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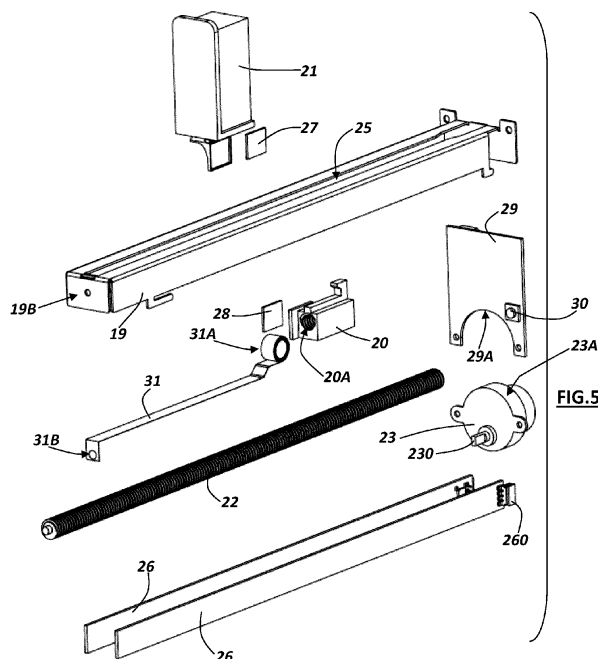
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(54) **AUTOMATIC VENDING MACHINE**

(57) An automatic vending machine, of the type comprising means for selecting one or more products to be dispensed and a plurality of compartments (14) intended for containing the products, in which the products are arranged in a row along a main direction, being provided with suitable means to move the products along said main direction (D) towards an outlet section (5) which is crossed by the product for the dispensing. The vending machine (1) comprises: - a pusher element (21) shaped

so as to constrain one or more products placed inside a compartment (14) towards the said outlet section (5) in said main direction; - a carriage (20) sliding under the action of motor means (23) along said main direction (D) to move said products along said main direction (D); - means for detecting the position of the carriage and/or the pusher comprising at least one digital position transducer capable of providing a signal relating to the position of the carriage (20) and/or the pusher (21).



Description

[0001] The present invention relates to an automatic vending machine.

[0002] As is known, a vending machine is a machine that dispenses products and/or services at the request of a user, subject to payment. Vending machines can dispense, for example, snacks, drinks, newspapers, cigarettes, tobacco, smoking items, tickets, prepaid cards, coupons, parapharmaceutical products, etc.

[0003] In a very common machine configuration, the products that are dispensed from the vending machine are arranged in special compartments that contain rows of aligned products. Usually each compartment is delimited by side walls and is provided with a motorization system that moves the products towards a dispensing outlet; in correspondence with each row of products, moreover, a pusher can be arranged and acting, which exerts a thrust on the last product of the row. The arrangements that the compartments inside the vending machine can take may vary considerably according to the type of product to be dispensed, its conformation and its size.

[0004] One of the drawbacks of known automatic vending machines relates to the vending machine loading procedure. In particular, product loading is not always easy because the vending machine manager is not always aware of the number of missing products to restore the row of a given compartment; another drawback relates to the possibility of unwanted movement of a product due to a stress received which can determine a different arrangement from what is expected for correct operation, for example by overturning or tilting with respect to the configuration conventionally indicated for the compartment in which it is contained.

[0005] EP3783574A1 aims to improve the accuracy of detecting the quantity of items in a column of items in a vending machine to avoid detection errors. In this document the detection of the quantity of articles in a column is performed by means which include a pressure sensor which detects the pressure exerted on the articles to verify that the articles of the column are in contact with each other. In the distributor of EP3783574A1, when new articles have to be loaded into a column, no means are provided for retaining the articles already present while the plate that holds them is moved.

[0006] The object of the present invention is to provide an automatic vending machine capable of overcoming the aforementioned drawbacks.

[0007] This result has been achieved in accordance with the invention by adopting the idea of making an automatic vending machine having the features described in claim 1.

[0008] Other features are described in the dependent claims.

[0009] Among the advantages of the present invention the following can be listed: the vending machine allows the charged operator to restore the products in the auto-

matic vending machine; the products are kept in the correct position even during the reloading operations thanks to the independence between a pusher element and a handling carriage provided in the product containment compartments; that it is possible to know the number of products contained in each compartment, using this information even remotely to check consumption and/or prepare the correct quantities of products to be integrated; that the system can be used for already existing distributors; that its realization is easily implemented by the same operators who realize traditional machines, without requiring special investments.

[0010] These and further advantages and characteristics of the present invention will be better understood by every person skilled in the art from the following description and with the help of the attached drawings, given as a practical example of the invention, but not to be considered in a limiting sense, in which:

- Fig. 1 is an overall schematic view of a possible embodiment of an automatic vending machine, schematically represented in a perspective view with the front and rear doors open and with drawers extracted;
- Fig. 2 is a schematic perspective view of a drawer with a plurality of compartments for containing the products to be dispensed;
- Figs. 3, 4 and 5 relate to a first embodiment of the present invention with a dispensing device, represented, respectively, in a perspective view from above (Fig. 3), in a perspective view from below (Fig. 4) and in an exploded perspective view (Fig. 5);
- Figs. 6, 7, 8, 9 and 10 relate to a second embodiment of the present invention with a dispensing device, represented, respectively, in a perspective view from above (Fig. 6), in a perspective view from bottom (Fig. 7), in an exploded perspective view (Fig. 8), in a partial perspective view from below relating to a detail in a first operational configuration (Fig. 9) and in a partial perspective view from below relating to a detail in a second operating configuration (Fig. 10);
- Figs. 11, 12 and 13 relate to a third embodiment of the present invention with a dispensing device, shown respectively in a perspective view from above (Fig. 11), in a perspective view from below (Fig. 12) and in an exploded perspective view (Fig. 13).

[0011] Fig. 1 schematically represents an automatic vending machine (1) comprising a box-like containment body (11) having a parallelepiped conformation.

[0012] In the example, the vending machine (1) is provided with a front door (2) provided with selection and payment means (not described in detail), with a rear access door (3) and with a plurality of drawers (10) to contain the products to be dispensed. In the example it is provided that the drawers (10) slide in the front-rear direction and that the products are dispensed through the front portion of the compartments to be picked up through

a door (4) placed at the front. The inventive principle of the present invention can also be applied to other configurations, such as, for example, to drawers placed orthogonally to those shown in Fig.1.

[0013] Each drawer (10) comprises a bottom or rear wall (12) and a plurality of side walls (13), connected to the rear wall (12) and which delimit the compartments (14) intended for the organized containment of the products to be dispensed.

[0014] In particular, in the example illustrated, the two outermost side walls (13A) are fixed to the rear wall (12) and are provided with rails (15) shaped so as to slide in corresponding lateral guides (16) fixed to the internal face of the side walls (17) of the containment body (11) of the vending machine (1).

[0015] In the front part of each compartment (14) there are two wings (18) which in their proximal end are fixed to the side walls (13) which delimit the compartment (14) and in their distal end move away from said side walls, approaching each other, so defining a constraint related to the overall width of the product. The two wings (18) provided for each compartment (14) can be made of elastically yielding material, for example metal sheet, and delimit the same compartment (14) at the front allowing the passage of the product contained when they are temporarily deformed by the thrust of a pusher element described below. In practice, the wings (18) define a front stop for the products, a stop which is temporarily overcome, during the product dispensing, when the thrust exerted exceeds a predetermined value.

[0016] In the present description the area of the compartments (14) intended for the outlet of the dispensed products is defined as the front part; the wall of the drawer opposite to said front part is defined as the rear wall.

[0017] On the bottom of each compartment (14) there is a guide (19) along which a carriage (20) slides engaged by a corresponding threaded rod (22) rotated by a gearmotor (23). The carriage (20) is provided with a threaded seat (20A) complementary to the threaded rod (22) so as to move along the guide (19) when the threaded rod (22) rotates. In particular, the gearmotor (23) has an output shaft (230) which engages a corresponding seat (not visible in the drawings) of the threaded rod (22) to make the latter rotate when activated. In practice, the output shaft (230) is integral with the threaded rod (22) and drives it into rotation; the carriage (20) consequently moves along the guide (19) because the seat (20A) of the carriage (20) is engaged by the thread of the rod (22) driven in rotation.

[0018] Experimentally, the movement of the carriage (20) by means of the rotation of a threaded rod (22) which engages a corresponding cavity or threaded hole of the same carriage (2) has proved to be very advantageous.

[0019] The guide (19) has a box-like shape, open at the bottom and provided with a longitudinal groove (25) placed on its upper face (19A). The upper face (19A) of the guide (19) means the one that in use is closest to the products arranged in the compartment (14).

[0020] With reference to the embodiment example of Figs. 3-5, two linear encoders (26) are provided inside the guide (19), located on the inner face of the longitudinal side walls of the guide (19). The encoders (26) are provided with corresponding connection elements (260) to be connected to an electronic board (29).

[0021] On the threaded rod (22) there is a pusher element (21) which can slide freely along the groove (25) of the guide (19) and along the same threaded rod (22).

The pusher (21) has the function of pushing the products placed in the compartment (14) forwards or, at least, of holding them against the wings (18) that delimit the front part (5) of the compartment (14). In a possible and advantageous embodiment, the pusher (21) is subjected to the force of a spring (31) which pushes it forward in the longitudinal direction (D). In particular, the spring (31) is a band spring, with a front end (31B) fixed to the front or head portion (19B) of the guide (19) and with the body that rolls up inside the pusher body. (21).

[0022] The constraint determined by the pusher (21) on the products placed in the compartment (14) can also be achieved by determining a friction between the pusher itself (21) and the guide (25) along which it slides. For example, clips or a particular conformation of the portion of the pusher itself (21) intended for contact with the guide (19) can be used. Also in this case the pusher (21) will maintain the position reached without allowing the remaining products to move even when the operator opens or closes the drawer (10) to visually check its contents.

[0023] A plate (27) made of a material capable of interacting with a linear encoder is fixed to the pusher (21).

[0024] Similarly, another plate (28) is fixed to the carriage (20), also this plate being made of a material capable of interacting with a linear encoder.

[0025] In the case of a magnetic linear encoder, the plates (27, 28) can be made of metal in order to generate a signal for the electronic board (29).

[0026] In practice, the detection system comprises a main sensor board and a printed circuit board or PCB (printed circuit board) mobile target. The main sensor board (29) contains two oscillator coils and two sense coils; an integrated circuit excites the two coils of the oscillator.

[0027] The position of the target varies the reception of the two sense coils relative to each other, while the integrated circuit demodulates the two received signals and generates an output signal representative of the relative difference between the signals of the sense coils. In practice, the metal target alters the magnetic field, the transmission coil generates the magnetic field that induces currents in the metal target, which in turn alters the magnetic field to allow the position to be calculated.

[0028] The electronic card (29) can be provided with a key (30) to supply a signal for assigning an address to the corresponding motor (23). In this way it is possible to know the quantity of products contained in all the compartments (14) by knowing the value of the size of the single product in the main direction (D) with respect to

which the measurements are made. The same compartment can be equipped with a light and/or sound indicator which is activated to signal the need to reset the number of products in the compartment (14). The detected values can be used to send alerts regarding the need for recovery even remotely, for example using a data network. The electronic board (29) can advantageously have an arched portion (29A), concave in the example, shaped in such a way as to copy a corresponding arched portion (23A), convex in the example, presented by the gearmotor (23); in this way the overall dimensions inside the drawer (10) are further optimized.

[0029] With reference to the example of Figs. 2-5, the products to be dispensed are placed in the compartments (14) of the drawer (10), arranged to form a row. The first product, i.e. the one that is dispensed first in the row, is placed at the front (5) of the compartment, held by the flaps (18), while the last product, i.e. the one that ends the row, is in contact with the pusher (21) which remains attached to it thanks to the thrust determined by the action of the spring (31) or the friction acting on the guide (25).

[0030] When the operator has to fill a compartment (14) in which there are no products, he removes the drawer (10) from the dispenser (1) and moves the carriage (20) backwards (towards the rear wall 12). In this configuration, the products are retained by the pusher (21) and therefore maintain their correct arrangement. The central (processing) unit of the vending machine (not shown in the drawings), which receives the signals from all linear encoders (26) via the relative electronic boards (29) is able to provide a value corresponding to the number of products required and their type, thanks to the combination of each compartment with the corresponding product to be contained for dispensing.

[0031] Advantageously, according to the present invention, the pusher (21) and the carriage (20) are separable and therefore when the carriage (20) is moved to load new products in the compartment (14), the products already present in the same compartment (14) are kept in position by the pusher (21) which is provided with positioning means (for example the spring 31) distinct from the means for moving the carriage (20) (the gearmotor 23).

[0032] In the example of Figs. 6-10, the compartments (14) are provided with guides with a single encoder (26) instead of the two provided in the previous example.

[0033] The vending machine is advantageously provided with a system for excluding the reading of one of the two components by the encoder (26), as will be described below. The carriage (20) is associated with an element (28) detectable by the encoder (26), such as, for example, a metal plate (28) for a magnetic type encoder.

[0034] The pusher (21) is provided with another plate (27) which can be moved away from the encoder (26) in order not to be detected. For this purpose, the plate (27) is connected to the pusher by means of an appendix (27A), which is in turn fixed to an angled lever (24) by

means of a pin (24D).

[0035] The angled lever (24) is formed of two straight portions connected by an angled portion to form an obtuse angle. The lever (24) is hinged to the pusher (21) by means of a pin (24A) passing through the angled portion of the lever (24) and its straight portions (24B, 24C) interact with the carriage (20) and with the appendix (27A) of the plate (27).

[0036] When the vending machine is in the operating configuration, the carriage (20) is in contact with the pusher (21) and the same carriage (20) pushes the portion (24B) causing a rotation of the angled lever (24), with a rotation that in the view of Fig. 9 is clockwise. The rotation of the lever (24) causes the plate (27) to move away from the encoder (26) since the appendix (27A) which is fixed to the lever (24) is dragged in the direction indicated by the arrow (V) in Fig. 9.

[0037] To facilitate the interaction between the carriage (20) and the angled lever (24), the same carriage (20) can have a suitably shaped portion (20B) to push the corresponding straight portion (24B) of the lever (24).

[0038] When the compartment (14) has to be loaded, the carriage (20) is moved away from the pusher (21) giving rise to a situation similar to that shown in the detail of Fig. 10. In this case, the carriage (20) no longer interacts with the angled lever (24) which rotates counter-clockwise, bringing the plate (27) into contact with the encoder (26). To facilitate the rotation of the lever (24) when it is not subject to the action of the carriage (20), a spring (32) can be provided which acts between the distal end of the appendix (27A) and a slider element (32A) placed on the opposite side with respect to the encoder (26).

[0039] In the example of Figs. 11-13, the vending machine is equipped with a digital position transducer consisting of a laser encoder. In this embodiment, the electronic board (29) supports a laser distance sensor (33) capable of detecting the distance between the pusher (21) and/or the carriage (20). The measuring system also includes a sensor (34) for the carriage (20) zero point.

[0040] As previously expressed, the vending machine (1) can advantageously be connected to a remote central unit with which to exchange data. In this way it will also be possible to report any anomalies and failures of the vending machine for carrying out assistance interventions.

[0041] In accordance with what has been described up to now and with the content of the attached claims, an automatic dispenser (1) made in accordance with the invention is of the type comprising means for selecting one or more products to be dispensed and a plurality of compartments (14) intended for containment of the products, in which the products are arranged in a row along a main direction, means being provided for moving the products along said main direction (F) towards an outlet section (5) which is crossed by the product for dispensing .

[0042] The vending machine (1) comprises:

- a pusher element (21) shaped so as to constrain one or more products placed inside a compartment (14) towards said outlet section (5) in said main direction;
- a carriage (20) sliding under the action of motor means (23) along said main direction (F) to move said products along said main direction (F);
- means for detecting the position of the carriage and/or pusher comprising at least one digital position transducer capable of providing a signal relating to the position of the carriage (20) and/or the pusher (21).

[0043] Said digital transducer can be a linear encoder device chosen from the group comprising: magnetic encoder, optical encoder, laser encoder, capacitive encoder, inductive encoder.

[0044] According to an embodiment of the invention, the compartments (14) are provided with a guide (19) whose longitudinal development corresponds to said main direction (F) and said digital transducer comprises at least one magnetic linear encoder (26) arranged parallel to said guide (19); furthermore, at least one element (28, 27) detectable magnetically by the encoder (26), fixed to said carriage (20) and/or to said pusher (21), is provided, which can be used to supply a signal relating to at least one linear measurement.

[0045] The vending machine can comprise: a first and a second encoder (26) arranged on opposite sides of said guide (19), a first magnetically detectable element (28) integral with said carriage (20) and placed in an interfering position with the first encoder (26), a second magnetically detectable element (27) integral with said pusher (21) and placed in an interfering position with the second encoder (26).

[0046] The vending machine can comprise a single encoder (26), a first magnetically detectable element (28) fixed to said carriage (20), a second magnetically detectable element (27) fixed to said pusher (21), and a device for excluding the reading of the second element (27) provided with means for removing the second element (27) from the encoder (26) in correspondence with an operating configuration corresponding to the contact between the carriage (20) and the pusher (21).

[0047] Said device for excluding the reading of the second element (27) can comprise an angled lever (24) hinged to the pusher (21) and connected to an appendage of the second element (27); one end (24B) of said lever (24) is turned towards said carriage (20) so as to be hit by the latter when the same carriage (20) is in contact with the pusher (21) so as to cause a rotation of the lever (24) adapted to move the second element (27) away from the encoder (26).

[0048] As previously described, the digital transducer can comprise at least one laser encoder (30) facing the longitudinal extension of said guide (19) to detect the position of said carriage (20) and/or said pusher (21).

[0049] Advantageously, a spring can be provided acting between a portion (19B) of said guide (19) and said

pusher (21) shaped and arranged so as to push the pusher (21) towards said outlet section (5). In particular, the spring (31) can be a band spring, or a greater friction can be determined between the pusher (21) and the guide (25) increasing the friction effect.

[0050] Furthermore, if each compartment (14) is equipped with an electronic card (29) acting on the means for detecting the position of the carriage and/or the pusher, all the electronic cards (29) of the vending machine (1) can be connected to a resident and/or remote central unit.

[0051] Advantageously, moreover, the pusher element (21) is provided with positioning means (31) in the compartment (14) which are distinct from the motor means (23) which move the carriage (20) inside the same compartment (14).

[0052] In practice, the details of execution can in any case vary in an equivalent manner in the shape, size, arrangement of the elements, nature of the materials used, without however departing from the scope of the idea of the solution adopted or of the inventive concept and therefore remaining within the limits of protection accorded by the claims.

Claims

1. Automatic vending machine, of the type comprising means for selecting one or more products to be dispensed and a plurality of compartments (14) intended for containing the products, in which the products are arranged in a row along a main direction, means being provided adapted to move the products along said main direction (D) towards an outlet section (5) which is crossed by the product for dispensing, vending machine (1) **characterized in that** it comprises:

- a pusher element (21) shaped so as to constrain one or more products placed inside a compartment (14) towards the said outlet section (5) in said main direction;
- a carriage (20) sliding under the action of motor means (23) along said main direction (D) to move said products along said main direction (D);
- means for detecting the position of the carriage and / or pusher comprising at least one digital position transducer capable of providing a signal relating to the position of the carriage (20) and / or the pusher (21).

2. Vending machine, according to claim 1, **characterized in that** said digital transducer is a linear encoder device of the magnetic type.

3. Vending machine, according to claim 1, **characterized in that** said digital transducer is a linear encoder device of the optical type.

4. Vending machine, according to claim 1, **characterized in that** said digital transducer is a laser linear encoder device.
5. Vending machine, according to claim 1, **characterized in that** said digital transducer is a linear encoder device of the capacitive type.
6. Vending machine, according to claim 1, **characterized in that** said digital transducer is a linear encoder device of the inductive type.
7. Vending machine, according to claim 1, **characterized in that** said compartments (14) are provided with a guide (19) whose longitudinal development corresponds to said main direction (D) and **in that** said digital transducer comprises at least one magnetic linear encoder (26) arranged parallel to said guide (19) and that at least one element (28, 27) is provided which can be magnetically detected by the encoder (26), fixed to said carriage (20) and/or to said pusher (21), usable to provide a signal relating to at least one linear measurement.
8. Vending machine, according to claim 7, **characterized in that** it comprises a first and a second encoder (26) arranged on opposite sides of said guide (19), a first magnetically detectable element (28) integral with said carriage (20) and placed in an interfering position with the first encoder (26), a second magnetically detectable element (27) integral with said pusher (21) and placed in an interfering position with the second encoder (26).
9. Vending machine, according to claim 7, **characterized in that** it comprises a single encoder (26), a first magnetically detectable element (28) fixed to said carriage (20), a second magnetically detectable element (27) fixed to said pusher (21), and a device for excluding the reading of said second element (27) provided with means for removing the second element (27) from the encoder (26) in correspondence with an operating configuration corresponding to the contact between said carriage (20) and said pusher (21).
10. Vending machine, according to claim 9, **characterized in that** said device for excluding the reading of said second element (27) comprises an angled lever (24) hinged to the pusher (21) and connected to an appendage of said second element (27), one end (24B) of said lever (24) facing towards said carriage (20) so as to be hit by the latter when the same carriage (20) is in contact with the pusher (21) so as to causing a rotation of the lever (24) apt to move the second element (27) away from the encoder (26).
11. Vending machine, according to claim 1, **characterized in that** said compartments (14) are provided with a guide (19) whose longitudinal development corresponds to said main direction (D) and **in that** said digital transducer comprises at least one laser encoder (30) directed towards the longitudinal development of said guide (19) to detect the position of said carriage (20) and/or said pusher (21).
12. Vending machine, according to one of the preceding claims, **characterized in that** said compartments (14) are provided with a guide (19) whose longitudinal development corresponds to said main direction (D) and **in that** an actuation means is provided to push the pusher (21) towards said outlet section (5) or to keep it adherent to the latter, said means being selected from the group comprising: a spring acting between a portion (19B) of said guide (19) and said pusher (21) shaped and arranged so as to push the pusher (21) towards said outlet section (5); a conformation of the portion of the pusher itself (21) intended for contact with the guide (19) able to determine a friction of a suitable value to block the pusher (21) along the guide (19).
13. Vending machine, according to claim 12, **characterized in that** the spring (31) is a band spring.
14. Vending machine, according to one of the preceding claims, **characterized in that** each compartment (14) is provided with an electronic card (29) acting on the means for detecting the position of the carriage and/or the pusher and **in that** all electronic boards (29) of the distributor (1) are connected to a resident and/or remote central unit.
15. Vending machine, according to one of the preceding claims, **characterized in that** said pusher element (21) is provided with positioning means (31) in the compartment (14) which are distinct from the motor means (23) which move the carriage (20) within the same compartment (14).

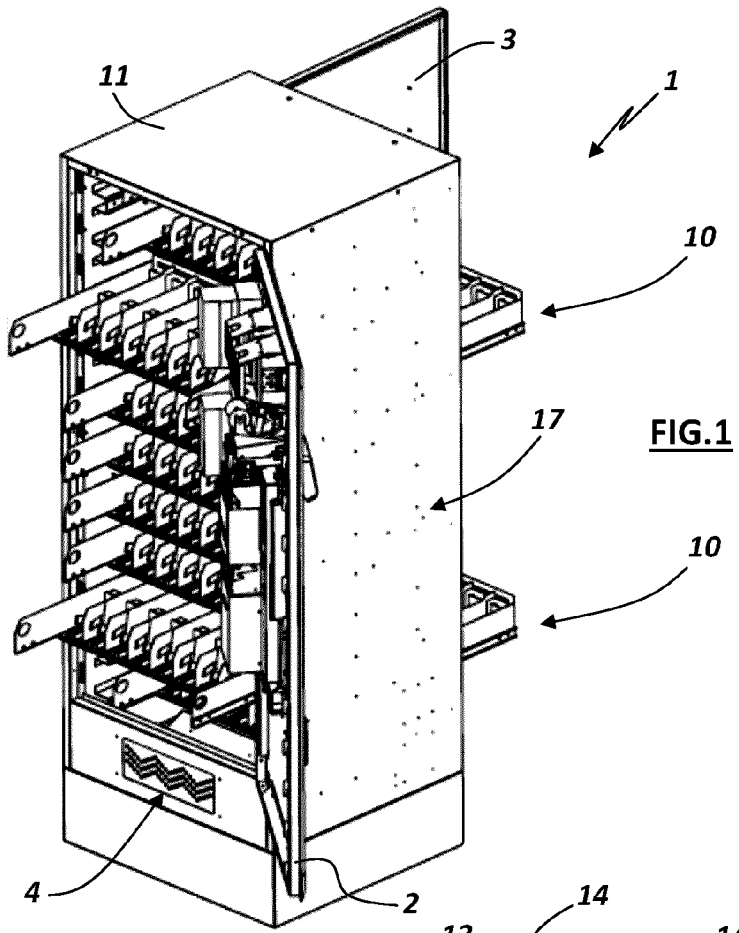


FIG.1

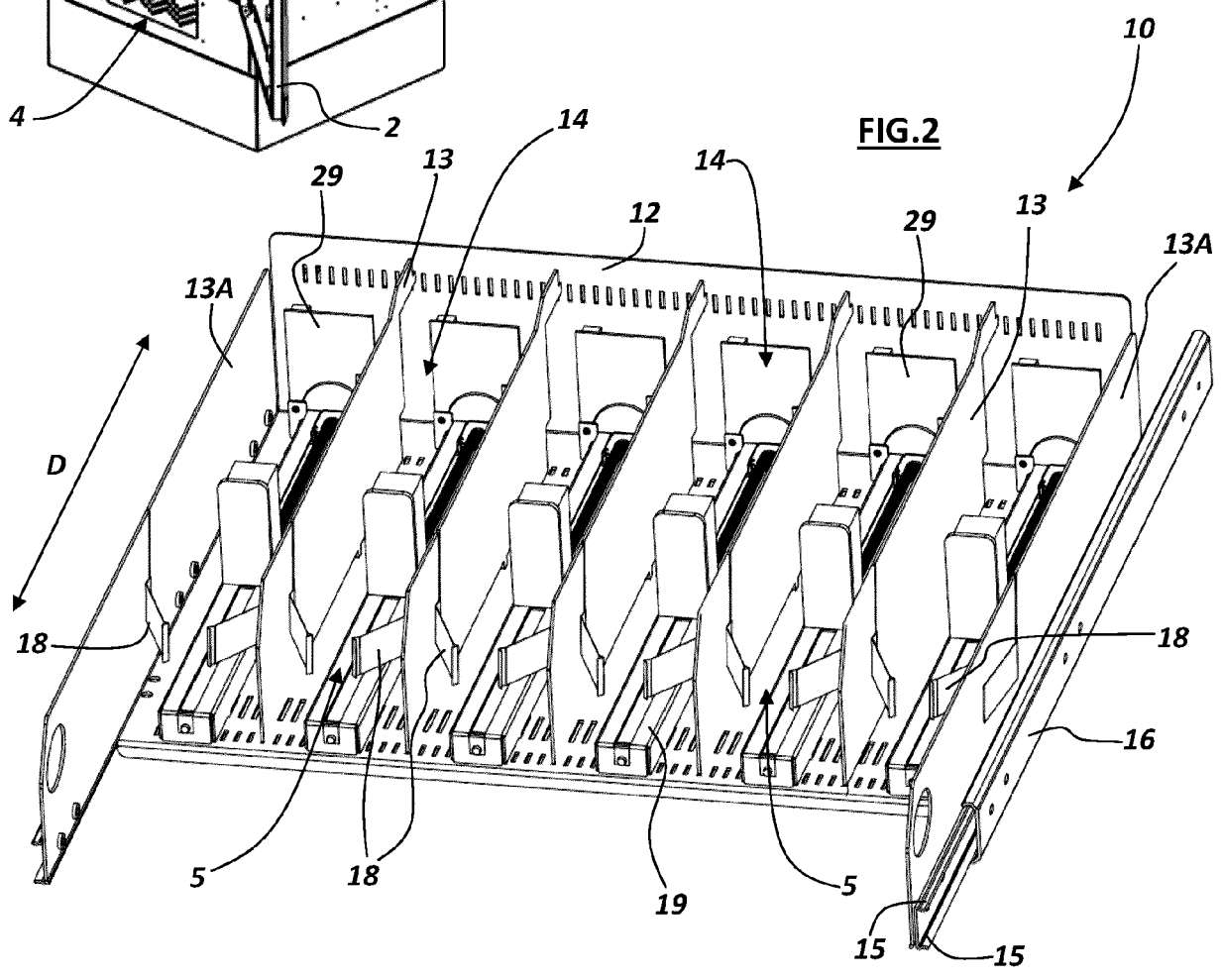
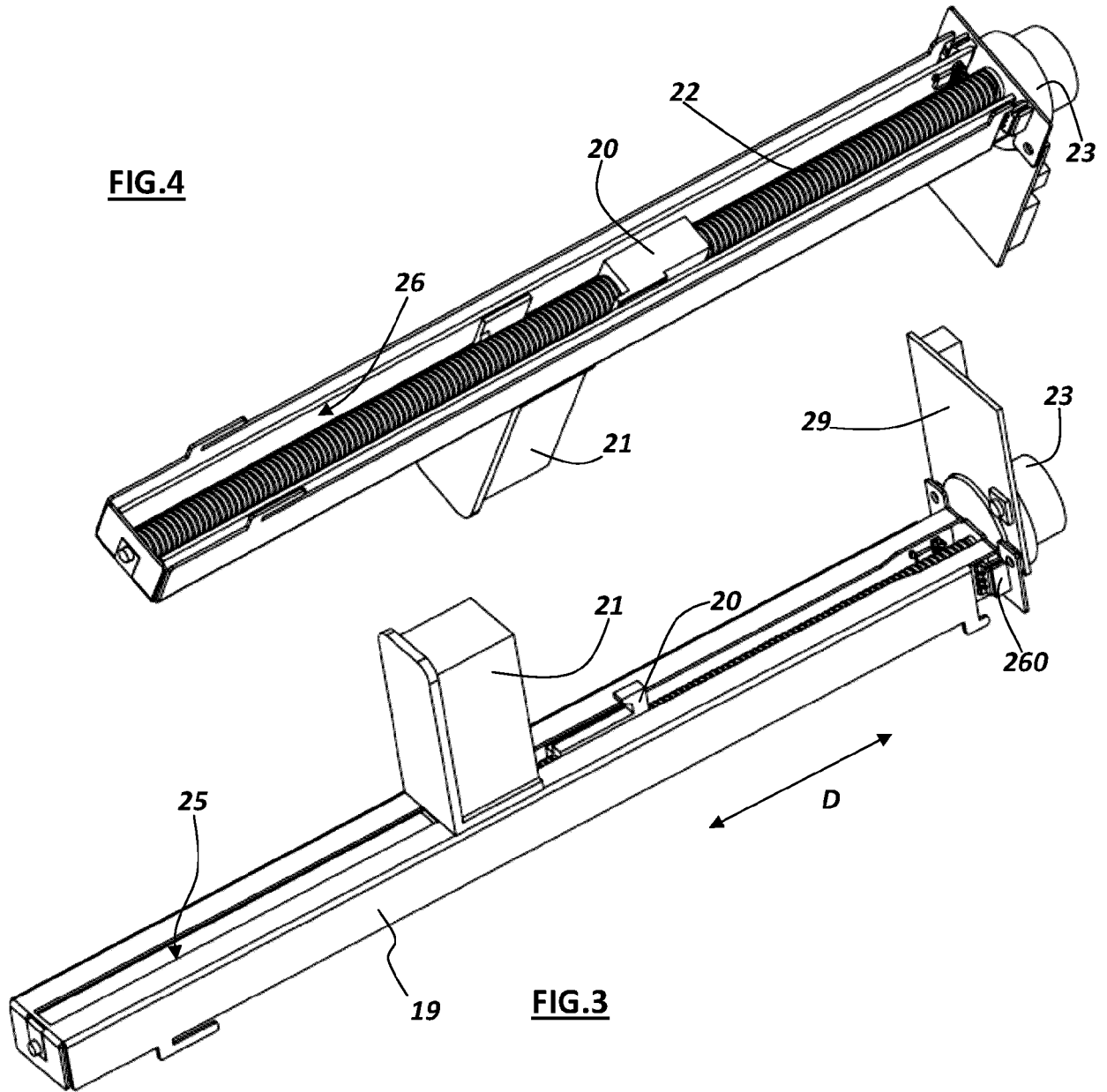


FIG.2



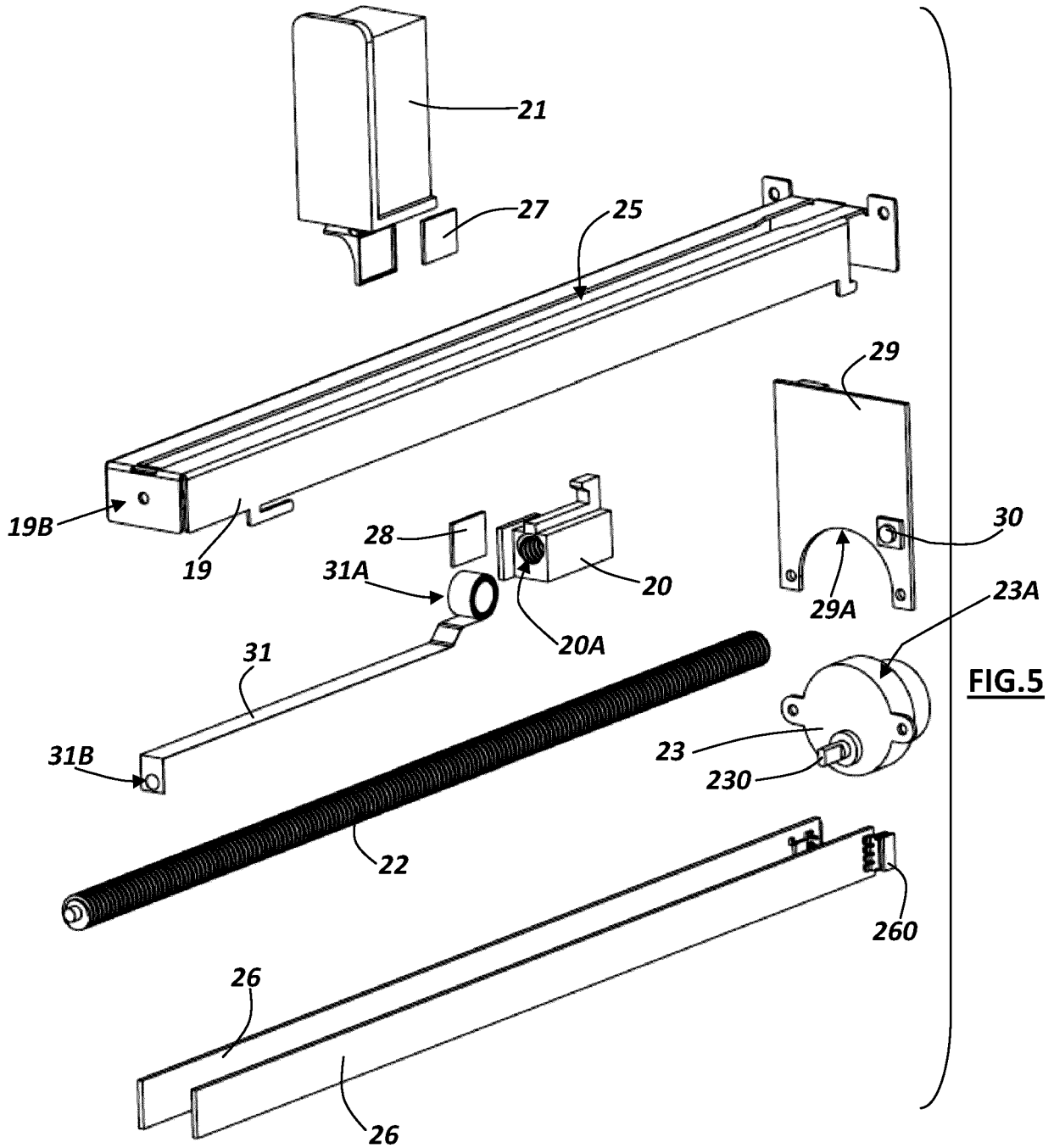


FIG.7

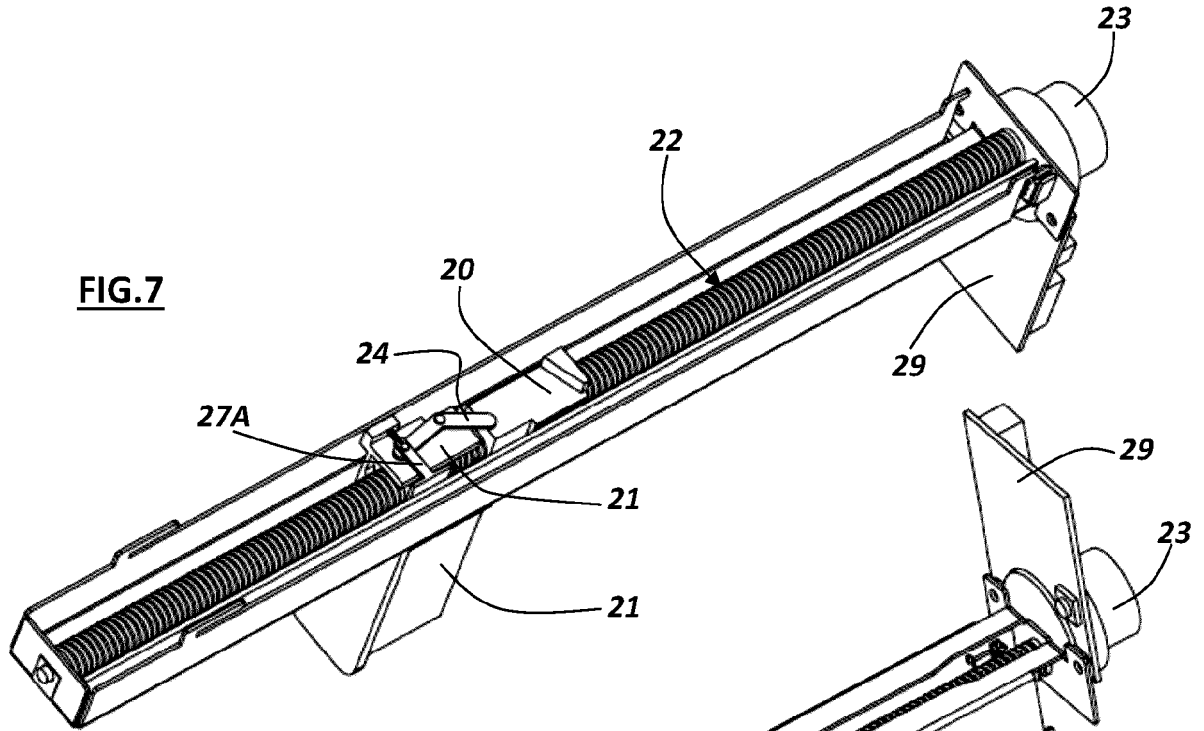
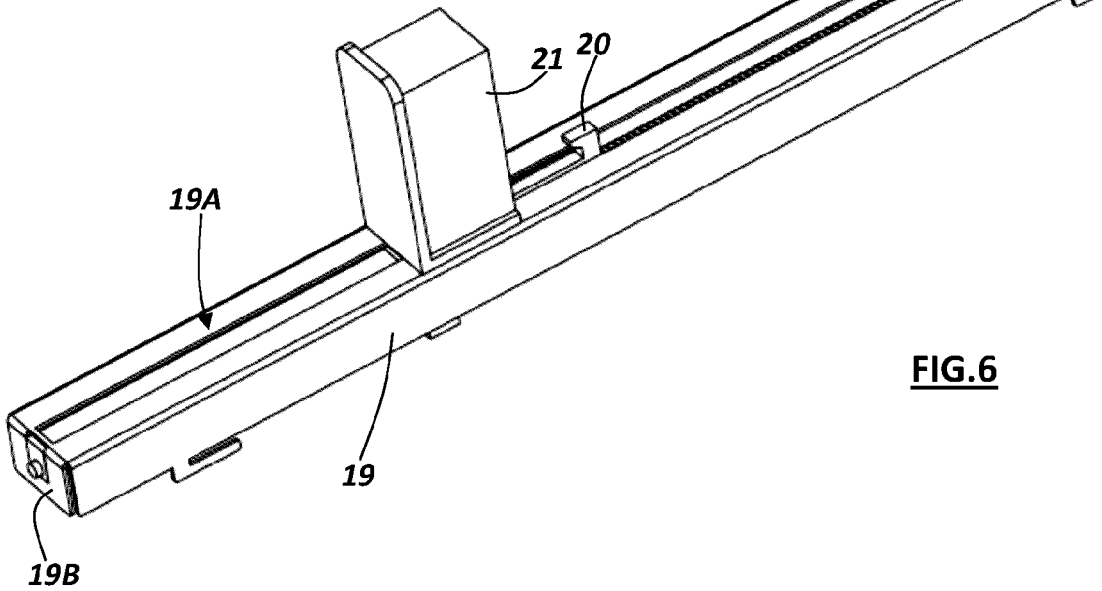


FIG.6



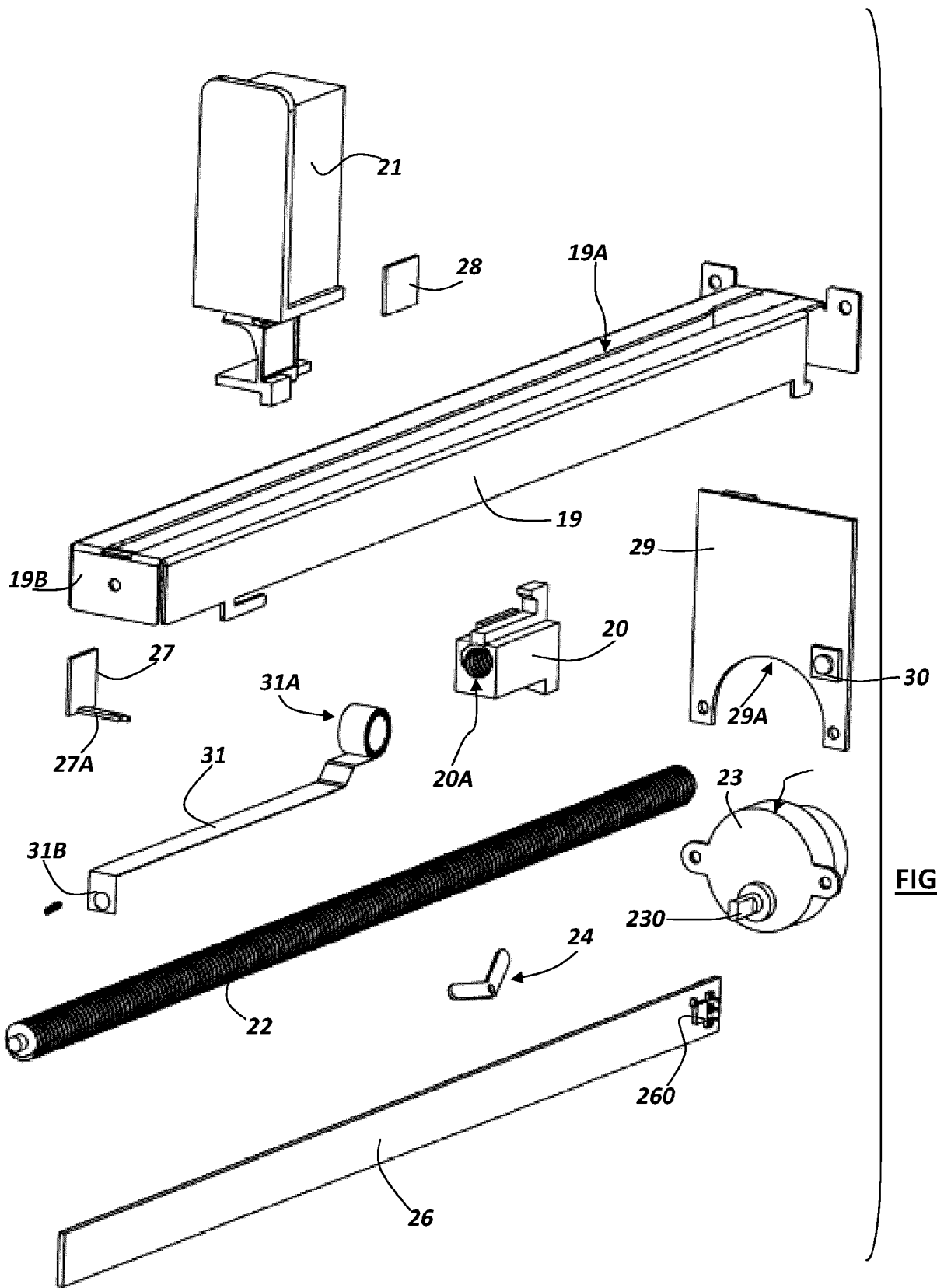


FIG.8

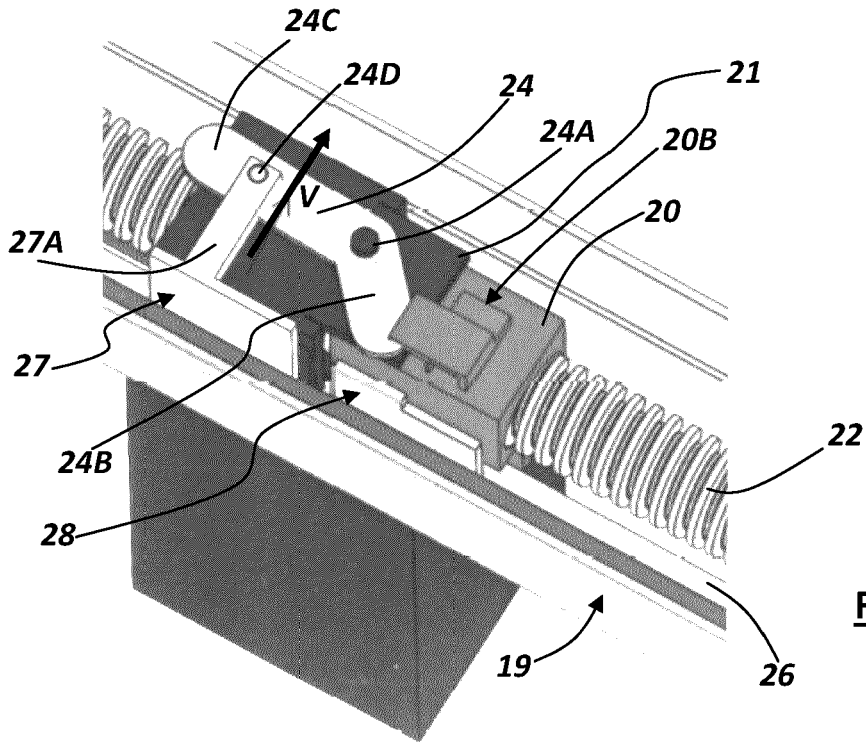


FIG.9

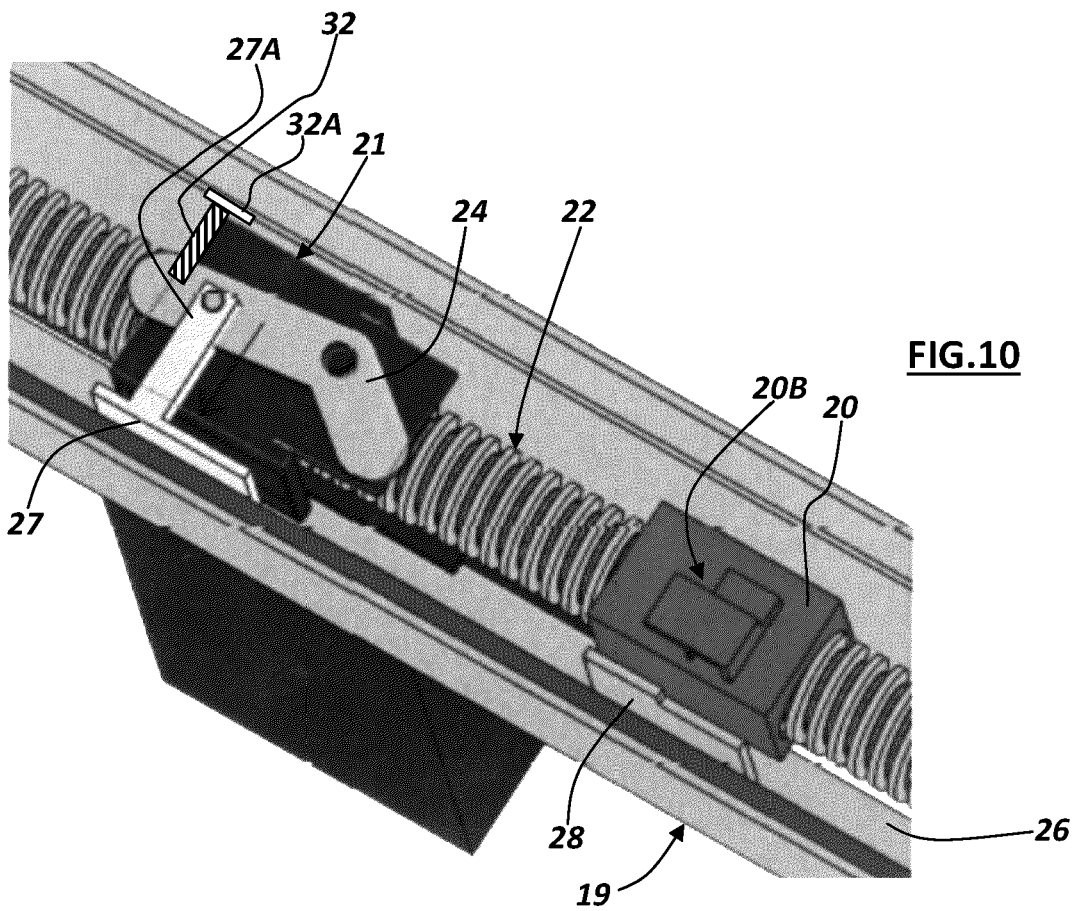


FIG.10

FIG.12

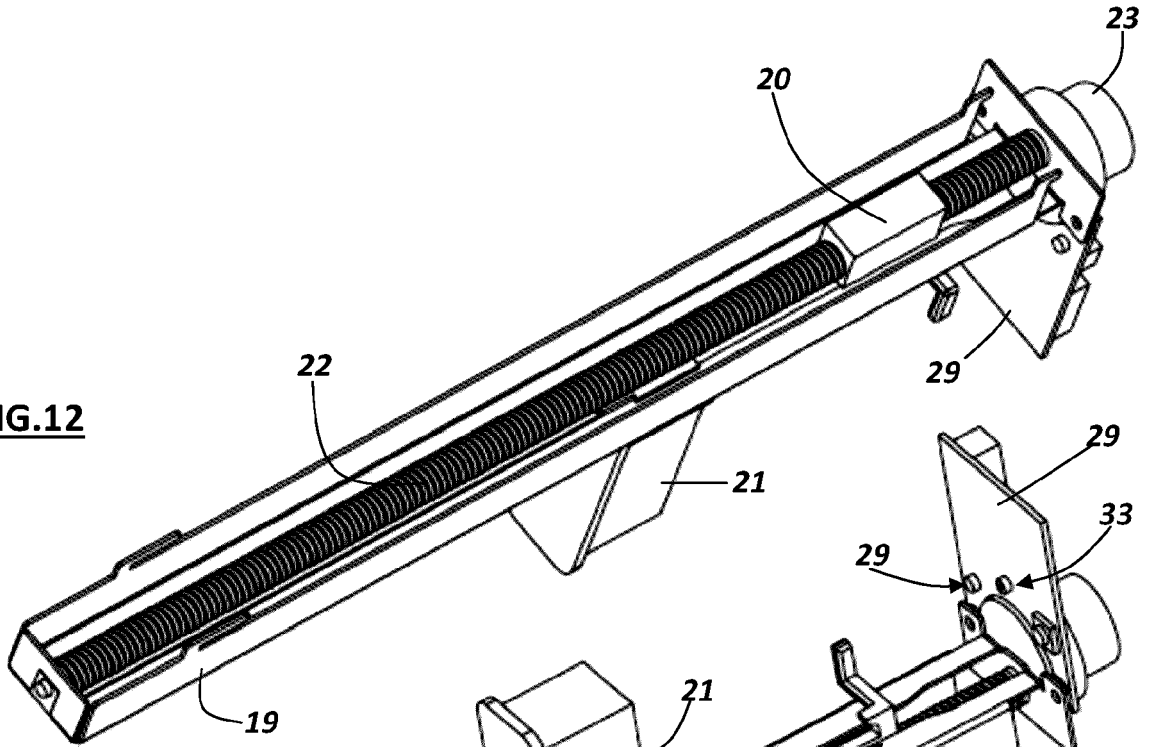
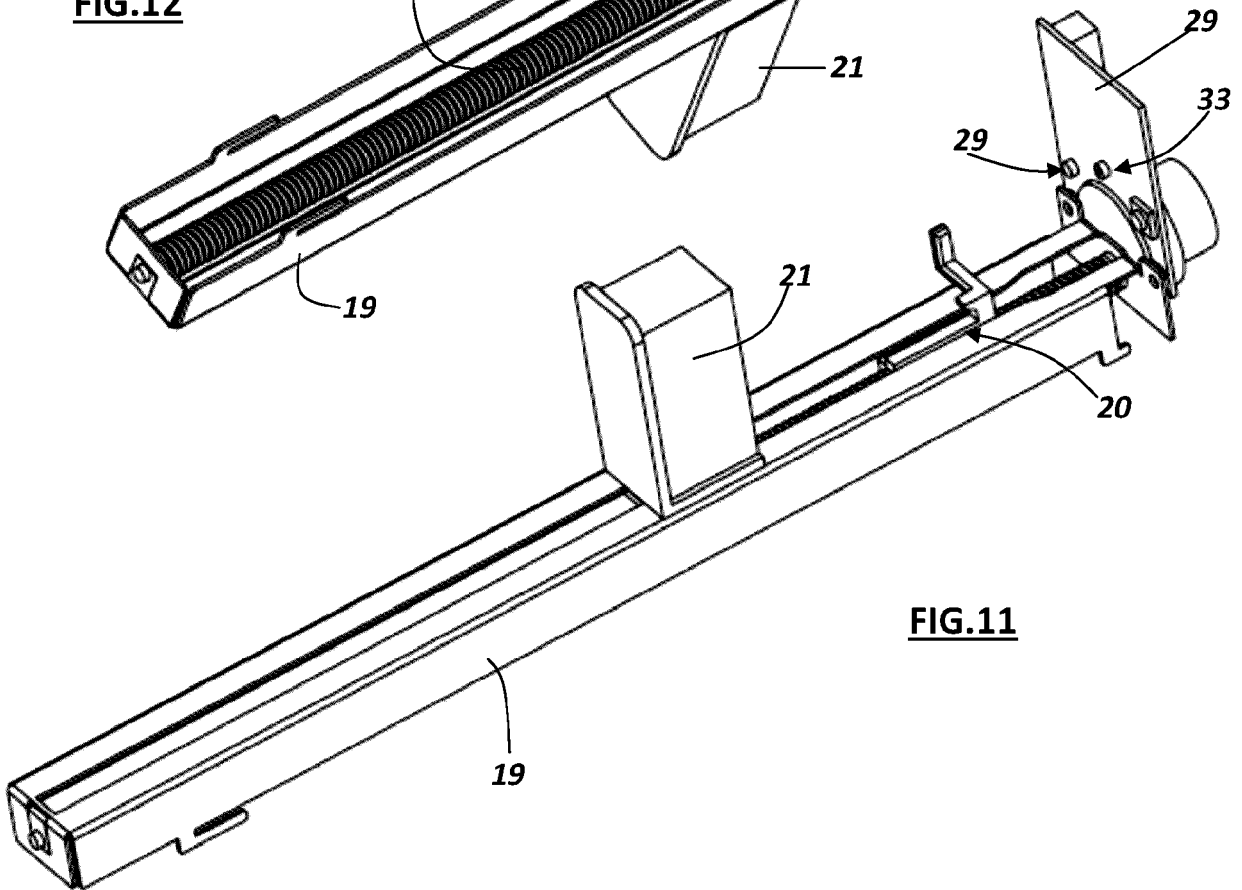


FIG.11



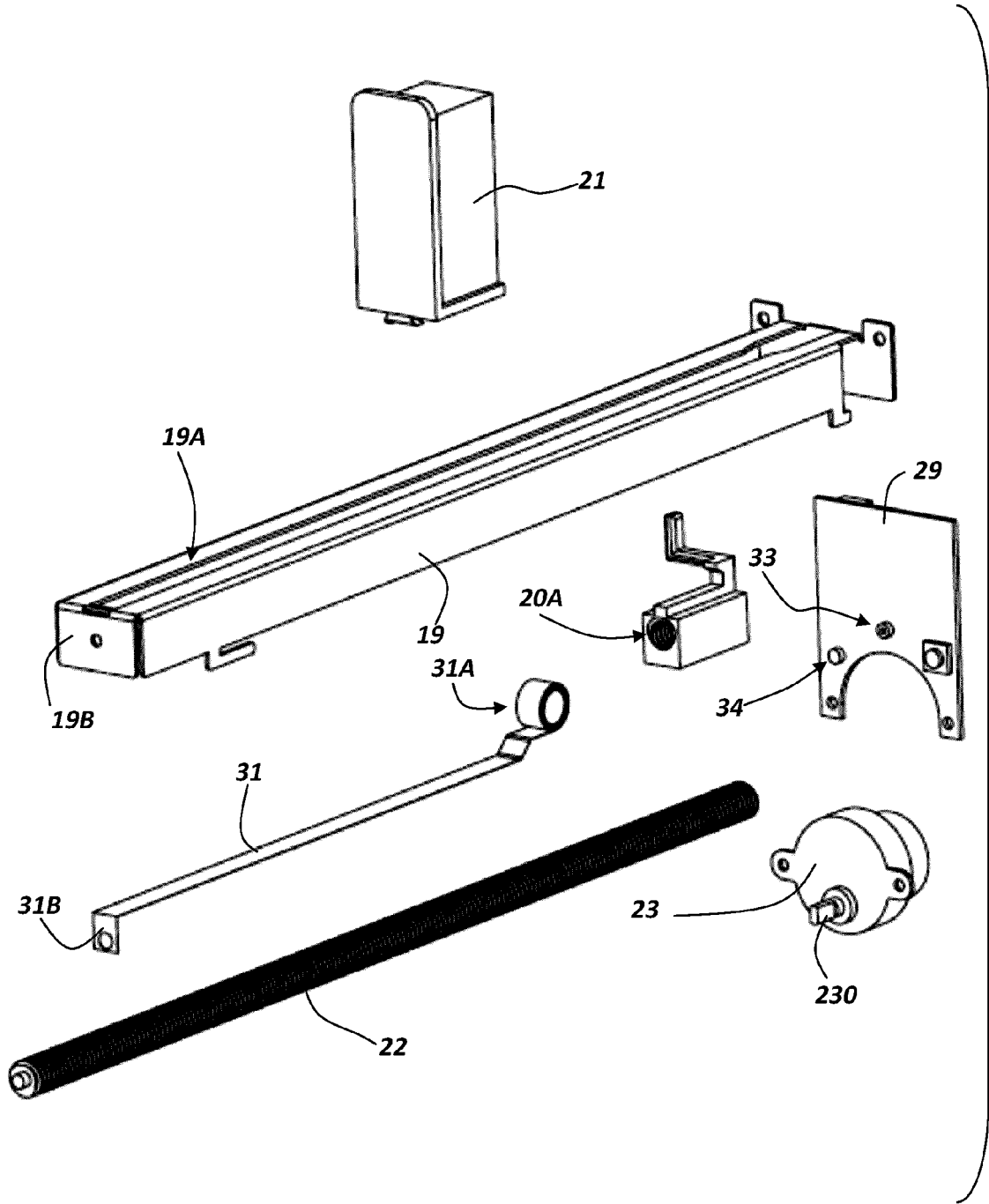


FIG.13



EUROPEAN SEARCH REPORT

Application Number

EP 22 02 0210

5

10

15

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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)
X	<p>EP 3 783 574 A1 (SHANDONG NEW BEIYANG INF TECH [CN] ET AL.) 24 February 2021 (2021-02-24) * figures 2, 3 * * paragraph [0003] * * paragraph [0009] * * paragraph [0016] - paragraph [0019] * * paragraph [0023] * * paragraph [0026] - paragraph [0027] *</p>	1-15	<p>INV. G07F9/02 G07F11/60 G07F11/42</p>
A	<p>US 2013/144433 A1 (LOCKWOOD THOMAS A [US] ET AL) 6 June 2013 (2013-06-06) * abstract * * paragraph [0046] - paragraph [0051] *</p>	1-15	<p>TECHNICAL FIELDS SEARCHED (IPC)</p> <p>G07F</p>
A	<p>EP 3 251 560 A1 (RTC IND INC [US]) 6 December 2017 (2017-12-06) * paragraph [0020] * * abstract * * paragraph [0070] *</p>	1-15	
<p>The present search report has been drawn up for all claims</p>			
<p>Place of search</p> <p>The Hague</p>		<p>Date of completion of the search</p> <p>27 June 2022</p>	<p>Examiner</p> <p>Coquil, David</p>
<p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document</p>			

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