

GRIPPER FOR AN ORDER-PICKING DEVICE, AND METHOD FOR OPERATING THE ORDER-PICKING DEVICE

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
5 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 face of the tray table of the gripper is straight. This front is moved for moving drug packages onto or from the tray table to a storage location, wherein the storage location may be, for example, a shelf or a conveyor belt for moving drug packages
10 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. The straight front then requires when performing only a rotational or pivotal movement that a gap remains between the front and the storage location, wherein
15 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, you can form the front of the tray table in a bent manner. This requires that after a pivoting or rotational movement for positioning the gripper, the gap
20 is smaller, at least in the middle of the curved front, but increases to the sides of the tray table.

When moving drug packages from a storage location onto the tray table, it may happen that the drug package remains hanging 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
25 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, in which can detect when drugs have become stuck.

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

It is an object of the present invention to provide a gripper in which an incorrect movement of a drug package onto the tray table of a gripper can be detected even with a curved
10 front of the tray table. It is another 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 the storage of drug packages according to claim 1. The gripper according to the invention comprises a tray table extending in a first horizontal direction (X-direction) and
15 a second horizontal direction (Y-direction) orthogonal to the first horizontal direction, having an end portion with an arcuate front extending in the Y-direction, said end portion forming the loading and unloading front, said tray table and said end portion defining an upper support surface. The arcuate design of the front enable grippers also extending in the Y-direction to be rotated in front of a storage location in such a way that not too wide
20 of a gap remains between the front of the gripper and the front of the storage location without said grippers themselves being able to travel in the Y-direction.

A transport device movable in the first horizontal direction is arranged above the tray table for moving drug packages from a horizontal storage surface onto the tray table. To grasp a drug package, the transport device is first moved in the X-direction to a storage location
25 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 X-direction toward the tray table, thereby pulling the drug package onto the tray table. In this pulling movement, the drug package is moved over the end portion with an arcuate front. How exactly the drug package is grasped 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.

- 5 In the gripper according to the invention, a plurality of (three or more) 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 Y-direction and wherein in Y-direction outer sensors are arranged at a distance in the X-direction from at least one sensor arranged further inside in the Y-
10 direction, such that the arrangement of the sensors is oriented towards the front extending in an arcuate manner.

It is not necessary that the sensors are exactly aligned with the arcuate shape of the front. It is also conceivable that the offset in the X-direction is linear, for example. Although an alignment with the arcuate shape is not necessary, this is preferred. In a
15 preferred embodiment it is therefore provided that the sensors are at a distance from one another in the X-direction in such a way that the sensors are substantially the same distance from the arcuate front, i.e. are aligned with the arcuate form of the front. The formulation "substantially the same distance" also includes such arrangements in which the distance from the front slightly varies due to production. A corresponding arrangement
20 of the sensors enables a very precise detection with respect to an incorrect movement of a drug package if the drug package, for example, lies slightly in an outer region of the end portion.

The aforementioned control device may be part of the gripper itself, but it may also be arranged at a different location of the picking device. Due to the arrangement of the
25 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, 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 a piece good 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 removal of drug packages, in which the drug package thus remains hanging in the transition area storage location/tray table, so that the package rests only in the end portion of the tray table. If one were to use a light barrier in such a case, which
5 can be arranged only in the parallel portion of the tray table, such an incorrect removal 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.

10 If in this application a drug package is mentioned, where it makes sense technically, several drug packages should also be included. 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
15 comprise such. Although such a design is structurally quite simple, a movement of several drug packages simultaneously from a storage surface onto the tray 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 X-direction
20 and with clamping surfaces facing one another, 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 be moved when applying a corresponding clamping force. The use of clamping jaws also has the advantage of being
25 able to guide the drug packages in the event of movement of drug packages from the tray table to a storage surface or delivery location. Furthermore, such a gripper can be used to move drug packages on a storage surface along the second horizontal direction.

The sensors serve, as stated above, to detect whether a drug package has become stuck in the end portion of the tray table when moving onto the tray table. In addition, however,

it is also possible to use the sensors for a plausibility check with respect to the removed 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 plurality of sensors are arranged mirror-symmetrically with respect to a center axis of the tray table extending in the 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.

10 As already stated, the end portion is formed arcuately in the gripper according to the invention. 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 center of the corresponding circle is located in a vertical axis of rotation of the tray table.

15 In order to avoid a long downtime of the gripper in case of failure of a sensor or multiple sensors, it is provided in a preferred embodiment that the end portion comprising at least one sensor is formed as sensor assembly detachable from the tray table. A corresponding design as a sensor assembly allows for rapid replacement, possibly also by a "normal" operator.

20 It is essential in the gripper according to the invention that the clamping jaws are movable in the X-direction, which means that the clamping jaws are movable from the tray table to a storage location and back again, the X-direction regularly corresponding to the longitudinal axis of the tray table. In order to ensure the clamping or gripping of a drug package, it is also necessary that at least one of the clamping jaws is movable in the 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 Y-direction and at least one is also designed 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 performing the
25 aforementioned movements. This jaw guide assembly comprises a frame structure, at

least a first and a second guide extending 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 associated with the first guide and two second jaw carriages are associated with the second guide, and wherein at least two jaw carriages spaced in the first horizontal direction are coupled to a clamping jaw. A drive unit is further coupled with 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 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 for 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 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 grasping the drug package, the transport device is moved in step b) from the storage location in the X-direction to the tray table, wherein the at least one drug package is moved over the arcuate front of the end portion to the support surface of the tray table. After moving the transport device in the 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 rests 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 test is positive, a signal is provided in a step d), which indicates a first incorrect removal attempt of a piece good from a storage location onto the tray table.

Providing a signal indicative of a first incorrect withdrawal attempt may result in the picking device being shut down until the error 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, wherein the transport device comprises two elongated X-directionally
5 extending clamping jaws arranged above the tray table, with clamping surfaces facing each other, the device is not completely shut down, but rather the clamping jaws are opened in the Y-direction and again moved in the X-direction to the storage location, and then the drug package disposed in the end portion is gripped with the clamping jaws. Since it is known on the basis of the check that (and where) the drug package is disposed
10 at least in sections in the end portion of the tray table, it can be estimated on the basis of the information present on the package how far the movement must take place in the X-direction. After the drug package has been gripped (or one has at least tried to grip it) with the clamping jaws, the above-mentioned process steps b) and c) are performed again, i.e. the package is returned to the tray table and an end portion test is performed.
15 Should the second check of the end portion also be positive, i.e. should it be determined that a drug package is again resting on the end portion, a signal indicative of a second incorrect withdrawal attempt is provided. In response, the device can now be shut down, or 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
20 package is determined by moving the at least one drug package toward the tray table by means of the sensors, the determined width is compared to a nominal width known to the control device and, when a limit deviation between the determined width and target width of a drug package is exceeded, a corresponding signal is provided. In this preferred embodiment, therefore, there is a further verification of the moved drug package. While it
25 is relatively unlikely that a drug package which the control device of the picking device does not expect would be located at a storage location, this may be the case if, for example, an error correction by an operator has displaced the drug packages in the picking device. The embodiment according to the invention thus once again 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 resting 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 improper depositing, which avoids a standstill of the picking device. The thus removed drug packages can be loaded again and the drug to be initially unloaded can be requested again.

10 The invention further relates to a use of a sensor assembly having an arcuate front extending in a Y-direction and a plurality of sensors (at least three) arranged under the 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 Y-direction and wherein in Y-direction outer sensors are arranged at a distance in the X-direction, orthogonal to
15 the Y-direction, from at least one sensor arranged further inside in the Y-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 on a support table of a gripper of a picking device for drugs.

20 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

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

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

Figs. 3a, 3b show the detail views of Figs. 2a and 2b without the tray table itself,

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

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

Fig. 6 shows an oblique view of the jaw guide assembly when the clamping jaws are in
5 parallel position,

Figs. 7a-7h show different stages of a preferred embodiment of the method according to the invention, and

Fig. 8 shows a flow chart of the preferred embodiment of the method according to the invention.

10 Figs. 1a and 1b show two oblique views of a first preferred embodiment of the gripper 1 according to the invention, wherein Fig. 1a shows an oblique view from above and Fig. 1b shows an oblique view from below. The gripper 1 according to the invention is part of an operating device (not shown) 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
15 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 disposed below the surface of the sensor assembly and capable of detecting the
20 presence of an object in their detection area. The sensors can detect when a drug package (at least in sections) rests in the end portion.

The sensors 73a are the outer sensors, wherein the sensor 73b is the inner sensor, wherein a plurality of further sensors 73 are arranged between this plurality of further sensors. Whether one or two inner sensors 73b are present depends on the precise
25 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 one sees, the sensors are arranged at a distance from one another in the Y-direction, and the outer sensors 73a are also arranged at a distance in the X-direction from the inner sensor 73b. The exact distance from one another in the X-direction of the sensors distributed in the Y-direction depends on the exact shape of the arcuate front and the number of sensors. It may be the case that, for example, two inner sensors 73a are not at a distance from one another in the X-direction; however, the outer sensors 73a are always arranged at a distance from at least one inner sensor 73b in the 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 rest or move. The front 71 of the end portion is arcuate. 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 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 shown) with a control device (shown 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. In the opening 11, a sliding element 12 is arranged with a widened sliding head 13. The sliding element 12 can be moved in the elongated opening 11 in the loading and unloading direction and 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 section, 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. Moreover, below the tray table, a further drive 7 is arranged, with which the sliding element 12 is movable in the elongated opening 11 in the first horizontal direction.

Figs. 2a, 2b and 3a, 3b show detailed views of the first embodiment in the region of the end portion of the tray table 10, wherein in Figs. 3a and 3b, the tray table is omitted to illustrate the lower part of the gripper. Figs. 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 X-direction) of the drug package(s) moved onto the tray table. For this purpose, the drug package is moved when moving on the tray table completely to the sliding head 13, by the clamping jaws 20a, 20b being completely moved back. Upon 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 X-direction can be determined and compared with the known length.

Figs. 4a and 4b show oblique views of a jaw guide assembly 30 of a second embodiment in which both clamping jaws are pivoted for grasping. The jaw guide assembly 30 includes

a slightly different frame structure 31, 32, 33a, 33b, wherein the front component 31 engages around the clamping jaws (and the tray table, not shown). 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 Figs. 2a, 2b and 3a, 3b) themselves may move to move the moving parts, for example by rotating, during which 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 designed 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 Fig. 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 illustrated embodiment of the operating device according to the invention, a portion of the jaw carriages surrounds a projection of the guides 35, 36, so that the jaw carriages partially rest on this projection.

Figs. 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 in the embodiment shown as racks. The drive elements 45a, 45b associated with the first guide 35 and the corresponding first jaw carriage 40a, 40b and the corresponding drive elements 46a, 46b associated with the second guide 36 are aligned with respect to the tooth elements of the racks in such a way that the toothed elements lie opposite one another and at their free ends form an overlap

area. A drive gearwheel 55, 56 is arranged in each case centrally in the overlapping region of the drive elements or racks and is coupled to a drive 51, 52 via a gear 53, 54 (not shown in Figs. 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, with the corresponding applying for the jaw carriages associated with 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 associated with 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 Figs. 4b and 5b. In the illustrated embodiment, the clamping jaws 20a, 20b are each connected via a pivot 23a, 43a; 23b, 43b with the jaw carriages 40a, 40b of the first guide 35 and via a slot guide 24a, 25a, 44a; 24b, 25b, 44b are connected to the jaw carriages 41a, 41b of the second guide 36. In alternative embodiments, the hinge may also be arranged in the jaw carriage associated with the second guide, and in this case, it is then required in the illustrated combination that the slot guides are arranged in the jaw carriages associated with the first guide 35.

However, a use of the combination rotary joint/slot guide is not mandatory. Although the clamping jaws must be kept in at least one guide to the corresponding jaw carriage by means of a rotary or swivel joint, 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.

Fig. 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 Fig. 6, the clamping jaws 20a, 20b are further moved together and aligned parallel to each other. In a comparison of Figs. 5a, 5b and Fig. 6 it can be seen how the position of the clamping jaws is influenced by a displacement of the jaw carriage on the guides.

With reference to Figs. 7a-7h and Fig. 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 removed are arranged approximately centrally with respect to the tray table 10 of the gripper, as illustrated in Fig. 7a. In Figs. 7a-7h, only a few components of the gripper are shown schematically which are essential for the method as such. 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 arcuate in the 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 in the X-direction to the storage location of the drug packages 6', 6, as illustrated in Fig. 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 Y-direction, so that the drug packages 6', 6 are gripped (see also Fig. 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 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 X-direction to their original position, with the gripped drug package or packages striking 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 a plurality of) the sensors 73, 73a, 73b, wherein the approximate position of the drug package can be determined thereby. The detection as to whether a drug package is arranged in the end portion depends on the type of sensor used, meaning particularly light scanners, light sensors and tactile sensors.

5 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 lying in the end portion, the gripper is moved subsequently to the storage location of the drug package or packages resting on the tray table (step 200). However, if it turns out that a drug package is disposed in the
10 end portion, as shown in Fig. 7d, a signal is provided which indicates a first incorrect removal attempt of the drug package from the storage location 80 to the tray table 10 (step 140). In the situation illustrated in Fig. 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 also partly arranged in the end portion. If the gripper would be
15 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 operation 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
20 a step 300, the clamping jaws 20a, 20b are opened in the Y-direction and moved in the 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 Y-direction. If only a smaller number of sensors are used, the procedure is simply to move the clamping jaws
25 maximally in the Y-direction. Once the clamping jaws have been moved correspondingly far in the X-direction to the storage location, an attempt is made to grasp the stuck drug package 6' with the clamping jaws (step 310) by retracting the clamping jaws in the Y-direction. Thereafter, process steps b) and c), that is, moving in the X-direction toward the tray table and checking the end portion for a resting drug package, are repeated (step
30 320). If it is determined that a drug package is still resting in the end portion, a signal indicative of a second incorrect removal attempt is provided (Fig. 7h). In this case, a third

removal attempt may be made, or a movement of the gripper is prevented and the intervention of operating personnel is requested.

Claims

1. A gripper (1) for a picking device with horizontal storage surfaces for storage of drug packages, comprising:

a tray table (10) extending in a first horizontal direction and a second horizontal direction orthogonal to the first horizontal direction, having an end portion (70) with an arcuate front (71) extending in the second horizontal direction, said end portion (70) forming the loading and unloading front, said tray table (10) and said end portion (70) defining an upper support surface,

a transport device (20a, 20b) arranged above the tray table (10) and movable in the first horizontal direction for moving drug packages from a horizontal storage surface onto the tray table (10),

characterized in that the gripper (1) comprises a plurality of sensors coupled to a control device (4) arranged in the end portion (70) 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 (73a) are arranged at a distance in the first horizontal direction from at least one sensor (73b) arranged further inside in the second horizontal direction, such that the arrangement of the sensors is oriented towards the front (71) extending in an arcuate manner.

2. The gripper (1) for a picking device having horizontal storage surfaces for storing drug packages according to claim 1, characterized in that the sensors (73, 73a, 73b) are at a distance one another in the first horizontal direction such that the sensors substantially are at the same distance from the arcuate front (71).

3. The gripper (1) for a picking device having horizontal storage surfaces for the storage of drug packages according to claim 1 or 2, characterized in that the transport device comprises two elongated clamping jaws (20a, 20b) extending in the first horizontal direction arranged above the tray table (10), with clamping surfaces (21a, 21b) facing

each other, wherein at least one of the clamping jaws is additionally movable at least in sections in the second horizontal direction.

4. The gripper (1) for a picking device with horizontal storage surfaces for the storage of drug packages according to any one of claims 1-3, characterized in that the sensors (73, 73a, 73b) are arranged mirror-symmetrically with respect to a central axis (MA) of the tray table (10) extending in the first horizontal direction.

5. The gripper (1) for a picking device with horizontal storage surfaces for storing drug packages according to one of claims 1-4, characterized in that the end portion is formed as a sensor assembly (72) which is detachable from the tray table (10).

6. The gripper (1) for a picking device with horizontal storage surfaces for storage of drug packages according to one of claims 1-5, characterized in that the arcuate front (71) of the end portion (70) is circularly curved, wherein the center of the corresponding circle is located in a vertical rotary axis (VA) of the tray table (10).

7. The gripper (1) for a picking device with horizontal storage surfaces for storing piece goods according to one of claims 3-6, characterized in that the gripper further comprises:
 a jaw guide assembly (30) with
 a frame structure (31, 32, 33a, 33b),
 at least a first and a second guide (35, 36) extending in parallel and in the first horizontal direction spaced from each other in the second horizontal direction transverse to the first horizontal direction, and
 at least four jaw carriages (40a, 40b, 41a, 41b) coupled to the guides (35, 36) and driven in the second horizontal direction, wherein two first jaw carriages (40a, 40b) are assigned to the first guide (35) and two second jaw carriages (41a, 41b) are assigned to the second guide (36) and wherein at least two jaw carriages (40a, 41a; 40b, 41b) spaced apart in the first horizontal direction are coupled to a clamping jaw (20a, 20b), and
 a drive unit (60, 61a, 61b, 62a, 62b) coupled to the jaw guide assembly for driving the jaw guide assembly (30) in the first horizontal direction.

8. A method of verifying a movement of drug packages (6, 6') onto a tray table (10) of a gripper (1) according to any one of claims 1-7, wherein

- a) the transport device is moved in the first horizontal direction to a storage location (80) of at least one drug package (6, 6') and the at least one drug package is gripped,
- b) the transport device is moved from the storage location (80) in the first horizontal direction to the tray table (10),
- c) after moving the transport device in the first horizontal direction by means of the sensors (73, 73a, 73b) in the end portion (70), it is checked whether a drug package (6') is present in the detection area of the sensors, and
- d) if this check is positive, a signal is provided indicating a first erroneous removal attempt.

9. The method for verifying a movement of drug packages (6, 6') onto a tray table (10) of a gripper (1) according to claim 8, wherein the transport device comprises two elongated, clamping jaws (20a, 20b) extending in the first horizontal direction and arranged above the tray table (10) with mutually facing clamping surfaces (21a, 21b),

characterized in that, in the case of a positive check according to step d), the clamping jaws (20a, 20b) are opened in the second horizontal direction and moved again in the first horizontal direction to the storage location (80),

a drug package arranged in the end section (70) is gripped by the clamping jaws (20a, 20b),

the method steps b) and c) are carried out, and

if this check is positive, a signal is provided which indicates a second incorrect removal attempt.

10. The method for verifying a movement of drug packages (6, 6') onto a tray table (10) of a gripper (1) according to one of claims 8 or 9,

characterized in that, when moving the at least one drug package (6) towards the tray table, the width of a drug package (6) is determined by means of the sensors (73, 73a, 73b) arranged in the tray table,

the determined width is compared with a desired width known to the control device (4), and

when a limit deviation between the determined width and desired width of a drug package is exceeded, a corresponding signal is provided.

11. The method for verifying a movement of drug packages (6, 6') onto a tray table (10) of a gripper (1) according to claim 10, characterized in that after providing a signal indicative of an exceeding of a limit deviation, the gripper (1) is moved towards an unloading station and the drug packages present are transferred to the unloading station.

12. Use of a sensor assembly (72) according to claim 5 with an front (71) extending in an arcuate manner in the second horizontal direction and a plurality of sensors (73, 73a, 73b) arranged under the 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, orthogonal to the second horizontal direction, from at least one sensor (73b) 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, an interface for connecting the sensor assembly to a control device for verifying a movement of drug packages (6, 6') onto a tray table (10) of a gripper (1) of a picking device for drugs.