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(73) Patenthaver: **Becton Dickinson Rowa Germany GmbH, Rowastraße 1, 53539 Kelberg, Tyskland**

(72) Opfinder: **BROKONIER, Stephan, Lörenstr. 20a, 54570 Neroth, Tyskland**
SCHMIDT-ELLINGER, Hardy, Bewinger Str. 25, 54568 Gerolstein-Bewingen, Tyskland
NELLINGER, Bernd, Theoderichstr. 9, 54413 Beuren, Tyskland
Gross, Dietmar, Auf dem Hermes 6, 53539 Kelberg, Tyskland
DAUMEN, Jochen, Freiherr-vom-Stein Str. 26, 56220 Urmitz, Tyskland

(74) Fuldmægtig i Danmark: **Plougmann Vingtoft A/S, Strandvejen 70, 2900 Hellerup, Danmark**

(54) Benævnelse: **GRIBER TIL ET KOMMISSIONERINGSAPPARAT SAMT FREMGANGSMÅDE TIL AT DRIVE KOMMISSIONERINGSAPPARATET**

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Description

The present invention relates to a gripper for a picking device for piece goods, in particular drug packages, and a method for operating the picking device, in particular for verifying a movement of drug packages onto a tray table of such a gripper.

In known grippers of operating systems for picking devices for drug packages, the loading and unloading front of the tray table of the gripper is formed straight. This front is moved to a storage location for moving drug packages onto or from the tray table, wherein the storage location may be, for example, a shelf or a conveyor belt for moving drug packages in or out of the picking device. For this purpose, the gripper with its tray table can be moved frontally along the longitudinal axis of the tray table to the storage location. Alternatively, the gripper can be pivoted or rotated for the tray table to approach the storage location. When performing carrying out a movement, the straight front then entails that a gap remains between the front and the storage location, wherein the width of the gap is dependent on the width of the tray table. When using larger grippers with correspondingly wide tray tables, this gap is increasingly wider, so that it is necessary in such a case, to reduce the gap by moving the gripper after pivoting or rotating the gripper. Alternatively, one can form the front of the tray table in a bent manner. This entails that after a pivoting or rotational movement for positioning the gripper, the gap is smaller, at least in the middle of the curved front, but increases to the sides of the tray table.

From EP 2 620 391 A1, a method for unloading drug packages from a picking device as well as the preamble of claim 1 are known, where a sensor is used to check whether grippers used to unload the drug packages are optimally aligned to the shelves assigned to the storage locations in order to prevent the drug packages from getting stuck on a gripper edge that may be arranged too high.

When moving drug packages from a storage location onto the tray table, it may happen that the drug package gets stuck in the gap between the storage location and the front of the tray table and is only partially pulled onto the tray table. In the case of known grippers with a straight front side, this is detected by a light barrier arranged at the front of the tray table which faces a storage location, which can detect when drug packages are left behind.

Depending on the design of the curved front, however, a portion of the tray table remains, which cannot be detected with a light barrier, since this light barrier must be located in the areas of the tray table where the tray table is not yet bent. This entails that

such incorrect unloading, which do not extend into the detection area of the light barrier, are not recognized and the operating device assumes a correct movement of a drug package onto the gripper, although the drug package is partially present in the bent portion of the front of the tray table.

It is an object of the present invention to provide a gripper where an incorrect movement of a drug package onto the tray table of a gripper can be detected even with a curved front of the tray table. It is a further object of the present invention to provide a method for verifying a movement of drug packages onto the tray table.

This object is achieved by a gripper for a picking device with horizontal storage surfaces for storage of drug packages according to claim 1. The gripper according to the invention comprises a control device, a tray table extending in a first horizontal direction (X-direction) and a second horizontal direction (Y-direction) orthogonal to the first horizontal direction, having an end portion with an arcuate front extending in the second horizontal direction, wherein the end portion forms the loading and unloading front, and wherein said tray table defines an upper support surface with said end portion. The arcuate design of the front enables also wide grippers (in the second horizontal direction) to be rotated in front of a storage location without themselves being able to move in the second horizontal direction in such a way that no gap that is too wide remains between the front side of the gripper and the front side of the storage location.

A transport device is arranged above the tray table and is movable in the first horizontal direction for moving drug packages from a horizontal storage surface onto the tray table. To grip a drug package, the transport device is first moved in the first horizontal direction toward a storage location of a drug package. Once the transport device is properly positioned, a drug package is gripped and the transport device is again moved in the first horizontal direction toward the tray table, thereby pulling the drug package onto the tray table. During this pulling movement, the drug package is moved over the end portion having an arcuate front. How exactly the drug package is gripped depends on the exact design of the transport device. According to the invention, the term transport device is intended to cover all devices with which a drug package can be moved from the storage surface onto the tray table. For example, it is conceivable that the transport device is designed as a suction arm or includes such, by means of which a drug package is pulled onto the tray table.

In the gripper according to the invention, at least three sensors coupled to a control device are arranged in the end portion below the support surface for determining the presence of a drug package, wherein the sensors are arranged at a distance from one another in the second horizontal direction and wherein in the second horizontal direction outer sensors are arranged at a distance in the first horizontal direction from at least one sensor arranged further inside in the second horizontal direction, such that the arrangement of the sensors is oriented towards the front extending in an arcuate manner.

It is not absolutely necessary that the sensors are exactly aligned with the arcuate shape of the front. It is also conceivable that the offset in the first horizontal direction (X-direction) is linear, for example. Although an alignment with the arcuate shape is not absolutely necessary, it is preferred. In a preferred embodiment it is therefore provided that the sensors are spaced apart from one another in the first horizontal direction (X-direction) in such a way that the sensors have a substantially equal distance from the arcuate front, i.e. are aligned with the arcuate shape of the front. The phrase "substantially the same distance" also comprises such arrangements in which the distance from the front varies slightly due to production. A corresponding arrangement of the sensors enables a very precise detection with respect to an incorrect movement of a drug package. Such an incorrect movement can also be detected if, for example, the drug package is present only slightly in an outer area of the end portion.

Due to the arrangement of the sensor in the end portion and below the support surface, any sensor can be used, which can detect the presence of an object. The sensor may, for example, operate on the principle of a light scanner, a light sensor or a tactile sensor, wherein the exact configuration of the sensor for the invention is not essential, as long as it is ensured that the sensor can detect the presence of piece goods in the end portion in the inventive arrangement.

With the gripper according to the invention, it is also possible to detect such incorrect movements or the unloading of drug packages, where the drug package thus gets stuck in the transition area storage location/tray table, so that the package is present only in the end portion of the tray table. If one were to use a light barrier in such a case, which can be arranged only in the parallel portion of the tray table, such an incorrect unloading would not be detected. However, the use and arrangement of at least one sensor below the support surface according to the invention makes such a detection

possible. The use of an aforementioned sensor has the additional advantage that it is less expensive than a light barrier.

If in this application a drug package is mentioned, several drug packages should also be comprised, where it makes sense technically. Thus, it is possible with appropriate arrangement of the drug packages to move several drug packages from a storage location onto the tray table.

As stated above, the transport device can be designed, for example, as a suction arm or comprise such. Although such a design is structurally quite simple, a movement of several drug packages simultaneously from a storage surface onto the tray surface is not, and a movement of very heavy drug packages is possible only with difficulty. In a preferred embodiment of the suction gripper according to the invention, it is therefore preferred that the transport device comprises two elongated clamping jaws extending in the first horizontal direction (X-direction) arranged above the tray table with mutually facing clamping surfaces, wherein at least one of the clamping jaws is additionally movable at least in sections in the second horizontal direction. In this embodiment of the transport device, several drug packages can be moved simultaneously. Furthermore, heavier drug packages can also be moved when applying a corresponding clamping force. The use of clamping jaws also has the advantage of being able to support the drug packages in a guided manner when moving drug packages from the tray table to a storage surface or storage location. Furthermore, such a gripper can be used to displace drug packages along the second horizontal direction on a storage surface.

As stated above, the sensors serve to detect whether a drug package is left behind or got stuck in the end portion of the tray table while being moved onto the tray table. Moreover, however, it is also possible to use the sensors for a plausibility check with respect to the unloaded drug package, by using the sensors to determine the approximate width of the drug package being pulled over the end portion onto the tray table. To make this possible, it is provided in a preferred embodiment of the gripper according to the invention that the several sensors are arranged mirror-symmetrically with respect to a central axis of the tray table extending in the first horizontal direction (X-direction). Based on the knowledge of the mirror-symmetrical arrangement of the sensors, it is easily possible to conclude the approximate width of the drug package moved onto the tray table. Depending on the number of sensors, the "resolution" can be increased during the plausibility check.

As already stated, the end portion of the gripper according to the invention is formed in an arcuate manner. In order to ensure that the gap between the front and the storage location of a drug package is particularly small, it is provided in a preferred embodiment that the arcuate front of the end portion is circularly arcuate, wherein the centre of the corresponding circle is located in a vertical rotary axis of the tray table. In order to avoid a long downtime of the gripper in case of failure of a sensor or several sensors, it is provided in a preferred embodiment that the end portion comprising at least one sensor is formed as a sensor assembly that is detachable from the tray table. A corresponding design as a sensor assembly allows for rapid replacement, possibly also by a "normal" operator.

It is essential in the gripper according to the invention that the clamping jaws are movable in the first horizontal direction (X-direction), which means that the clamping jaws are movable from the tray table to a storage location and back again, wherein the first horizontal direction (X-direction) regularly corresponds to the longitudinal axis of the tray table. In order to ensure the clamping or gripping of a drug package, it is further necessary that at least one of the clamping jaws is movable in the second horizontal direction (Y-direction). To make the gripping of a drug package particularly effective and efficient, it is advantageous that both clamping jaws are movable in the second horizontal direction (Y-direction) and at least one is also formed to be pivotable. To achieve this, it is provided in a preferred embodiment of the gripper that the gripper has a jaw guide assembly for carrying out the aforementioned movements. This jaw guide assembly comprises a frame structure, at least a first and a second guide extending in parallel and in the first horizontal direction spaced from each other in the second horizontal direction, and at least four jaw carriages coupled to the guides and driven in the second horizontal direction, wherein two first jaw carriages are assigned to the first guide and two second jaw carriages are assigned to the second guide, and wherein at least two jaw carriages spaced apart in the first horizontal direction are coupled to a clamping jaw. A drive unit is further coupled to the jaw guide assembly, with which drive unit the jaw guide assembly is driven in the first horizontal direction. The use of the combination of the guides with jaw carriages makes it possible to move the clamping jaws evenly toward or away from each other and at the same time pivot one of the clamping jaws, when the jaw carriages are not moved simultaneously to one another on the first and second guides. A corresponding embodiment of the movement mechanism of the clamping jaws has the further

advantage that due to the guiding of the clamping jaws, a significant clamping force can be applied to drug packages to be moved.

The above object is further achieved by a method of verifying a movement of drug packages onto a tray table of a gripper for a picking device according to claim 8. In the method according to the invention, in a step a), the transport device is moved in the first horizontal direction (X-direction) to a storage location of at least one drug package and the at least one drug package is gripped. The storage location may be, for example, a shelf surface. Alternatively, the storage location can also be formed by, for example, a conveyor belt from which the drug package is gripped in order to move it to a shelf surface. After gripping the drug package, the transport device is moved in step b) from the storage location in the first horizontal direction (X-direction) to the tray table, wherein the at least one drug package is moved over the arcuate front of the end portion onto the support surface of the tray table. After moving the transport device in the first horizontal direction (X-direction), it is checked in a step c) by means of the sensors in the end portion whether at least one drug package is present in the detection area of the sensor. If this is the case, it means that at least a portion of a drug package is present in the end portion of the tray table, indicating an incorrect movement of a drug package from a storage location onto the tray table. If the check is positive, a signal is provided in a step d), which indicates a first erroneous removal attempt of piece goods from a storage location onto the tray table.

If a signal is provided which indicates a first incorrect removal attempt, this may result in the picking device being shut down until the fault is corrected by an operator. In a preferred embodiment of the method for verifying a movement of drug packages onto a tray table of a gripper, in which the transport device comprises two elongated clamping jaws extending in the first horizontal direction (X-direction) arranged above the tray table with mutually facing clamping surfaces, the device is not completely shut down, but rather the clamping jaws are opened in the second horizontal direction (Y-direction) and moved again in the first horizontal direction (X-direction) to the storage location, and then the drug package arranged in the end section is gripped by the clamping jaws. Since it is known from the checking that (and where) the drug package is arranged at least in sections in the end portion of the tray table, based on the information present on the package, it can be estimated, how far the movement in the first horizontal direction (X-direction) must take place.

After the drug package has been gripped (or was at least attempted to be gripped) with the clamping jaws, the above-mentioned method steps b) and c) are carried out again, i.e. the package is returned to the tray table and checking of the end portion is carried out. Should the second check of the end portion also be positive, i.e. should it be determined that a drug package is again present on the end portion, a signal indicative of a second incorrect removal attempt is provided. In response thereto, the device can now be shut down, or, if necessary, a third removal attempt may also be carried out.

In a preferred embodiment of the method according to the invention, the width of a drug package is determined by means of the sensors while moving the at least one drug package toward the tray table, the determined width is compared with a desired width known to the control device and, when a limit deviation between the determined width and desired width of a drug package is exceeded, a corresponding signal is provided. In this preferred embodiment, therefore, a further verification of the moved drug package takes place. Although it is relatively unlikely that the drug package that the control device of the picking device is expecting is not arranged at a storage location, this can be the case if, for example, the drug packages in the picking device have been displaced during an error correction by an operator. Therefore, the embodiment according to the invention again further increases the certainty that the correct drug package is removed.

The response to the provided signal indicative of an improper drug package may be that the picking device is stopped due to the unexpected drug package. Alternatively, it can be provided in a preferred embodiment that, after providing a signal indicative of an exceeding of a limit deviation, the gripper is moved towards an unloading station and the drug packages present on the tray table are transferred to the unloading station.

This avoids that a user must enter the picking device in the case of a detected incorrect loading, which avoids a downtime of the picking device. The thus unloaded drug packages can be loaded again and the drug to be initially unloaded can be requested again.

The invention further relates to a use of a sensor assembly with a front extending in an arcuate manner in the second horizontal direction extending orthogonal to a first horizontal direction and at least three sensors arranged under a surface of the sensor assembly for determining the presence of a drug package, wherein the sensors are arranged at a distance from one another in the second horizontal direction and wherein in the second horizontal direction outer sensors are arranged at a distance in the first

horizontal direction from at least one sensor arranged further inside in the second horizontal direction, such that the arrangement of the sensors is oriented towards the front extending in an arcuate manner, and an interface for connecting the sensor assembly to a control device for verifying a movement of drug packages onto a tray table of a gripper of a picking device for drugs.

In the following, preferred embodiments of the gripper according to the invention and the method according to the invention will be described in more detail with reference to the drawing, in which

Figures 1a and 1b show oblique views of a first embodiment of the gripper according to the invention,

Figures 2a, 2b show detailed views of the first embodiment in the region of the end portion of the tray table,

Figures 3a, 3b show the detailed views of Figures 2a and 2b without the tray table itself,

Figures 4a, 4b show a jaw guide assembly of a second embodiment of the gripper according to the invention,

Figures 5a and 5b show detailed views of this jaw guide assembly,

Figure 6 shows an oblique view of the jaw guide assembly with the clamping jaws in parallel position,

Figures 7a - 7h show different stages of a preferred embodiment of the method according to the invention, and Figure 8 shows a flow chart of the preferred embodiment of the method according to the invention.

Figures 1a and 1b show two oblique views of a first preferred embodiment of the gripper 1 according to the invention, wherein Figure 1a shows an oblique view from above and Figure 1b shows an oblique view from below. The gripper 1 according to the invention is part of an operating device (not depicted) for a picking device and comprises a tray table 10 and a transport device which in this embodiment comprises two clamping jaws 20a, 20b with opposite clamping surfaces 21a, 21b. At their free ends, the clamping jaws 20a, 20b have a portion 22a, 22b which is coated with an anti-slip material.

At the free ends of the clamping jaws, the tray table 10 has an end portion 70, which in this embodiment is a sensor assembly 72 having a plurality of sensors 73, 73a, 73b arranged below the surface of the sensor assembly and capable of detecting the presence

of an object in their detection area. The sensors can detect when a drug package (at least in sections) is present in the end portion.

The sensors 73a are the outer sensors, wherein the sensor 73b is the inner sensor, wherein a several further sensors 73 are arranged there between. Whether one or two inner sensors 73b are present depends on the precise configuration of an embodiment; the same applies to the number of further sensors between the outer and inner sensors (wherein this number may also be zero).

The sensors are arranged oriented towards the front 71 of the end portion shaped in an arcuate manner, wherein small deviations (e.g. due to production) as such with respect to the precise distance from the front are insignificant. As can be seen, the sensors are arranged at a distance from one another in the second horizontal direction (Y-direction), and the outer sensors 73a are also arranged at a distance in the first horizontal direction (X-direction) from the inner sensor 73b. The exact distance from one another in the first horizontal direction (X-direction) of the sensors distributed in the second horizontal direction (Y-direction) depends on the exact shape of the arcuate front and the number of sensors. Thus, it may be the case that, for example, two inner sensors 73a are not at a distance from one another in the first horizontal direction (X-direction); however, the outer sensors 73a are always arranged at a distance from at least one inner sensor 73b in the first horizontal direction (X-direction).

The end portion forms the loading and unloading front of the tray table 10, and together with the tray table, the end portion forms a support surface on which drug packages are present or moved. The front 71 of the end portion is formed in an arcuate manner. This is necessary with correspondingly wide tray tables if they are only to be pivoted to approach a storage location and not additionally moved in the first horizontal direction (X-direction) towards the storage location and a gap between front and storage location should be kept as small as possible. In the embodiment shown, the end portion is formed as a detachable sensor assembly which is coupled via connecting means (not depicted) with a control device (depicted in Figure 1b).

The tray table comprises in the middle an elongated opening 11 which extends in the direction of loading and unloading, i.e. in the first horizontal direction (X-direction). In the opening 11, a sliding element 12 with a widened sliding head 13 is arranged. The sliding element 12 can be moved in the elongated opening 11 in the loading and unloading direction or in the first horizontal direction.

Opposite the end portion, a jaw guide assembly 30 is arranged to which the clamping jaws 20a, 20b are connected and which includes a mechanism for moving and pivoting the clamping jaws. In the upper portion, the jaw guide assembly 30 comprises a drive unit 50 with two drives 51, 52 and associated gears 53, 54. The clamping jaws are moved and pivoted by way of these two drives in the embodiment shown, as will be described in more detail with reference to the following figures. The jaw guide assembly further comprises an optical detection device 2, with which various aspects can be monitored during the loading and unloading operation.

The jaw guide assembly 30 and all of its electronic components are connected to a control device 4, which is arranged below an attachment arm 3 in the embodiment shown. The attachment arm 3 itself is fastened to the tray table or to a substructure of the tray table via a swivel joint.

For loading and unloading of drug packages, the jaw guide assembly 30 must be moved in the first horizontal direction (X-direction) or the loading and unloading direction. For this purpose, a drive 60 is arranged below the tray table in the embodiment shown, by means of which the jaw guide assembly 30 is moved, as will be described in more detail with reference to subsequent figures. Furthermore, a further drive 7 is arranged below the tray table, with which the sliding element 12 is movable in the elongated opening 11 in the first horizontal direction.

Figures 2a, 2b and 3a, 3b show detailed views of the first embodiment in the area of the end portion of the tray table 10, wherein in Figures 3a and 3b, the tray table is omitted to illustrate the lower part of the gripper. Figures 2a and 2b show the arrangement of the sensors 73, 73a, 73b which in the embodiment shown are arranged mirror-symmetrically with respect to the central or longitudinal axis MA of the tray table 10 of the gripper. In the embodiment shown, the sensor assembly comprises, in addition to the sensors 73, 73a, 73b a sensor 74 which is formed corresponding to the other sensors and which can serve to determine the length (in the X-direction) of the drug package(s) moved onto the tray table. For this purpose, when being moved on the tray table, the drug package is moved completely to the sliding head 13, by moving the clamping jaws 20a, 20b completely back. Upon making contact with the sliding head, the drug package is moved toward the end portion until the sensor 74 is activated. Based on the movement distance, the length in the first horizontal direction (X-direction) can be determined and compared with the known length.

Figures 4a and 4b show oblique views of a jaw guide assembly 30 of a second embodiment in which both clamping jaws are pivoted for gripping. The jaw guide assembly 30 includes a slightly different frame structure 31, 32, 33a, 33b, wherein the front component 31 encompasses the clamping jaws (and the tray table, not depicted). At the lower ends of the component 31, movable parts 62a, 62b (the "runners") of a linear drive are mounted with which the jaw guide assembly 30 can be moved in the first horizontal direction. The components are referred to as being "movable" as they move together with the jaw guide assembly along corresponding fixed parts (which are rotated to move the moving parts) in the first horizontal direction. The fixed parts 61a, 61b (see Figures 2a, 2b and 3a, 3b) themselves may move to move the moving parts, for example, by rotating, wherein, during this rotating movement, the moving parts are moved along the longitudinal axis of the fixed parts. The fixed parts are therefore only fixed in relation to their position within the operating device itself. In an alternative embodiment, it is conceivable, for example, that the fixed parts are formed as toothed belts, which are formed between the longitudinal ends of the operating device and cooperate with corresponding deflection rollers for moving the movable parts.

As can be seen in Figure 4b, two guides 35, 36, a first guide 35 and a second guide 36, extend between the lateral frame structure components 33a, 33b in a second horizontal direction Y parallel to one another and spaced apart in the first horizontal direction X, wherein the first guide faces the free ends of the clamping jaws. Two jaw carriages 40a, 40b; 41a, 41b are arranged on each of the guides 35, 36; two first jaw carriages 40a, 40b on the first guide 35, two second jaw carriages 41a, 41b on the second guide 36. In the depicted embodiment of the operating device according to the invention, a portion of the jaw carriages encompasses a projection of the guides 35, 36, so that the jaw carriages are partially present on this projection.

Figures 5a and 5b show detailed views of the jaw assembly of the second embodiment. It can be seen from these Figures that jaw carriages 40a, 40b; 41a, 41b are connected with drive elements 45a, 45b; 46a, 46b, which are formed as racks in the embodiment shown. The drive elements 45a, 45b assigned to the first guide 35 and the corresponding first jaw carriage 40a, 40b and the corresponding drive elements 46a, 46b assigned to the second guide 36 are aligned with respect to the tooth elements of the racks in such a way that the toothed elements are opposite one another and form an overlapping area at their free ends. A drive gearwheel 55, 56 is arranged in each case

centrally in the overlapping area of the drive elements or racks and is coupled to a drive 51, 52 via a gear 53, 54 (not depicted in Figures 5a and 5b). The distance between the jaw carriages 40a, 40b; 41a, 41b of a guide and the corresponding drive gear is identical, a drive gear is thus arranged exactly in the middle between two jaw carriages, so that a movement of the drive gear causes synchronous movements of the jaw carriages. Upon rotation of the drive gear, the jaw carriages are thus synchronously moved toward or away from each other, wherein the same applies to the jaw carriages assigned to the two guides 35, 36.

Thus, the jaw carriages of the first guide can be moved simultaneously or separately with respect to the jaw carriages of the second guide, so that there is great flexibility in the movement of the jaw carriages. The jaw carriages of the first and second guides may be moved synchronously, or only the jaw carriages assigned to the first or second guides may be moved. In this way, it is possible to simultaneously move the clamping jaws attached to the jaw carriage parallel or already pivoted without angular adjustment (by simultaneously moving the jaw carriages of both guides) or, if only the jaw carriages of a guide are moved, to pivot the jaws.

As already stated, the clamping jaws 20a, 20b are coupled to the jaw guide assembly 30. This coupling can be seen in Figures 4b and 5b. In the shown embodiment, the clamping jaws 20a, 20b are each connected to the jaw carriages 40a, 40b of the first guide 35 via a swivel joint 23a, 43a; 23b, 43b and are connected to the jaw carriages 41a, 41b of the second guide 36 via a slot guide 24a, 25a, 44a; 24b, 25b, 44b. In alternative embodiments, the swivel joint may also be arranged in the jaw carriage assigned to the second guide, and in this case, it is then required in the depicted combination that the slot guides are arranged in the jaw carriages assigned to the first guide 35.

However, a use of the combination swivel joint/slot guide is not mandatory. Although the clamping jaws must be held to the corresponding jaw carriage by means of a rotary or swivel joint in at least one guide, the use of a slot guide is not mandatory. Thus, it is conceivable, for example, that the clamping jaws are moved in an alternative embodiment with the jaw carriages against a resetting force, and when returning the jaw carriage, the resetting force moves the clamping jaws back.

Figure 6 shows a detailed view of the jaw guide assembly 30 of the second embodiment, wherein parts of the drive unit 50 and the frame structure are omitted for a better view of the remaining components. In Figure 6, the clamping jaws 20a, 20b are

further moved together and aligned parallel to each other. In a comparison of Figures 5a, 5b and Figure 6 it can be seen how the position of the clamping jaws is influenced by a displacement of the jaw carriages at the guides.

With reference to Figures 7a - 7h and Figure 8, a preferred embodiment of the method according to the invention will now be described. First, the gripper is moved to a storage location 80 such that the drug packages 6', 6 to be unloaded are arranged approximately centrally with respect to the tray table 10 of the gripper, as illustrated in Figure 7a. In Figures 7a - 7h, only a few components of the gripper which are essential for the method as such are depicted schematically. In addition to the clamping jaws 20a, 20b, the sliding head 13 is illustrated, which represents a stop for the drug packages when pulling them onto the tray table 10. As indicated in the figures, the tray table comprises an end portion which is circularly curved in the second horizontal direction (Y-direction) and in which a plurality of mirror-symmetrically arranged sensors 73, 73a, 73b are arranged. The tray table itself is brought into position by pivoting the table about a vertical axis VA in front of the storage location. To move drug packages toward the tray table, first the clamping jaws 20a, 20b of the gripper are moved first in the first horizontal direction (X-direction) to the storage location of the drug packages 6', 6, as illustrated in Figure 7b (step 100). As soon as the clamping jaws are moved correspondingly far to the storage location, they are moved towards each other in the second horizontal direction (Y-direction), so that the drug packages 6', 6 are gripped (see also Figure 7b, step 110). Once the drug packages are gripped, in a step 120, the clamping jaws 20a, 20b are moved from the storage location 80 in the first horizontal direction (X-direction) to the tray table 10 of the gripper, which is illustrated in Figure 7c. In order to move the drug packages onto the tray table, the clamping jaws 20a, 20b are moved in the first horizontal direction (X-direction) to their original position, wherein the gripped drug package or packages come into contact with the sliding head 13. Once the complete return movement of the clamping jaws has been performed, it is checked in a step 130 whether a drug package 6' is present in the detection area of one of (or several of) the sensors 73, 73a, 73b, wherein the approximate position of the drug package can also be determined thereby. The detection as to whether a drug package is arranged in the end portion depends on the type of sensor used, wherein in particular light scanners, light sensors, and tactile sensors are suitable. How exactly the presence of an object is detected as a function of the specific type of sensor is known to the person skilled in the art and will not

be explained in more detail here. If the check reveals that no drug package is present in the end portion, the gripper is moved subsequently to the storage location of the drug package or packages that are present on the tray table (step 200). However, if it turns out that a drug package is arranged in the end portion, as depicted in Figure 7d, a signal is provided which indicates a first incorrect removal attempt of the drug package from the storage location 80 onto the tray table 10 (step 140). In the situation depicted in Figure 7d, it is the case that the drug package 6' has not been moved completely onto the tray table 10, but is still arranged largely at the storage location 80, but is also partly arranged in the end portion. If the gripper would be moved in this situation, it could happen that the drug package 6' falls from the storage location and, in the worst case, blocks subsequent movement operations of the operating device. For example, the signal provided could cause gripper movement not to be possible and operator intervention to be necessary. Alternatively, however, it is also conceivable that this signal initiates a second removal attempt using the gripper. For this purpose, in a step 300, the clamping jaws 20a, 20b are opened in the second horizontal direction (Y-direction) and moved in the first horizontal direction (X-direction) to the storage location. In the described embodiment, a plurality of sensors are used in the end portion, so that the control device can use the activated sensors to evaluate how far the clamping jaws have to be moved apart in the second horizontal direction (Y-direction). If only a smaller number of sensors are used, the procedure is simply to move the clamping jaws maximally in the second horizontal direction (Y-direction). Once the clamping jaws have been moved correspondingly far in the first horizontal direction (X-direction) to the storage location, an attempt is made to grip the stuck drug package 6' with the clamping jaws (step 310) by retracting the clamping jaws in the second horizontal direction (Y-direction). Thereafter, method steps b) and c), that is, moving in the first horizontal direction (X-direction) toward the tray table and checking the end portion for a drug package to be present, are repeated (step 320). If it is determined that a drug package is still present in the end portion, a signal indicative of a second incorrect removal attempt is provided (Figure 7h). In this case, a third removal attempt may be carried out, or a movement of the gripper is prevented and the intervention of operating personnel is requested.

Patentkrav

1. Griber (1) til et kommissioneringsapparat med vandrette lagerflader til lagring af lægemiddelpakninger, omfattende:

en styreindretning (4),

et fralægningsbord (10), der strækker sig i en første vandret retning (X-retningen) og en anden vandret retning (Y-retningen), vinkelret på den første vandrette retning, med et endeafsnit (70) med en endeflade (71), der strækker sig bueformigt i den anden vandrette retning, idet endeafsnittet (70) danner læsse- og lossefladen, idet fralægningsbordet (10) med endeafsnittet (70) definerer en øvre kontaktflade,

en over fralægningsbordet (10) anbragt og i den første vandrette retning bevægelig transportindretning (20a, 20b) til at bevæge lægemiddelpakninger fra en vandret lagerflade til fralægningsbordet (10),

kendetegnet ved, at griberen (1) omfatter mindst tre med styreindretningen (4) koblede og i endeafsnittet (70) under kontaktfladen anbragte sensorer (73, 73a, 73b) til bestemmelse af tilstedeværelsen af en lægemiddelpakning, idet sensorerne er anbragt i afstand fra hinanden i den anden vandrette retning, og idet der i den anden vandrette retning er anbragt ydre sensorer (73a) i afstand i den første vandrette retning fra mindst en i den anden vandrette retning længere inde anbragt sensor (73b), således at anbringelsen af sensorerne er orienteret mod den endeflade (71), der strækker sig bueformigt.

2. Griber (1) til et kommissioneringsapparat med vandrette lagerflader til lagring af lægemiddelpakninger ifølge krav 1, **kendetegnet ved, at** sensorerne (73, 73a, 73b) har en sådan afstand fra hinanden i den første vandrette retning (X-retningen), at sensorerne har i det væsentlige samme afstand til den bueformige endeflade (71).

3. Griber (1) til et kommissioneringsapparat med vandrette lagerflader til lagring af lægemiddelpakninger ifølge krav 1 eller 2, **kendetegnet ved, at** transportindretningen omfatter to over fralægningsbordet (10) anbragte langstrakte spændebakker (20a, 20b), der strækker sig i den første vandrette retning (X-retningen), med mod hinanden vendende spændeflader (21a, 21b),

idet mindst en af spændebakkerne desuden i det mindste i afsnit kan bevæges i den anden vandrette retning.

4. Griber (1) til et kommissioneringsapparat med vandrette lagerflader til lagring af lægemiddelpakninger ifølge et af kravene 1-3, **kendetegnet ved, at** sensorerne (73, 73a, 73b) er anbragt spejlsymmetrisk med hensyn til en midterakse (MA) på fralæggerbordet (10), der strækker sig i den første vandrette retning (X-retningen).

5. Griber (1) til et kommissioneringsapparat med vandrette lagerflader til lagring af lægemiddelpakninger ifølge et af kravene 1-4, **kendetegnet ved, at** endeafsnittet er udformet som fra fralægningsbordet (10) aftagelig sensorenhed (72).

6. Griber (1) til et kommissioneringsapparat med vandrette lagerflader til lagring af lægemiddelpakninger ifølge et af kravene 1-5, **kendetegnet ved, at** den bueformige endeflade (71) på endeafsnittet (70) er udformet cirkelbueformig, idet den tilsvarende cirkels centrum ligger i en lodret omdrejningsakse (VA) på fralæggerbordet (10).

7. Griber (1) til et kommissioneringsapparat med vandrette lagerflader til lagring af stykgods ifølge et af kravene 3-6, **kendetegnet ved, at** griberen endvidere har:

en spændebakkestyringsindretning (30) med
en rammestruktur (31, 32, 33a, 33b),
mindst en første og en anden styring (35, 36), der strækker sig parallelt og i den første vandrette retning (X) i afstand fra hinanden i den anden vandrette retning (Y) på tværs af den første vandrette retning, og
mindst fire med styringerne (35, 36) koblede og i den anden vandrette retning (Y) drevne spændebakkeslæder (40a, 40b, 41a, 41b), idet i hvert tilfælde to første spændebakkeslæder (40a, 40b) fra den første styring (35) og to andre spændebakkeslæder (41a, 41b) fra den anden styring (36) er tilordnede, og idet i hvert tilfælde mindst to spændebakkeslæder (40a, 41a; 40b, 41b) i afstand i den første vandrette retning (X) er koblede med en spændebakke (20a, 20b), og

en med spændebakkestyringsindretningen koblet drivenhed (60, 61a, 61b, 62a, 62b), med hvilken spændebakkestyringsindretningen (30) drives i den første vandrette retning (X).

8. Fremgangsmåde til verifikation af en bevægelse af lægemiddelpakninger (6, 6') til en gribers (1) fralægningsbord (10) ifølge et af kravene 1-7, ved hvilken

a) transportindretningen bevæges i den første vandrette retning (X-retningen) hen til et fralægningssted (80) for mindst af en lægemiddelpakning (6, 6'), og den mindst ene lægemiddelpakning gribes,

b) transportindretningen bevæges fra fralægningsstedet (80) i den første vandrette retning (X-retningen) hen til fralægningsbordet (10),

c) efter bevægelsen af transportindretningen i den første vandrette retning (X-retningen) kontrolleres det ved hjælp af sensorerne (73, 73a, 73b) i endeafsnittet (70), om der findes en lægemiddelpakning (6') i sensorernes detekteringsområde, og

d) såfremt denne kontrol falder positivt ud, tilvejebringes et signal, der karakteriserer et første fejlbehæftet udtagningsforsøg.

9. Fremgangsmåde til verifikation af en bevægelse af lægemiddelpakninger (6, 6') til en gribers (1) fralægningsbord (10) ifølge krav 8, ved hvilken transportindretningen omfatter to over fralægningsbordet (10) anbragte langstrakte spændebakker (20a, 20b), der strækker sig i den første vandrette retning (X-retningen), med mod hinanden vendende spændeflader (21a, 21b),

kendetegnet ved, at spændebakkerne (20a, 20b) i den anden vandrette retning (Y-retning) ved positiv kontrol ifølge trin d) åbnes og påny bevæges hen til fralægningsstedet (80) i den første vandrette retning (X-retningen), en i endeafsnittet (70) anbragt lægemiddelpakning gribes med spændebakkerne (20a, 20b),

fremgangsmådetrinnene b) og c) gennemføres, og

ved positiv kontrol tilvejebringes et signal, der karakteriserer et andet fejlbehæftet udtagningsforsøg.

10. Fremgangsmåde til verifikation af en bevægelse af lægemiddelpakninger (6, 6') til en gribers (1) fralægningsbord (10) ifølge et af kravene 8 eller 9,

kendetegnet ved, at bredden af en lægemiddelpakning (6) bestemmes ved bevægelsen af den mindst ene lægemiddelpakning (6) hen til fralægningsbordet ved hjælp af de i fralægningsbordet anbragte sensorer (73, 73a, 73b),

den bestemte bredde sammenlignes med en styreindretningen (4) bekendt ønsket bredde, og

ved overskridelse af en grænseafvigelse mellem bestemt bredde og ønsket bredde af en lægemiddelpakning tilvejebringes et tilsvarende signal.

11. Fremgangsmåde til verifikation af en bevægelse af lægemiddelpakninger (6, 6') til en gribers (1) fralægningsbord (10) ifølge krav 10,
kendetegnet ved, at griberen (1) efter tilvejebringelse af et signal, der henviser til en overskridelse af en grænseafvigelse, bevæges hen til en aflæsningsstation, og de på den liggende lægemiddelpakninger overgives til aflæsningsstationen.

12. Anvendelse af en sensorenhed (72) med

en endeflade (71), der strækker sig bueformigt i en anden vandret retning (Y-retningen), vinkelret på en første vandret retning (X-retningen), og mindst tre under en overflade på sensorenheden anbragte sensorer (73, 73a, 73b) til bestemmelse af tilstedeværelsen af en lægemiddelpakning, idet sensorerne er anbragt i afstand fra hinanden i den anden vandrette retning, og idet der i den anden vandrette retning er anbragt ydre sensorer (73a) i afstand i den første vandrette retning fra mindst en i den anden vandrette retning længere inde anbragte sensor (73b), således at anbringelsen af sensorerne er orienteret mod den endeflade (71), der strækker sig bueformigt,

og

en grænseflade til tilslutning af sensorenheden til en styreindretning til verifikation af en bevægelse af lægemiddelpakninger (6, 6') til et fralægningsbord (10) for en griber (1) i et kommissioneringsapparat til lægemidler.

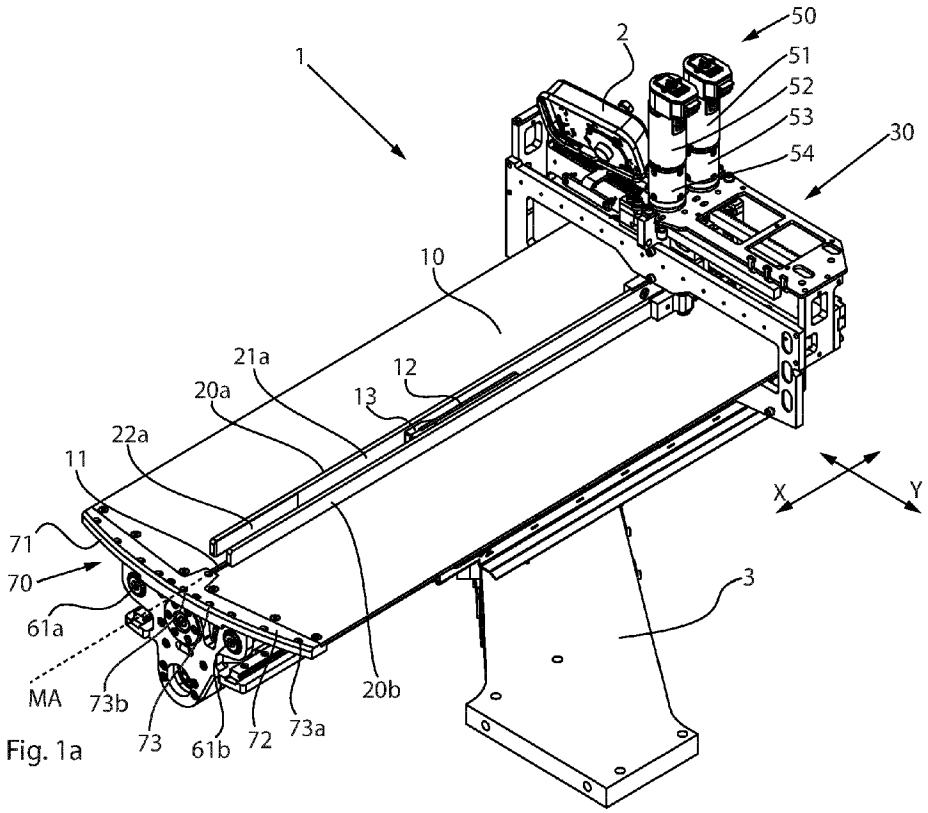
1
2
50
51
52
53
54
30
10
21a
20a
12
13
22a
11
71
70
61a
MA
73b
73
61b
72
73a
20b
3
X
Y

Fig. 1a

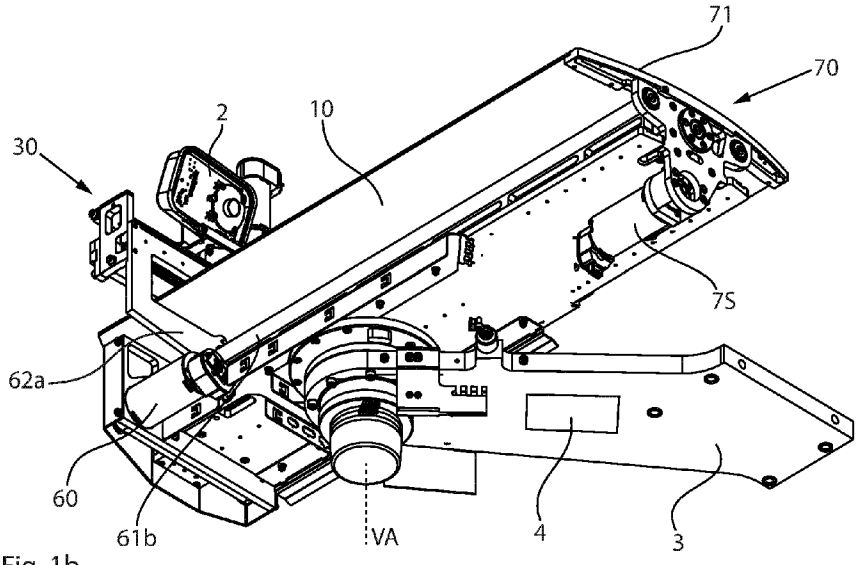
71
70
30
2
10
7S
62a
60
61b
VA
4
3

Fig. 1b

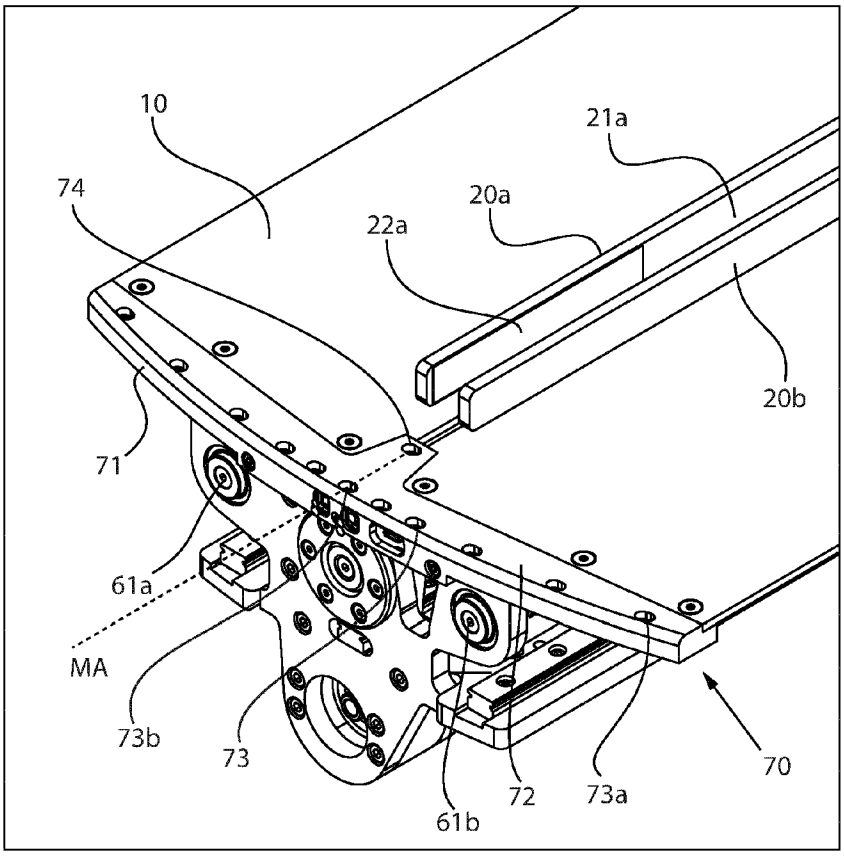
10
21a
74
20a
22a
20b
71
61a
MA
73b
73
72
73a
70
61b

Fig. 2a

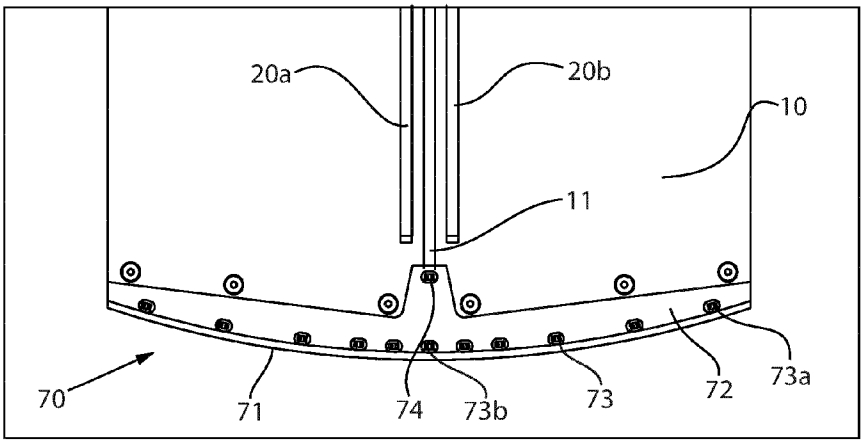
20a
20b
10
11
X
70
71
74
73b
73
72
73a

Fig. 2b

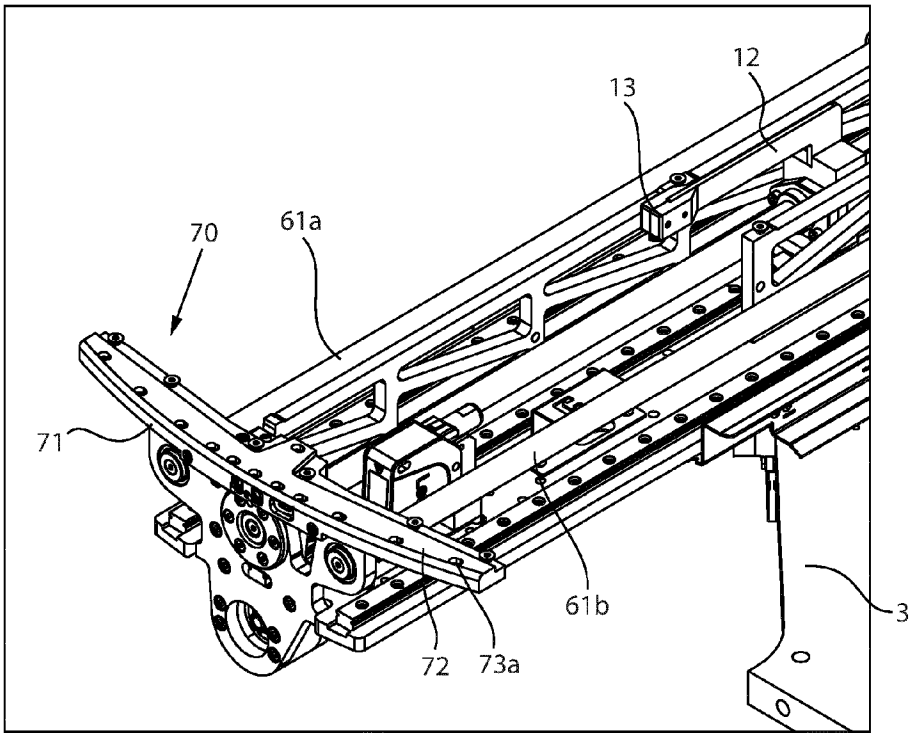

Fig. 3a

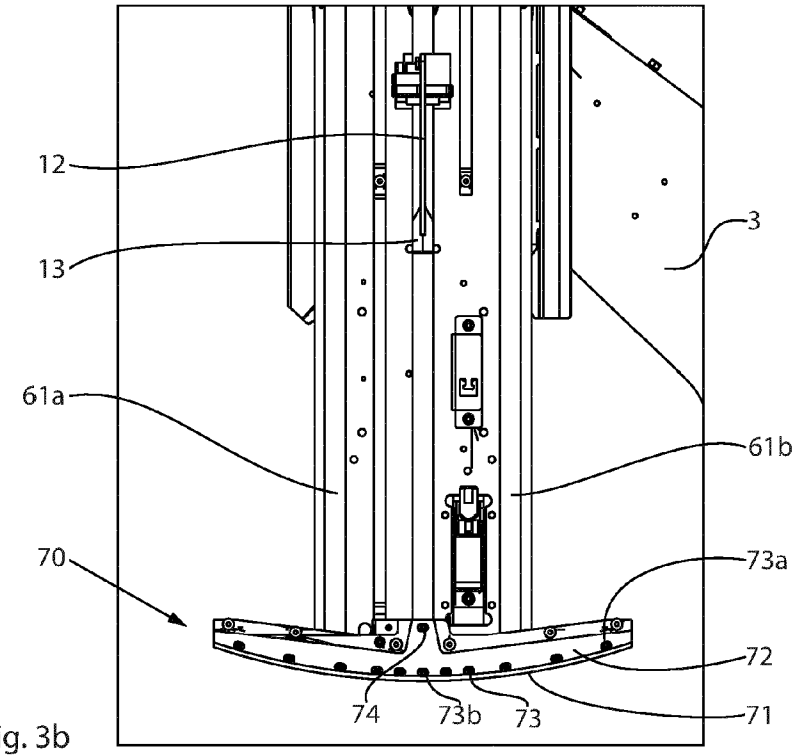

Fig. 3b

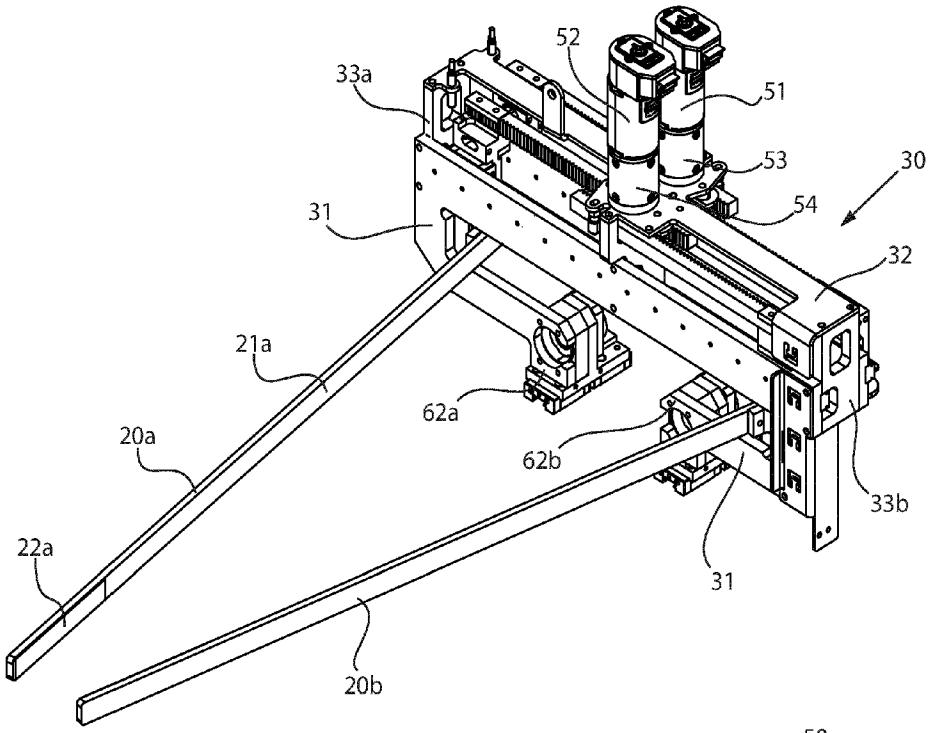
52
33a
51
53
30
54
31
32
21a
62a
20a
62b
33b
22a
31
20b

Fig. 4a

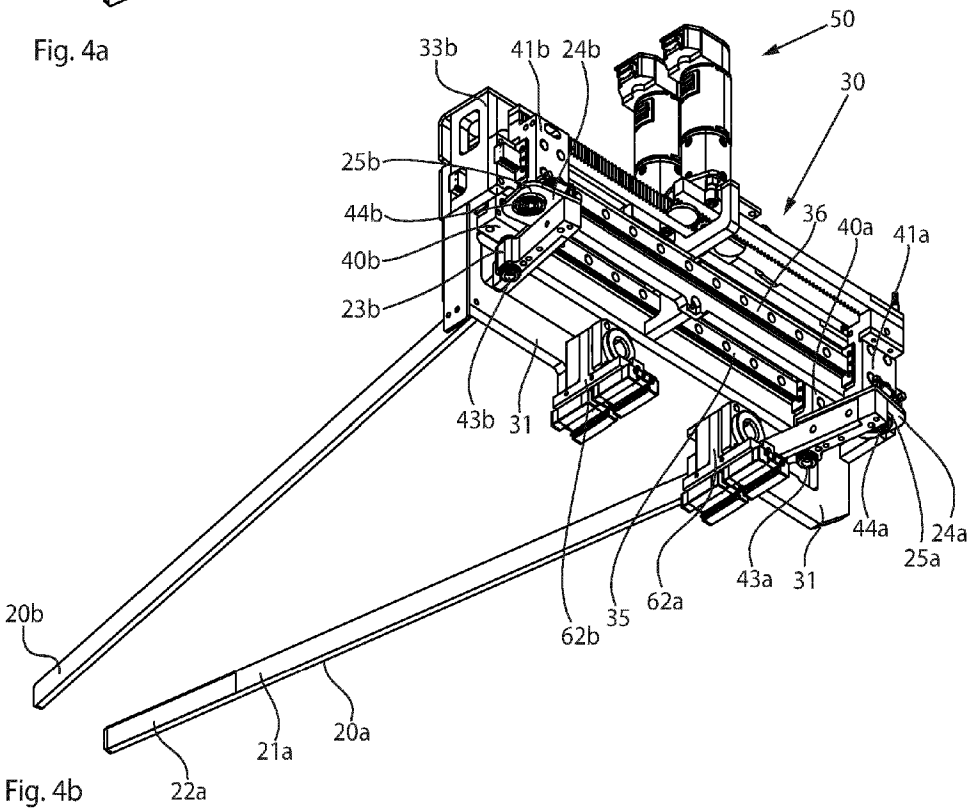
50
33b
41b
24b
30
25b
44b
36
40a
41a
40b
23b
43b
31
44a
24a
25a
43a
31
62a
35
62b
20b
21a
20a
22a

Fig. 4b

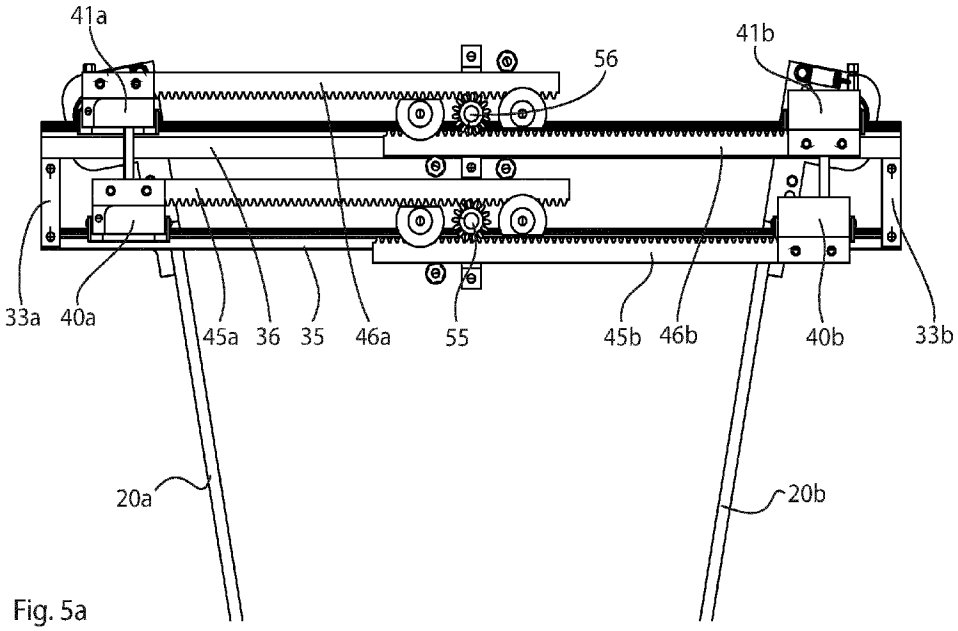
41a
41b
56
33a
40a
45a
36
35
46a
55
45b
46b
40b
33b
20a
20b

Fig. 5a

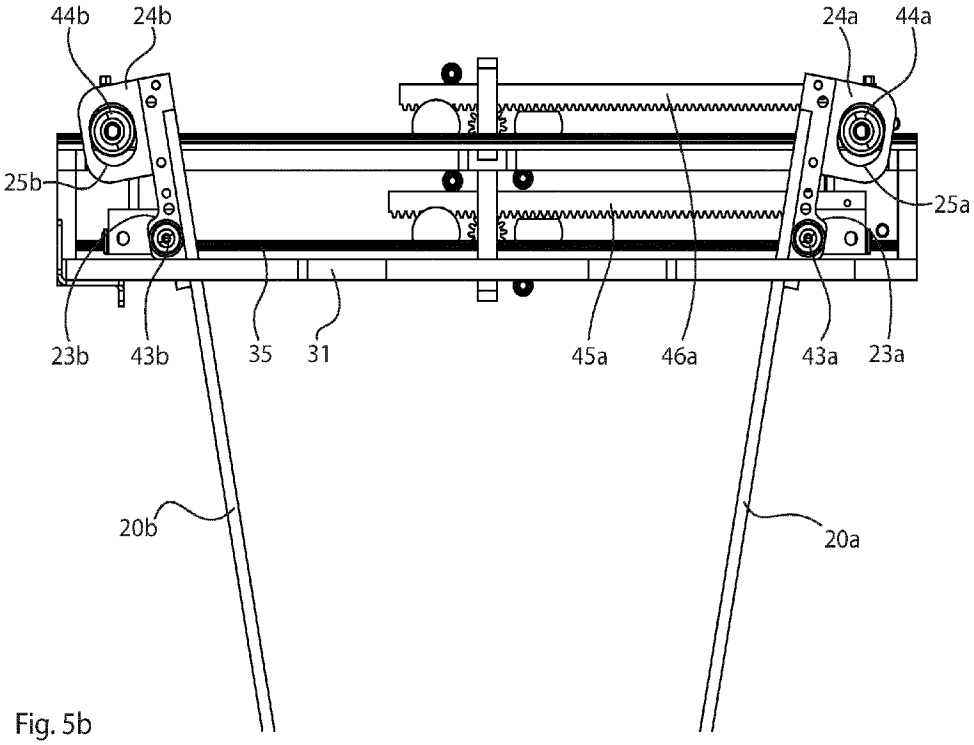
44b
24b
24a
44a
25b
25a
23b
43b
35
31
45a
46a
43a
23a
20b
20a

Fig. 5b

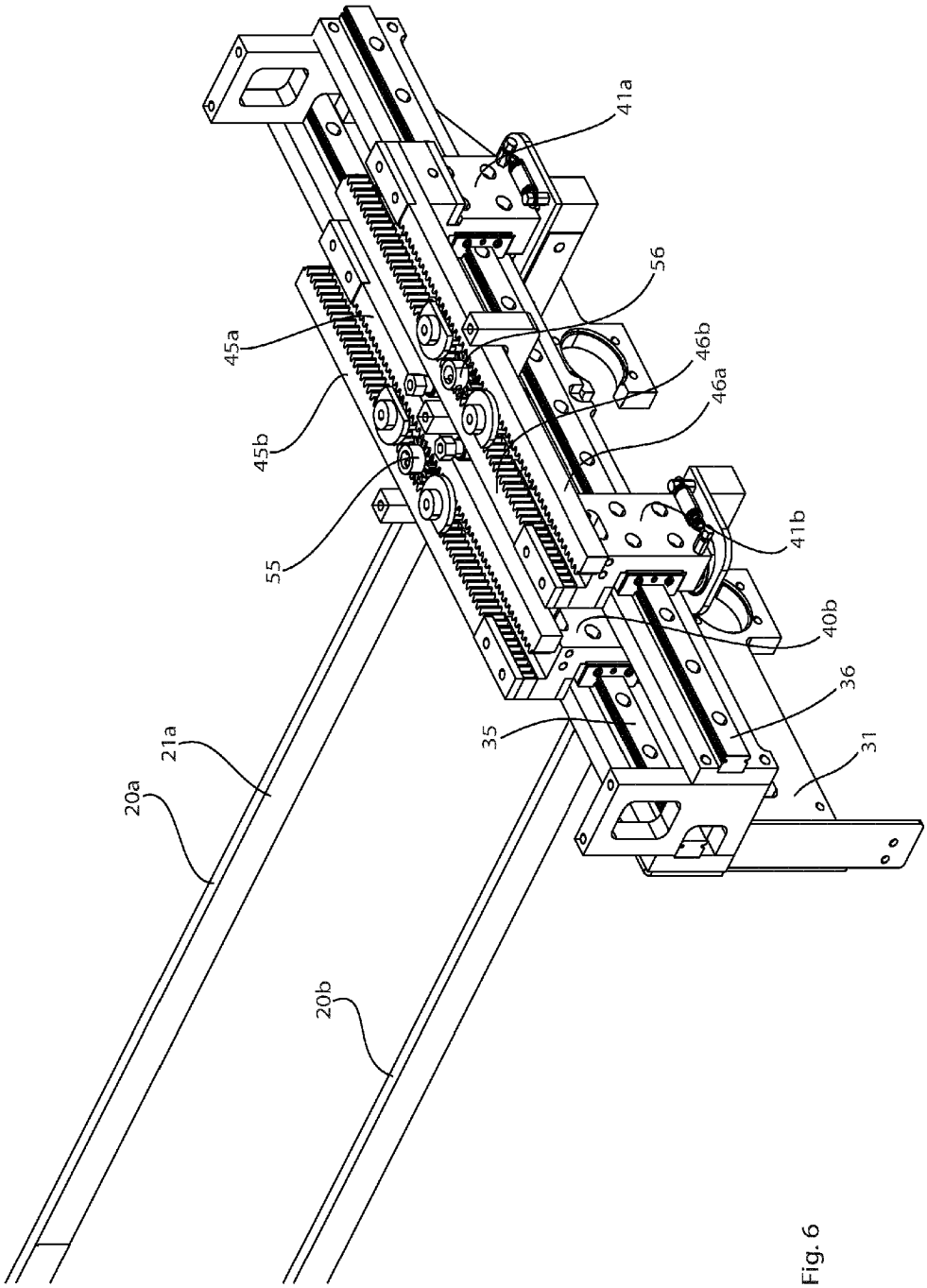

Fig. 6

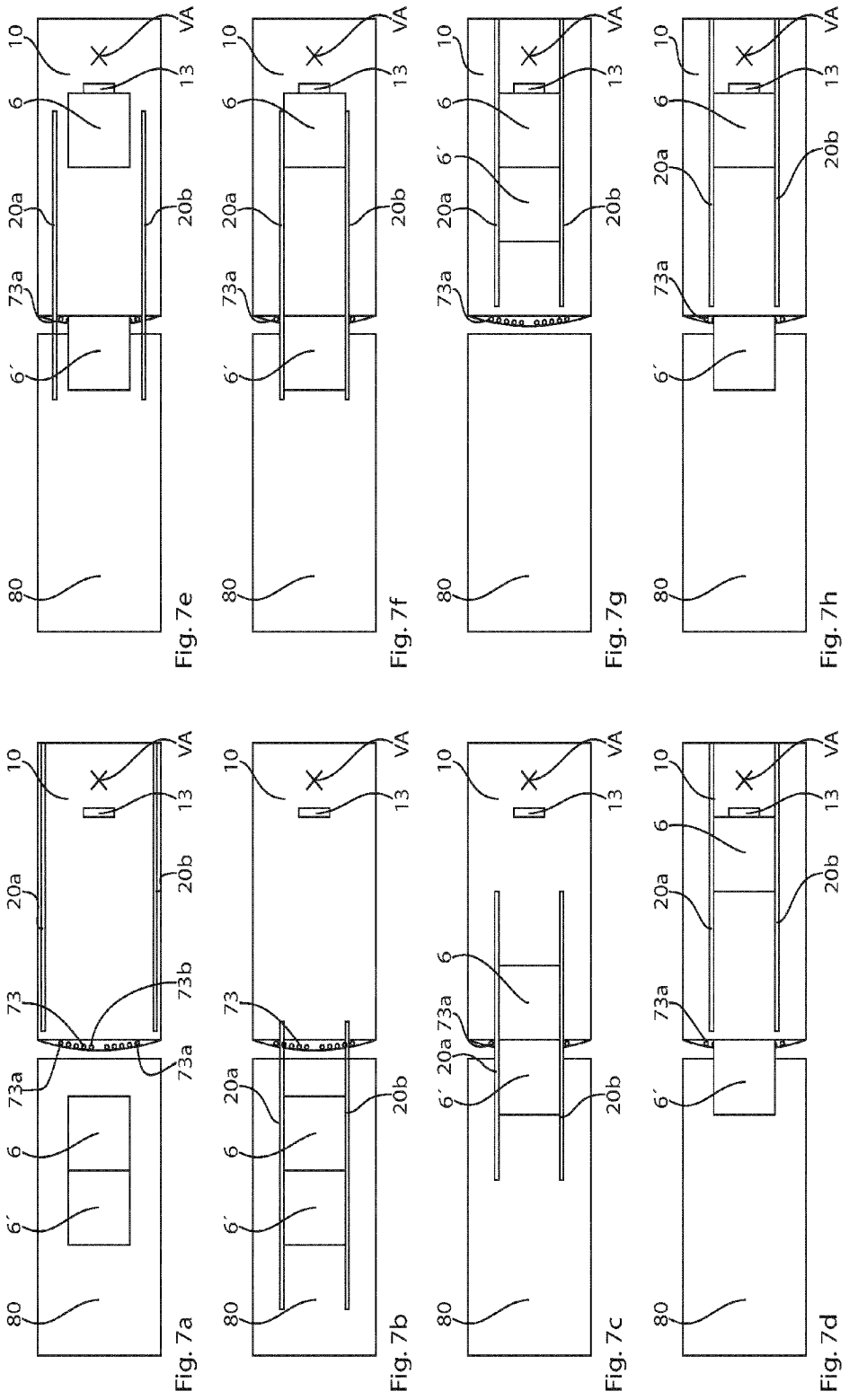

Fig. 7e Fig. 7f Fig. 7g Fig. 7h

Fig. 7a Fig. 7b Fig. 7c Fig. 7d

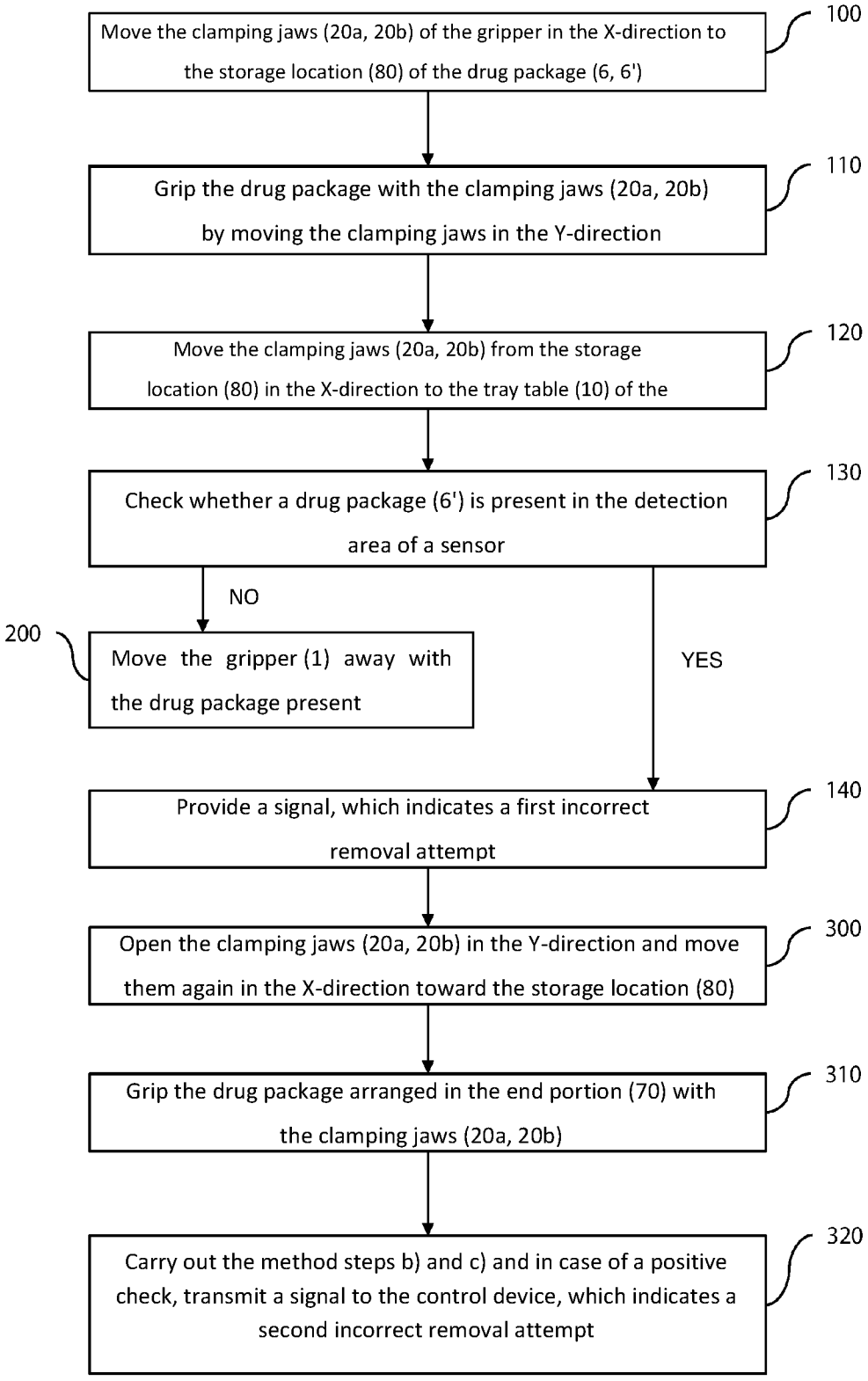
Move the clamping jaws (20a, 20b) of the gripper in the X-direction to the storage location (80) of the drug package (6, 6')
100
Grip the drug package with the clamping jaws (20a, 20b) by moving the clamping jaws in the Y-direction
110
Move the clamping jaws (20a, 20b) from the storage location (80) in the X-direction to the tray table (10) of the
120
Check whether a drug package (6') is present in the detection area of a sensor
130
NO
YES
200
Move the gripper (1) away with the drug package present
Provide a signal, which indicates a first incorrect removal attempt
140
Open the clamping jaws (20a, 20b) in the Y-direction and move them again in the X-direction toward the storage location (80)
300
Grip the drug package arranged in the end portion (70) with the clamping jaws (20a, 20b)
310
Carry out the method steps b) and c) and in case of a positive check, transmit a signal to the control device, which indicates a second incorrect removal attempt
320

Fig. 8