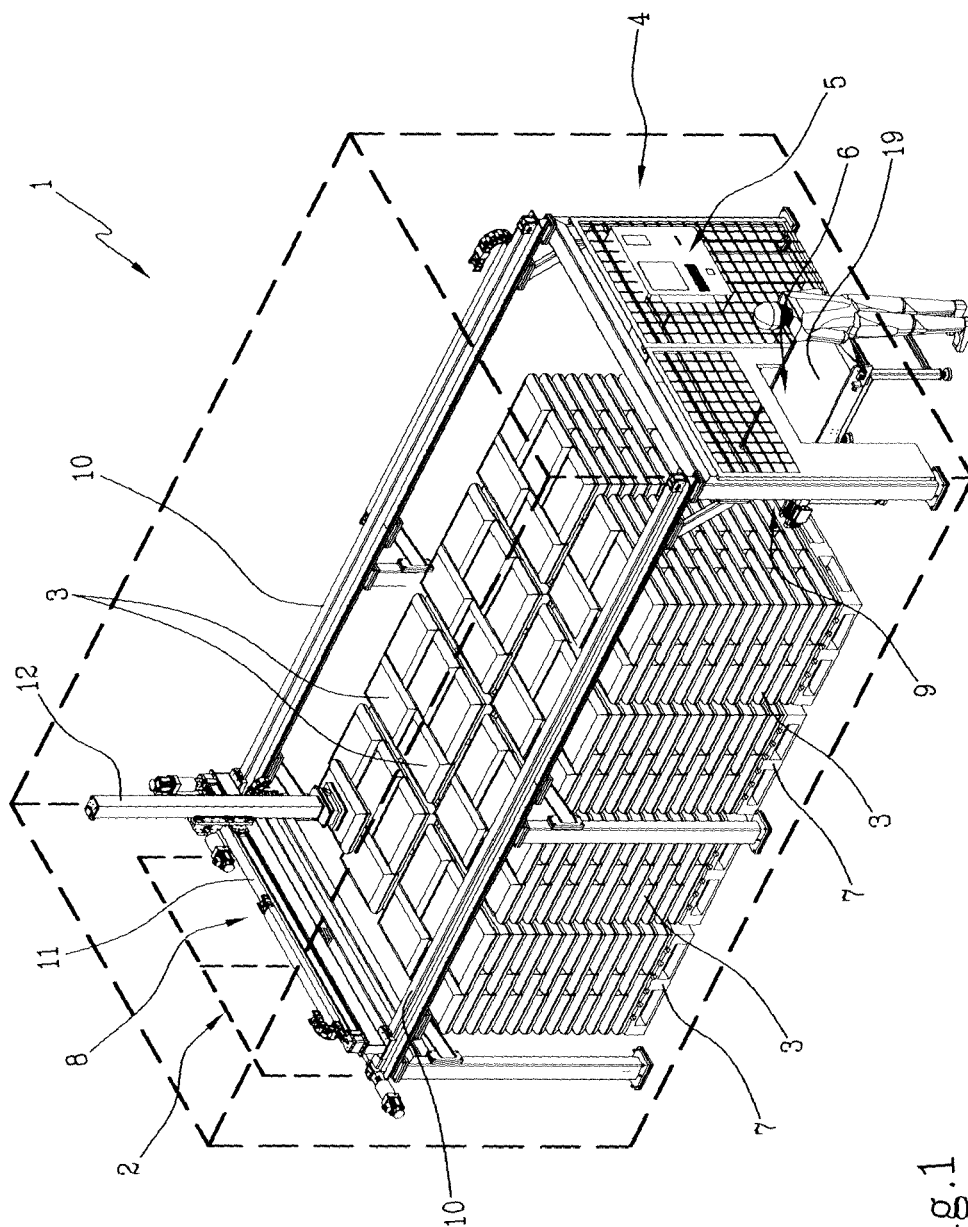
1. An automatic dispenser of pellets, firewood and biofuel in general for residential heating systems comprising a closed storage unit (1) provided with at least a closeable door (2) for loading therein a plurality of packages (3) of pellets and firewood and other biofuel forming the product, a front wall (4) having at least a panel (5), provided with at least means for selecting the type and quantity of product desired and means for paying the amount due for the desired product selected, and with an opening (6) for dispensing and delivering outside the product selected, **characterised in that** said packages (3) of pellets and firewood and other biofuel are arranged inside the storage unit (1) in predefined positions, in orderly and homogeneous stacks of product, on pallets or stillages (7) and **in that** it comprises, inside the storage unit (1), a depalletizer (8) adapted to pick from said stacks at least one package (3) of the product selected on said panel (5) by the user and to transport it to a release position (9), and means (17) adapted to convey the product from said release position (9), inside the storage unit 1, to the outside through said dispensing opening (6); a software being provided for managing the storage unit and the orderly stacks of product, for acquiring the selection of the type and quantity of product desired, for acquiring the payment of the amount due, for controlling said depalletizer (8).
2. The automatic dispenser according to claim 1, **characterised in that** said depalletizer (8) is of the robotic arm type.
3. The automatic dispenser according to claim 1, **characterised in that** said depalletizer (8) is of the Cartesian type and comprises a pair of tracks (10) arranged longitudinally on opposite sides of the storage unit (1) at a height which is greater than the maximum height provided for said orderly and homogeneous stacks of product, a crosspiece (11) which moves on said tracks (10) along an axis X, a gripper rod (12) engaged movable along said crosspiece (11) according to an axis Y and movable vertically with respect to said crosspiece (11) according to an axis Z; said gripper rod (12) being provided at the lower end thereof with a head (13) provided with removable members (14) for gripping at least one of said packages (3) of product, which are adapted to transfer the package of product from the grip position to the release position (9) by moving said gripper rod (12) and said crosspiece (11) along said axes Z, Y

and X; drive means being provided for said movements.

4. The automatic dispenser according to claim 3, **characterised in that** said gripper members (14) consist of one or more suction means (15).
5. The automatic dispenser according to claim 4, **characterised in that** said one or more suction means (15) are connected to members for creating the vacuum within said one or more suction means, to facilitate and ensure the firm grip and transport of the package (3) of product.
6. The automatic dispenser according to claim 4, **characterised in that** said one or more suction means (15) is associated with a pincer gripper (16) to facilitate and ensure the firm grip and transport of the package (3) of product also when it is not suitable for being gripped with said suction means.
7. The automatic dispenser according to claim 1, **characterised in that** said dispensing opening (6) is provided with means (17) adapted to convey the product from said release position (9), inside the storage unit (1), to the outside, through the opening; closing and safety means (18) of said dispensing opening (6) being provided to prevent access from the outside, to the inside of the storage unit through the opening.
8. The automatic dispenser according to claim 7, **characterised in that** said means (17) adapted to convey the product comprise a conveyor belt (19) having a portion thereof inside the storage unit (1) subjected to said release position (9) of the product, and an external portion thereof useful for the user to take the product.
9. The automatic dispenser according to claim 7, **characterised in that** said means (17) adapted to convey the product comprise a hopper or slide element (20) adapted to receive the product by gravity in said release position (9) and to convey it outside by gravity through said dispensing opening (6).
10. The automatic dispenser according to claims 1 and 7, **characterised in that** said means (17) adapted to convey the product from said release position (9), inside the storage unit (1), to the outside, are provided with sensor devices connected with said software and adapted to detect the presence thereon of the package (3) of product released, to enable/disable said closing and safety means (18), to detect the product outside being taken by the user in order to activate a new pick, transfer and release cycle of another product.
11. The automatic dispenser according to claim 1, **char-**

**acterised in that** said software for managing the storage unit provides acquiring the selection of the type and quantity of product desired and selected by the user through a keyboard on said panel 5, acquiring the payment of the amount due, controlling said depalletizer 8 to move it along said axes X, Y and Z to a position of taking a package 3 of product and from there, to said release position 9 of the product; the software saving the position coordinates of each individual product, to then pick the next product through a precise sequential list of positions and being provided with a remote control system for exchanging data on the remaining product availability and on the status of regular functionality of the whole system.

12. The automatic dispenser according to claim 1, **characterised in that** it comprises sensor means connected with said software adapted to determine the presence or lack of packages (3) of product in each orderly and homogeneous pile and to determine the type of product for the purposes of the command for moving said depalletizer (8).



File 1

Fig.2

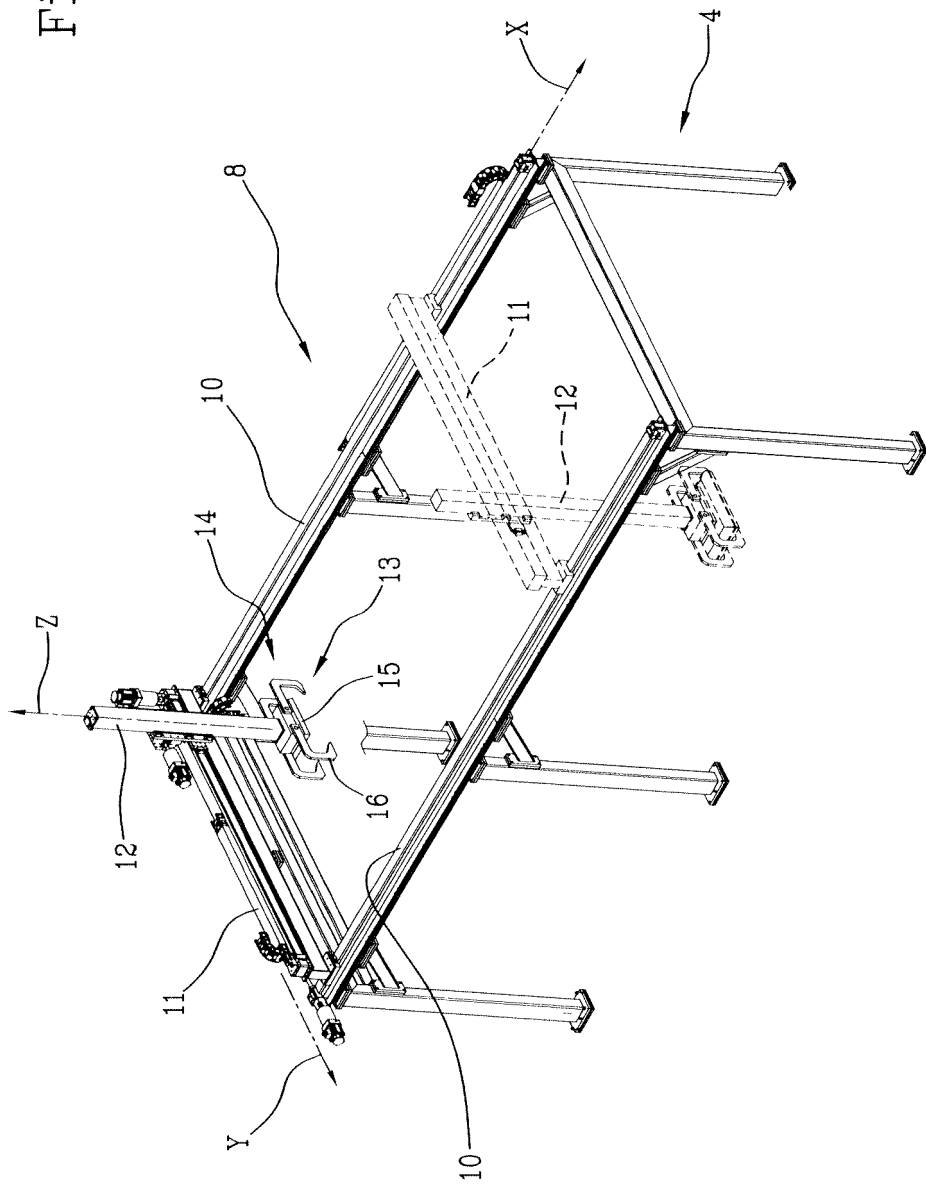


Fig.3

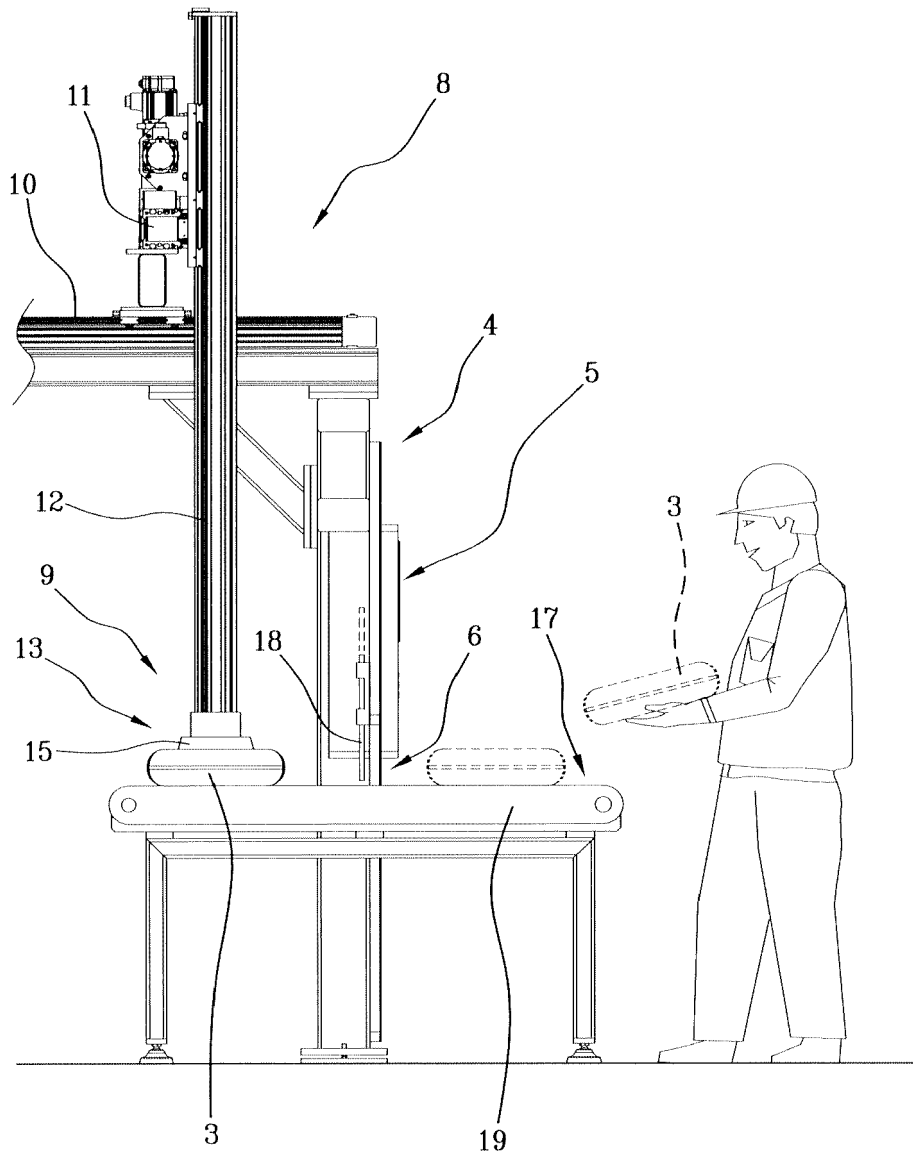
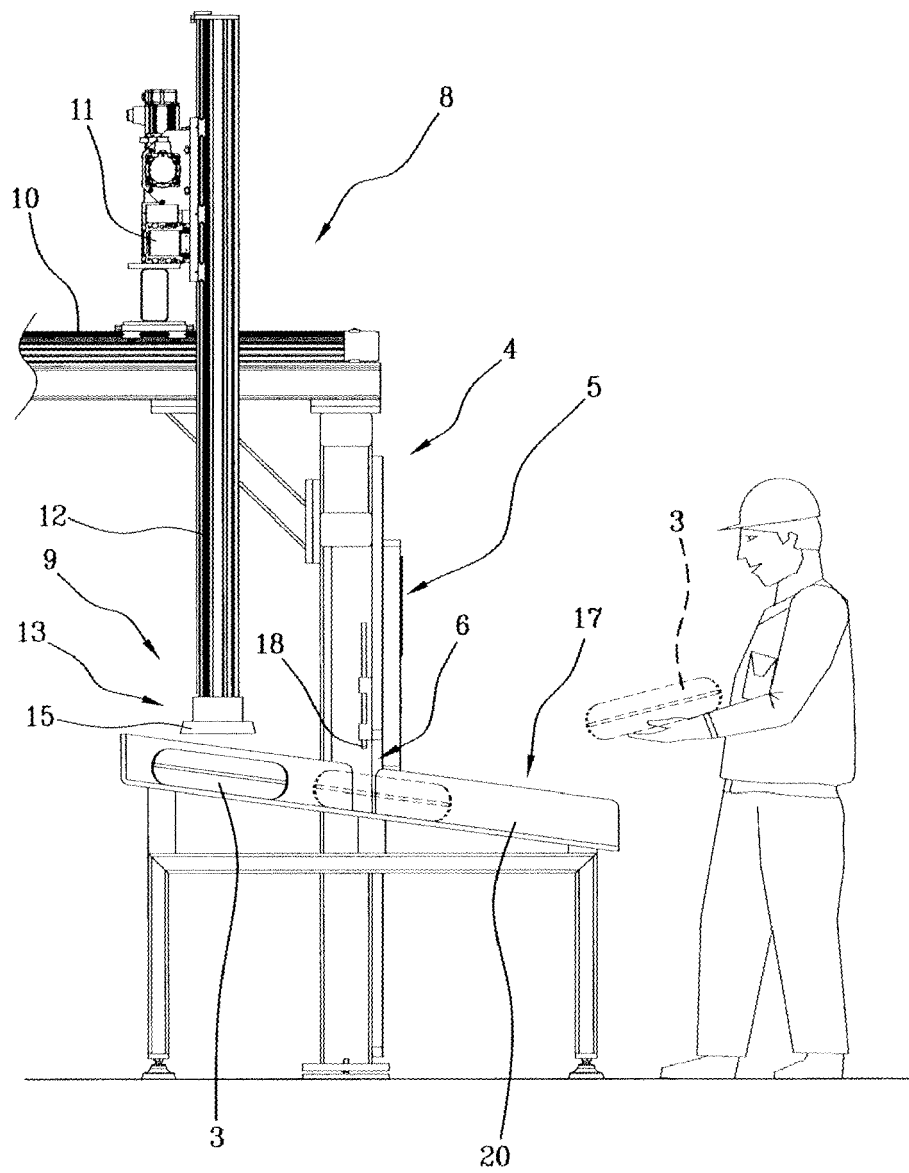


Fig.4





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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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|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                 |                                                          | G07F                                    |
| The present search report has been drawn up for all claims                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                 |                                                          |                                         |
| Place of search<br><b>Munich</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                 | Date of completion of the search<br><b>14 March 2016</b> | Examiner<br><b>Pastore, Edoardo</b>     |
| CATEGORY OF CITED DOCUMENTS<br>X : particularly relevant if taken alone<br>Y : particularly relevant if combined with another document of the same category<br>A : technological background<br>O : non-written disclosure<br>P : intermediate document<br>T : theory or principle underlying the invention<br>E : earlier patent document, but published on, or after the filing date<br>D : document cited in the application<br>L : document cited for other reasons<br>& : member of the same patent family, corresponding document |                                                                                                                                                 |                                                          |                                         |

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**ANNEX TO THE EUROPEAN SEARCH REPORT  
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