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(54) APPARATUS FOR PACKAGING ONE OR MORE LAYERS OF ROD-SHAPED ARTICLES INTO A CONTAINER

(57) An apparatus is described (10) for packaging one or more layers of rod-shaped articles into a container (100). The apparatus comprises:
- a conveyor (20) for advancing a plurality of containers (100) along a feeding path (K);
- a hopper (40) for containing an accumulation of articles;
- a member (60) for extracting a layer of articles from the bottom of the hopper (40);
- at least one gripping unit (80) to pick up the layer of articles extracted from the hopper (40) and insert it inside a container (100) on the conveyor (20).

The gripping unit (80) comprises: a housing module (81), which provides a series of seats (81A) to receive an article in each; a series of sensors (84) for detecting the presence of articles in each seat (81A) of the housing module (81).

FIG. 1

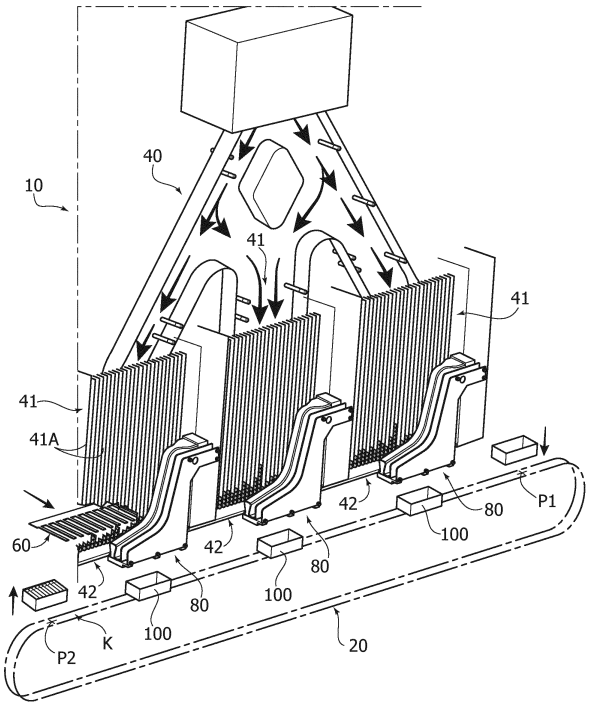

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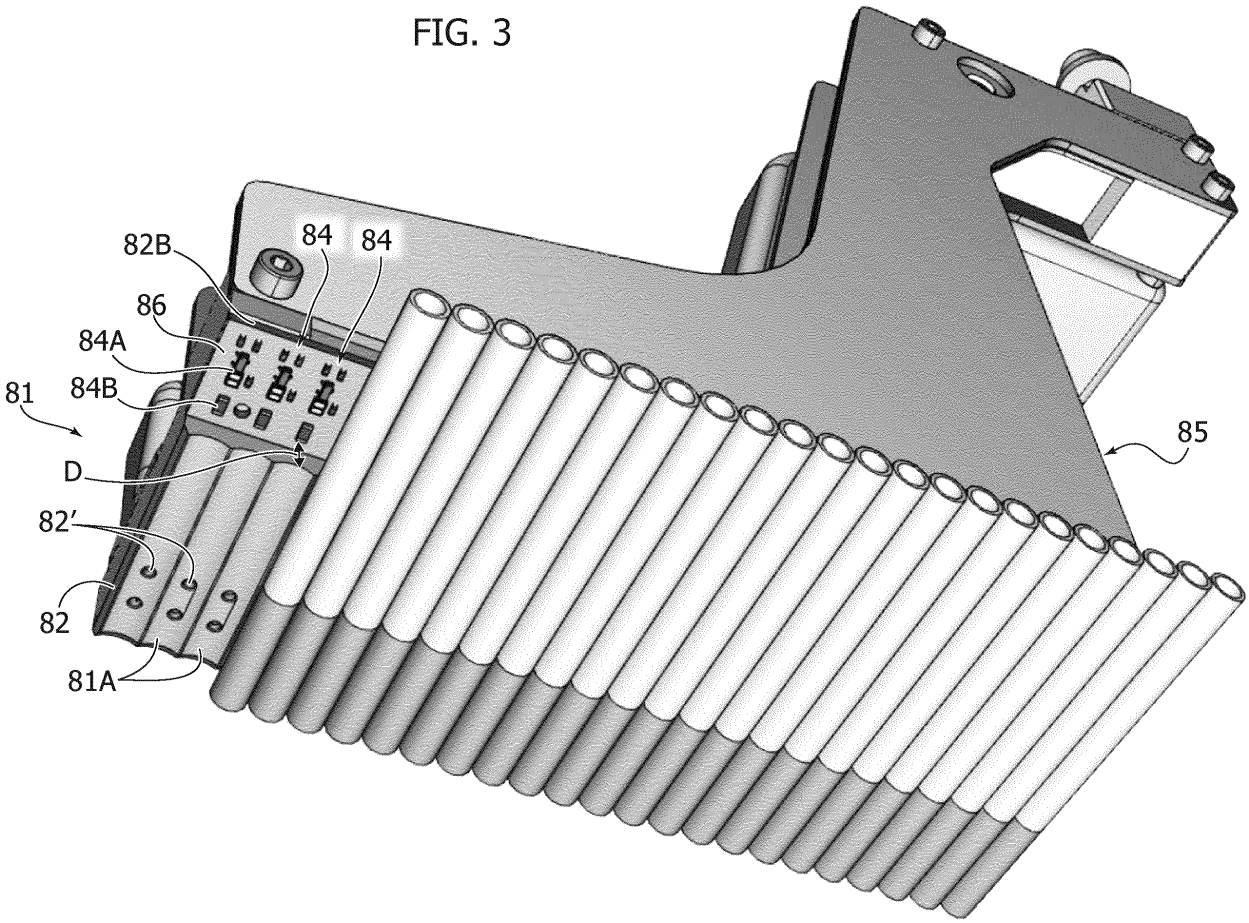
FIG. 3



Description

[0001] The present invention relates to an apparatus for packaging one or more layers of rod-shaped articles into a container. In particular, the proposed apparatus finds advantageous application in the tobacco sector, i. e. for packaging one or more layers of rod-shaped articles.

[0002] A known apparatus for packaging multiple layers of cigarettes inside a container includes:

- a conveyor for advancing a plurality of containers along a feeding path;
- a hopper to contain an accumulation of cigarettes; wherein, at least at one of its lower regions, the hopper is arranged with a plurality of vertical channels for subdividing the cigarettes into side-by-side columns of a width substantially equal to a cigarette;
- a member for extracting a layer of cigarettes from the bottom of the hopper;
- at least one gripping unit to pick up the layer of cigarettes extracted from the hopper, and to insert it inside a container on the transport line.

[0003] The gripping unit comprises: a housing module that provides a series of seats designed to receive, in each, a respective cigarette; and a frame which carries the housing module and which is movable between a pick-up position, wherein each seat receives a cigarette of the layer of cigarettes extracted from the hopper, and a release position wherein the cigarettes are released inside a container advanced along the feeding path.

[0004] During the operation of such an apparatus, it is necessary to verify that each layer of cigarettes deposited inside the container is complete, in order to check the quality of the packages made.

[0005] To this end, the use of a video camera has been proposed, which captures the layer of cigarettes deposited in the container, and of a control process based on algorithms designed to process the images taken by the video camera so as to determine the number of articles present in the layer deposited.

[0006] The Applicant has found a number of drawbacks in this known solution, in particular in relation to the reliability of the results provided and the setup of the system for each new application, which is somewhat laborious.

[0007] In this context, the present invention aims to provide a new solution that overcomes the aforesaid drawbacks. This object is achieved through an apparatus having the characteristics referred to in claim 1.

[0008] The present invention also relates to a method according to claim 8.

[0009] The claims form an integral part of the disclosure provided here.

[0010] Further characteristics and advantages of the present invention will become evident from the description that follows with reference to the attached drawings, provided purely by way of non-limiting example, wherein:

- Figure 1 represents an embodiment of the apparatus subject of the present invention;
- Figure 2 represents a detail of the apparatus of Figure 1;
- Figure 3 represents a preferred embodiment of the gripping unit of the apparatus of Figure 1 according to an axonometric view from below;
- Figure 4 represents the gripping unit of Figure 3, according to an axonometric view from above;
- Figure 5 schematically illustrates a control unit of the apparatus subject of the present invention.

[0011] In the following description various specific details are illustrated aimed at a thorough understanding of the embodiments. The embodiments may be implemented without one or more of the specific details, or with other methods, components, materials, etc. In other cases, known structures, materials or operations are not shown or described in detail to avoid obscuring various aspects of the embodiments.

[0012] The references used here are only for convenience and do not, therefore, define the field of protection or the scope of the embodiments.

[0013] As anticipated above, the solution described here relates to an apparatus for packaging one or more layers of rod-shaped articles into a container. For example, the apparatus described here can be used for the packaging of cigarettes, of the traditional type or of the heat-not-burn type, filter pieces, tobacco pieces, aerosol generating pieces, etc. Alternatively, the apparatus described here can be used for packaging straws.

[0014] In particular, the apparatus described here may be used to store rows of articles inside containers having a parallelepiped shape. In particular, the number of articles for each row is variable according to the size of the container.

[0015] With reference to the Figures, the apparatus described here, indicated as a whole with the reference number 10, comprises:

- a conveyor 20 for advancing a plurality of containers 100 along a feeding path K;
- a hopper 40 for containing an accumulation of articles;
- a member 60 for extracting a layer of articles from the bottom of the hopper 40; and
- a gripping unit 80 to pick up a layer of articles extracted from the hopper 40 and insert it inside a container 100 on the conveyor 20.

[0016] In one or more preferred embodiments, the hopper 40 comprises a plurality of sectors 41, side-by-side along the feeding path K, which define respective side outlets 42, obtained on the bottom of the hopper 40.

[0017] In a per se known manner, in one or more preferred embodiments, such as the one illustrated, each

sector 41 is arranged, at least at a lower region thereof, with a plurality of vertical channels 41A for subdividing the articles into side-by-side columns of width substantially equal to one article, and so as to feed to the respective outlet 42, a succession of ordered layers of articles, which are found superimposed on each other inside the channels 41.

[0018] The extractor member 60 may be single and may operate, alone, on all outlets 42 of the hopper 40. Alternatively, the apparatus may comprise a plurality of extractor members 60, each associated with a respective outlet 42.

[0019] Still in a per se known manner, the extractor member 60 is preferably a pusher member movable horizontally according to an alternating motion, to engage the layer of articles that is located at the single outlet 42 and to push it out of the hopper 40 to deliver it to the gripping unit 80. Incidentally, it will be noted that once the layer of articles has come out of the hopper, the layer of articles immediately above it descends by gravity, positioning itself at the outlet 42.

[0020] In one or more preferred embodiments, such as the one illustrated, the apparatus 10 comprises a plurality of gripping units 80 for picking up the layers of articles extracted from the various outlets 42, and arranging them inside respective containers 100, which are located in corresponding positions, along the feeding path K.

[0021] Preferably, the conveyor 20 is arranged to determine a feeding path K comprising at least one straight and horizontal section that passes alongside the different sectors 41 of the hopper 40. During operation, the conveyor 20 (which advances stepwise) operates to receive the empty containers 100 at a position PI from an upstream line (not shown), to bring a container 100 to the various gripping units 80 in succession, and finally transferring each filled container 100 to a delivery position P2 of the container 100 to a downstream line (not shown). At each sector 41 of the hopper 40, the container 100 receives several layers of articles from the respective gripping unit 80, until the container 100 is filled. In accordance with the illustrated embodiment, the apparatus 10 allows simultaneous filling of three different containers 100. It is understood that the number of containers 100 that can be filled at the same time may vary with respect to that illustrated from 1 up to a certain number.

[0022] The conveyor 20 may be of a known type; for example, it may comprise a conveyor belt, a roller track, a sliding channel with a driving belt, etc.

[0023] With reference now to Figures 3 and 4, each gripping unit 80 comprises:

- a housing module 81, which provides a series of seats 81A arranged to receive, in each, a respective article;
- a frame 85, which carries the housing module 81 and which is movable between a pick-up position, wherein each seat 81A receives one article of the layer of articles extracted from the hopper 40, and a release position, wherein the articles are released inside a container 100 arranged on the conveyor 20.

[0024] In one or more preferred embodiments, such as the one illustrated, the pick-up position is a position wherein the seats 81A are found substantially on the same horizontal plane as the outlet 42 of the hopper 40, so as to be able to directly receive the layer of articles extracted from the hopper 40 by means of the horizontal movement of said layer caused by the extractor member 60.

[0025] The release position is, instead, a position (lower than the withdrawal position) wherein the layer of articles housed in the seats 81A is positioned inside the container 100 and released there.

[0026] In one or more preferred embodiments, such as that illustrated, the housing module 81 comprises a support 82, on which the plurality of seats 81A is formed. The support 82 has a plurality of holes 82' which put each seat 81A in communication with an air intake duct 83 arranged on the same gripping unit 80, in particular, fixed to the mobile frame 85. Valve means (not illustrated) control the communication between an external suction source and the intake duct 83.

[0027] During operation, the air intake through the holes 82' serves to retain the articles inside the respective seats 81A. Preferably, the air intake is activated at least starting from when the extractor member 60 begins to push the layer of articles out of the hopper 40, so that these can be retained by the gripping unit 80 as soon as the support given by the bottom of the hopper 40 is missing.

[0028] According to an important characteristic of the apparatus described here, the gripping unit 80 comprises a series of sensors 84 to detect the presence of articles in each seat 81A of the housing module 81.

[0029] By means of these sensors 84, the apparatus described here is able to verify whether the layer of articles picked up is complete or not.

[0030] Thanks to the fact that a sensor 84 is provided for each seat 81A, the solution described here guarantees high reliability of the results of the control carried out on the number of articles picked up by the gripping unit 80. Furthermore, since the sensors 84 are carried by the same gripping unit 80, the detection of the articles is not influenced by external conditions, such as, for example, ambient lighting or any obstacles that may cover the view of the articles.

[0031] In one or more preferred embodiments, the apparatus described here comprises at least one control unit 11 - Figure 5 - to determine an indicative value of the number of articles present in the seats 81A of the housing module 81, as a function of at least one signal generated by the series of sensors 84, and to associate a conformity/non-conformity code Y, N with the container 100 in which the layer of articles is inserted, on the basis of the determined value.

[0032] In particular, in one or more preferred embodi-

ments, the control unit compares the aforesaid determined value with at least one reference threshold Si, and associates a conformity code Y with the container 100, if the determined value is greater than or equal to the reference threshold Si, and a non-conformity code N, if the determined value is below the reference threshold Si.

[0033] In one or more embodiments, it is possible to provide a first reference threshold corresponding to the number of articles of a complete layer of articles, and a second reference threshold corresponding to a minimum acceptable number of articles. Furthermore, it is possible to provide two distinct compliance codes, the first to be assigned in cases where the number of articles determined is equal to the first threshold, and the second to be assigned in cases where the number of articles determined is less than the first threshold and greater than or equal to the second threshold. The non-compliance code is, on the other hand, assigned when the number of articles determined is less than the second threshold.

[0034] The non-compliant container 100 may be destined for rejection.

[0035] In one or more preferred embodiments, such as that illustrated, the series of sensors 84 is arranged on the housing module 81, preferably according to an arrangement such that a respective sensor 84 is positioned adjacent to each seat 81A.

[0036] Preferably, the gripping unit 80 comprises an electronic board 86, which is fixed to the support 82 and carries the series of sensors 84.

[0037] With reference to Figure 3, in one or more preferred embodiments, such as that illustrated, the support 82 comprises, at the bottom, a first side 82A facing downwards, on which the seats 81A are formed, and a second side 82B also facing downwards, which extends parallel to the first side 82A and on which the electronic board 86 is fixed. The side 82B is set back with respect to the side 82A (in the direction perpendicular to the same side), so that a given distance D is obtained between the sensors 84 and the articles received in the seats 81A.

[0038] In one or more preferred embodiments, such as that illustrated, each sensor 84 comprises an electromagnetic wave emitter module, 84A, for emitting electromagnetic waves against an article received in the corresponding seat 81A of the housing module 81, and a receiver module 84B for detecting the electromagnetic waves reflected by the same article.

[0039] Those skilled in the art will understand that the aforesaid distance D between the sensors 84 and the articles received in the seats 81A is selected so as to ensure the incidence of the waves reflected by the single article on the corresponding receiver module 84B.

[0040] In one or more preferred embodiments, such as that illustrated, the mobile frame 85 carries electrical/electronic components 88 on it for connecting the electronic card 86 to an external control unit and to a power supply network.

[0041] In one or more preferred embodiments, the housing module 81 is mounted on the movable frame 85 by means of quick connection means, and is interchangeable with other housing modules of different format. In particular, it is possible to provide a series of housing modules 81 which vary, from each other, for example, in the number and/or dimensions of the seats 81A and, correspondingly, in the number of sensors 84 and their reciprocal distance. These housing modules may be arranged for packaging articles of different types and/or for packaging articles in packages of different dimensions (in this case, the number of articles of each layer varies).

[0042] According to these preferred embodiments, the apparatus may be prepared for a new application in a simple and fast way, by replacing the previously used housing module 81, with the housing module 81 intended for the new application.

[0043] Preferably, the aforesaid quick connection means are arranged to create both a mechanical and electrical connection between the frame 85 and the housing module 81; they can, for example, comprise quick release fastening members, for example by means of a lever or button.

[0044] Of course, without prejudice to the principle of the invention, the details of construction and the embodiments may vary, even significantly, with respect to those illustrated here, purely by way of non-limiting example, without departing from the scope of the invention as defined by the attached claims.

Claims

1. An apparatus (10) for the packaging of one or more layers of rod-shaped articles inside a container (100), the apparatus comprising:

   - a conveyor (20) for advancing a plurality of containers (100) along a feeding path (K);
   - a hopper (40) for containing an accumulation of articles; wherein, at least at one of its lower regions, the hopper is arranged with a plurality of vertical channels (41A) for subdividing the articles into side-by-side columns of a width substantially equal to an article;
   - a member (60) for extracting a layer of articles from the bottom of the hopper (40);
   - at least one gripping unit (80) to pick up the layer of articles extracted from the hopper and insert it inside a container (100) on the conveyor (20),

   wherein the gripping unit (80) comprises: a housing module (81) that provides a series of seats (81A) designed to receive, in each, a respective article; and a frame (85), which carries the housing module (81), and which is movable between a pick-up position, wherein each seat (81A) receives an article of the layer of articles extracted from the

bottom of the hopper, and a release position wherein the articles are released inside a container (100) advanced along the feeding path (K);
said apparatus (10) **characterized in that** said gripping unit (80) comprises a series of sensors (84) to detect the presence of articles in each seat (81A) of the series of seats of the housing module (81) of the gripping unit (80).

2. An apparatus according to claim 1, wherein said series of sensors (84) is arranged on the housing module (81).

3. An apparatus according to claims 1 or 2, wherein said housing module (81) comprises a support (82) on which the plurality of seats (81A) is made, and wherein the gripping unit (80) comprises an electronic board (86), which is fixed to the support (82) and carries the series of sensors (84).

4. An apparatus according to claim 3, wherein the gripping unit (80) comprises an air intake duct (83) and wherein the support (82) provides a plurality of holes (82'), which connect each seat (81A) of the series of seats with the air intake duct (83).

5. An apparatus according to any one of the preceding claims, wherein each sensor (84) of the series of sensors comprises an electromagnetic wave emitting module (84A) for emitting electromagnetic waves against an article received in a corresponding seat (81A) of the housing module, and a receiver module (84B) for detecting electromagnetic waves reflected from the article received in the corresponding seat (81A) of the housing module (81).

6. An apparatus according to any one of the preceding claims, comprising at least one control unit (11) for determining a value indicative of the number of articles present in the series of seats of the housing module (81), as a function of at least one signal generated by the series of sensors, and to associate a conformity/non-conformity code (Y, N) with the container (100) in which the layer of articles is inserted, on the basis of the determined value.

7. An apparatus according to any of the preceding claims, wherein the housing module (81) is mounted in the gripping unit (80) with quick connection means and is interchangeable with one or more housing modules of different format.

8. A method for packaging one or more layers of rod-shaped articles inside a container (100), the method comprising the steps of:

- conveying a plurality of containers (100), in succession, along a feeding path (K);
- arranging an accumulation of articles in a hopper (40), and at least at a lower region of the hopper (40) subdividing the articles into side-by-side columns of a width substantially equal to one article;
- extracting one layer of articles at a time from the bottom of the hopper (40);
- picking up the layer of articles extracted from the hopper (40) by means of a gripping unit (80), wherein the gripping unit (80) comprises: a housing module (81) that provides a series of seats (81A) designed to receive, in each, a respective article; and a frame (85), which carries the housing module (81) and which is movable between a pick-up position, wherein each seat (81A) receives an article of the layer of articles extracted from the hopper, and a release position wherein the articles are released inside a container (100) advanced along the feeding path (K);
- moving the gripping unit (80) from the pick-up position to the release position and inserting the layer of articles inside a container (100) advanced along the feeding path (K);
the method being **characterized in that** it comprises the step of detecting, by means of a series of sensors (84) the presence of articles in each seat (81A) of the series of seats of the housing module (81) of the gripping unit (80).

9. A method according to claim 8, wherein the step of detecting, by means of a series of sensors (84), the presence of articles in each seat (81A) of the series of seats of the housing module (81) of the gripping unit (80) is performed during the step of moving the gripping unit (80) from the pick-up position to the release position.

10. A method according to claims 8 or 9, which includes the steps of:

determining a value indicative of the number of articles present in the series of seats (81A) of the housing module (81), as a function of at least one signal generated by the series of sensors; and
associating a conformity/non-conformity code (Y, N) with the container (100) in which the layer of articles is inserted, on the basis of the determined value.

11. A method according to claim 10, which includes the step of comparing the determined value with at least one reference threshold (Si), and associating a conformity code (Y) with the container (100), if the determined value is greater than the reference thresh-

old (Si), and a non-compliance code (N), if the determined value is below the reference threshold (Si).

FIG. 1

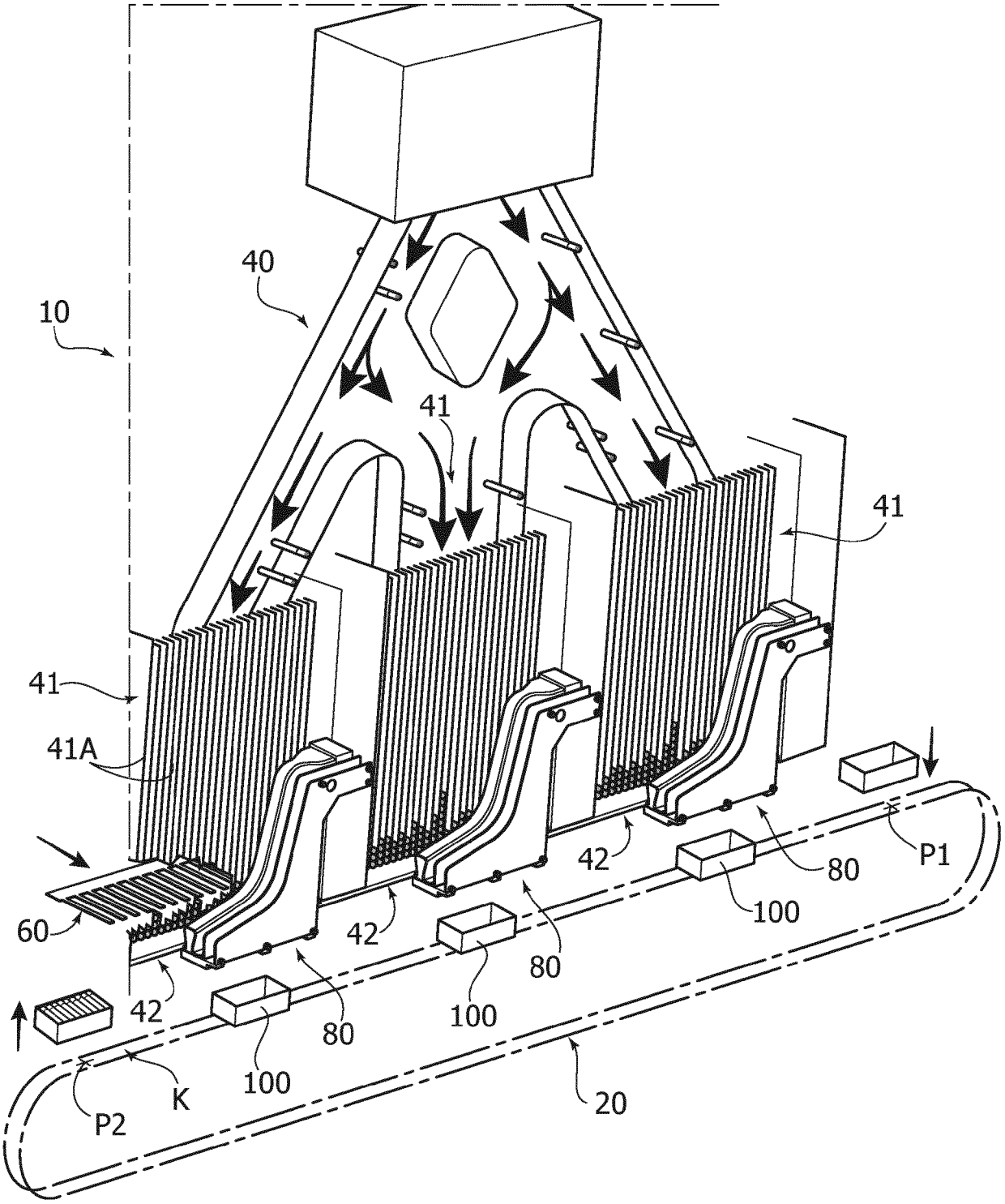


FIG. 2

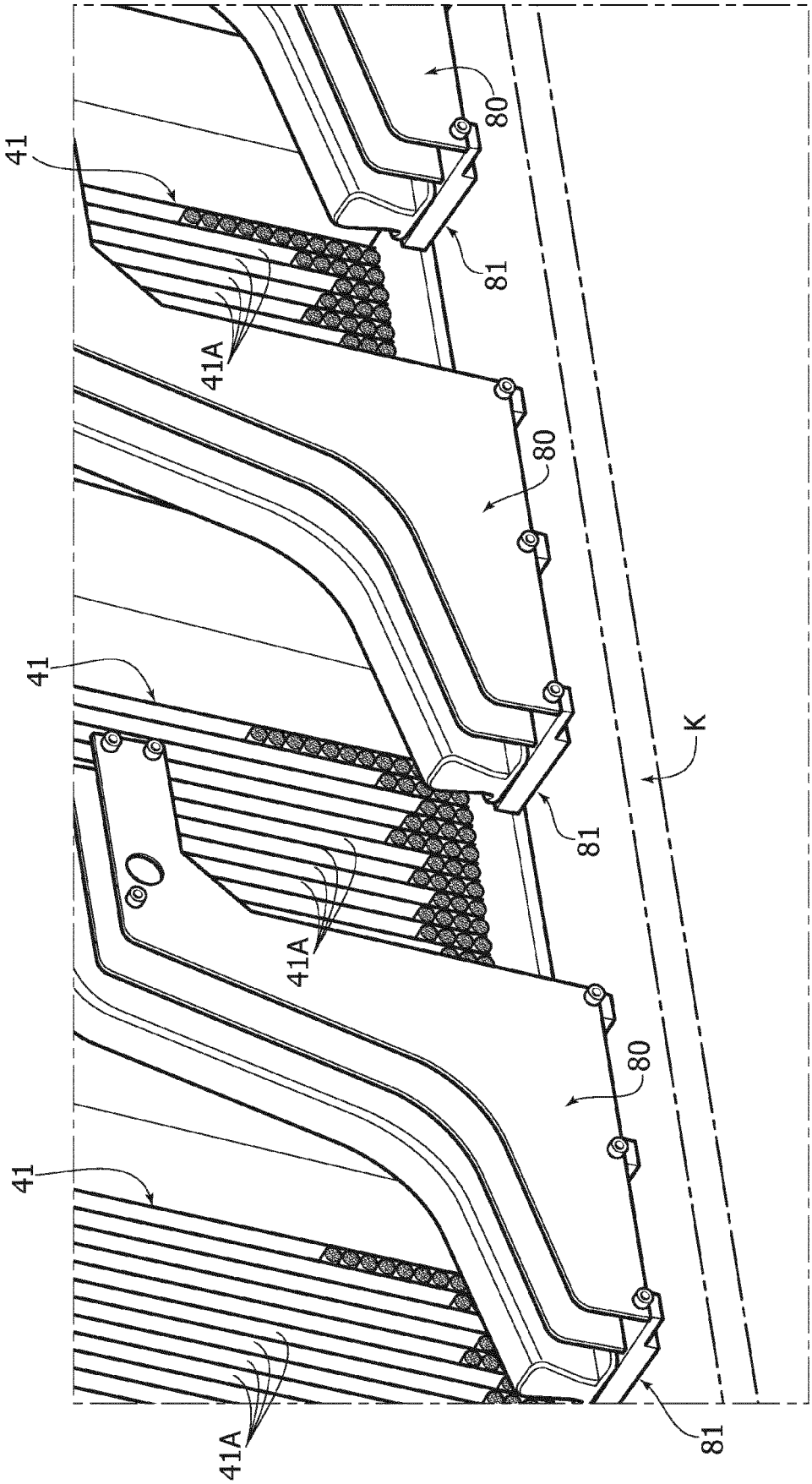


FIG. 3

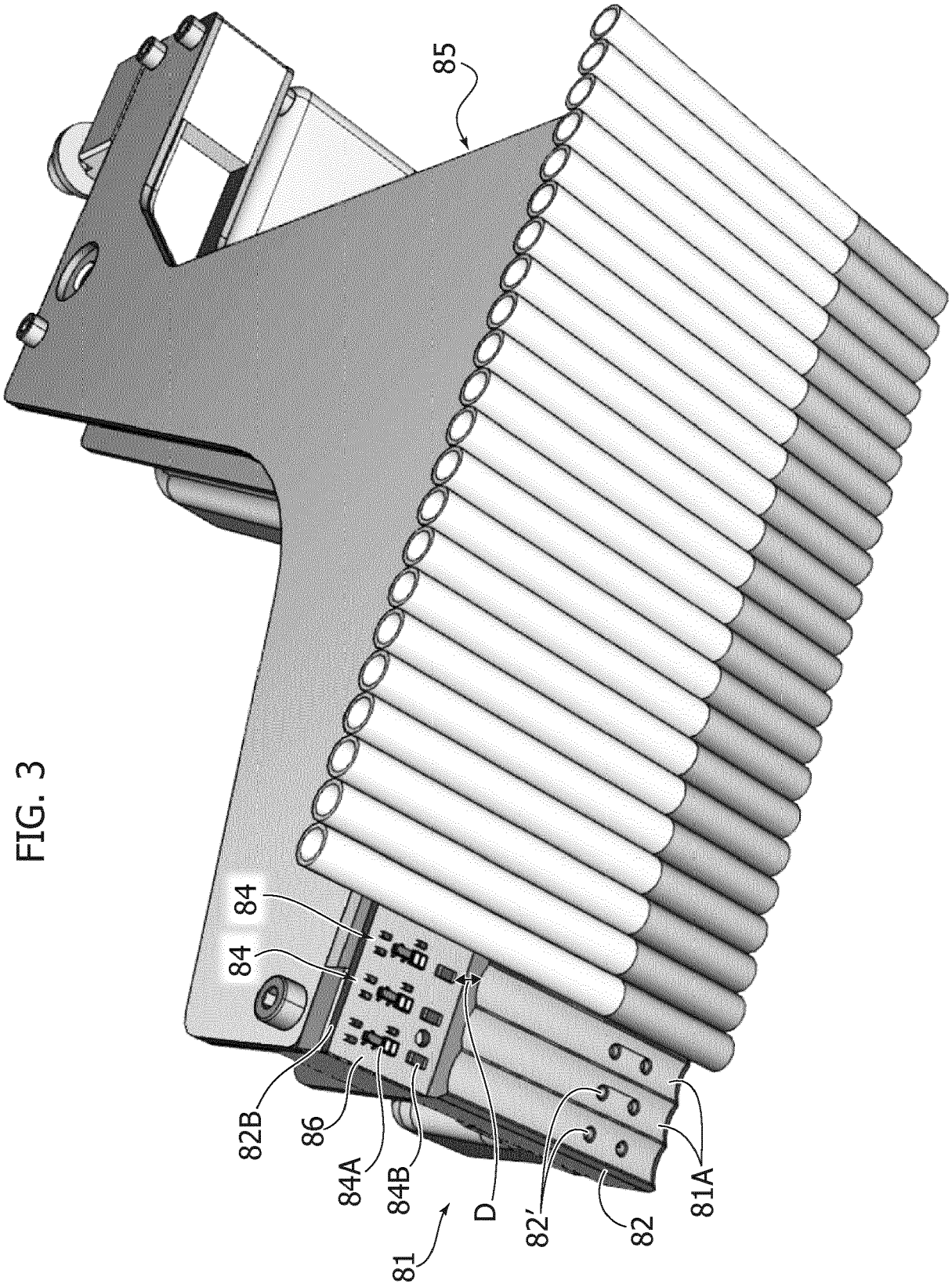


FIG. 4

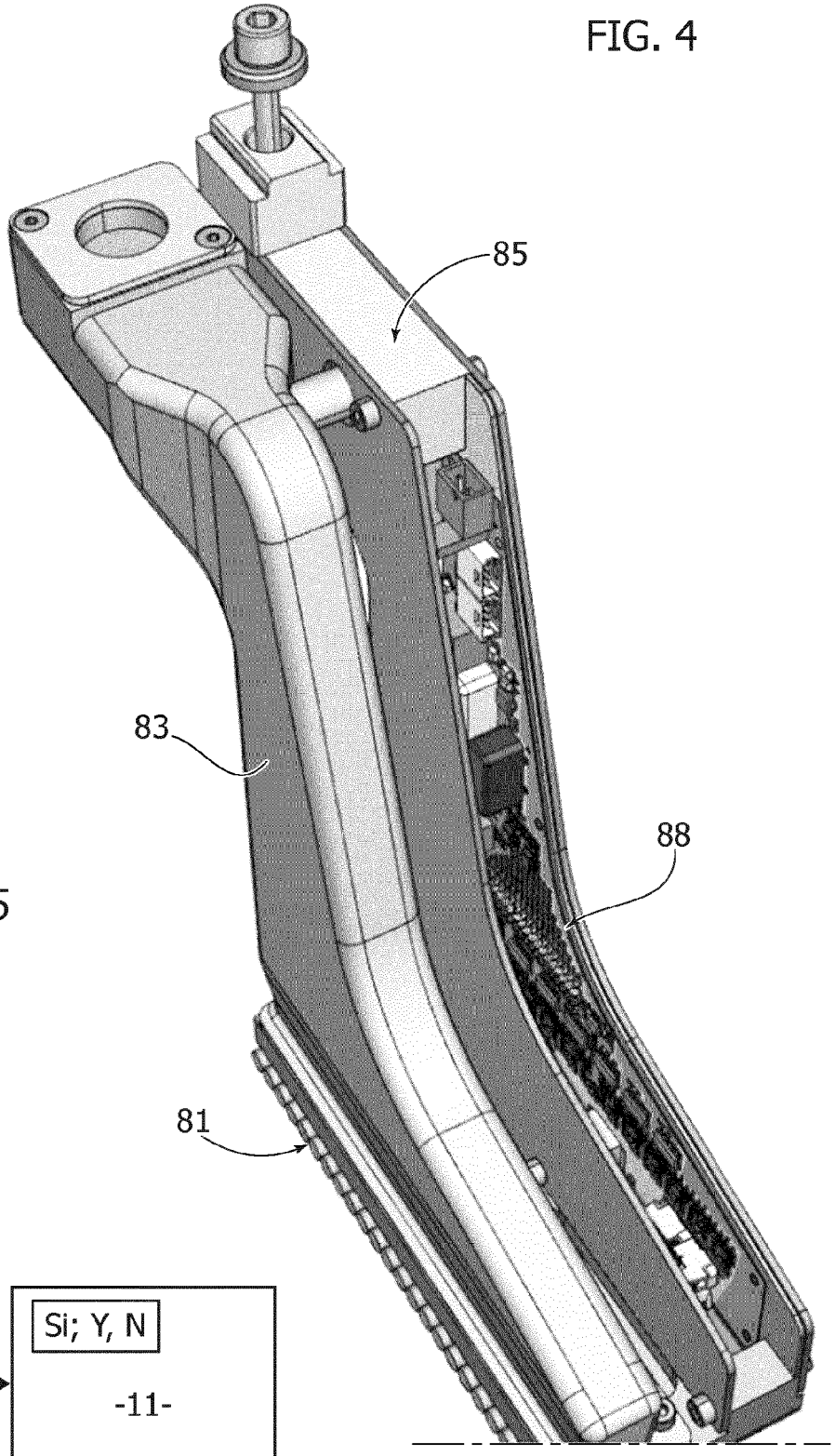
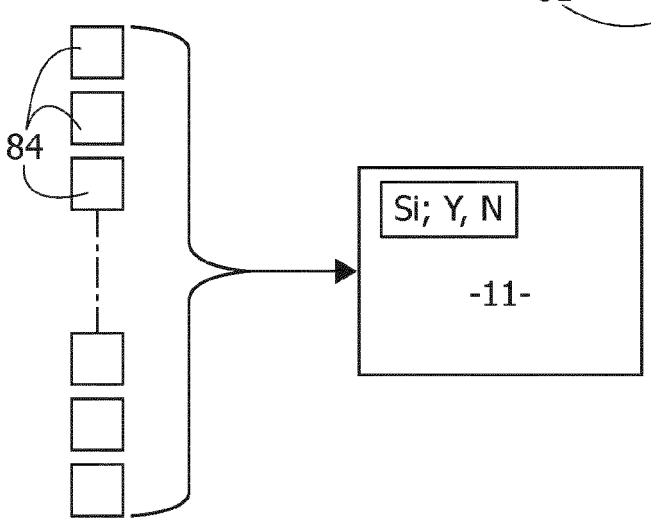


FIG. 5



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EUROPEAN SEARCH REPORT

Application Number
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	12 April 2023	Ungureanu, Mirela

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