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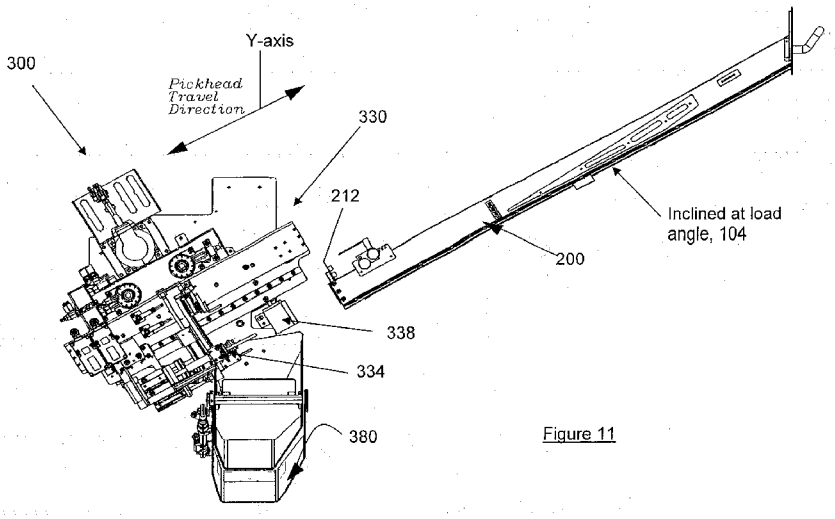

Figure 11

(57) Abstract: A pharmaceutical dispensing apparatus (100) for dispensing pharmaceutical packages containing pharmaceuticals is disclosed herein. In a described embodiment, the apparatus (100) comprises an array of dispensing cartridges (200) adapted to receive a plurality of individual pharmaceutical packages in the form of blister packs (212). Each dispensing cartridge (200) has a longitudinal axis (106) and arranged to support the individual blister pack (212) at a load angle of between 20° and 38°, the load angle being an angle formed between the longitudinal axis (106) and a horizontal axis (108) of the apparatus. The pharmaceutical dispensing apparatus (100) also includes a pick-and-place mechanism (300) operable to selectively remove the blister pack (212) from the array of dispensing cartridges (200).

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Pharmaceutical Dispensing Apparatus

Background and Field of the Invention

The invention relates to a pharmaceutical dispensing apparatus.

It is common to package pharmaceuticals in unit-dose packaging in the form of tablets or capsules and blister packs are used to contain these pharmaceuticals. When a doctor prescribes medicine to a patient, the prescription is interpreted by a nurse or pharmacy and the medicine, which may be in the form of blister packs, collected from various storage areas and packed for distribution to the patient. Such a process may be acceptable to a clinic but might be labour intensive and unproductive in a large facility, such as a hospital, where medicine is prescribed to hundreds of patients each day. Moreover, such a process of dispensing pharmaceuticals is also prone to errors.

As a result, it has been proposed to provide a pharmaceutical dispensing apparatus having a pick and place device which automatically picks up pharmaceutical packages from storage areas based on instructions received from a controller and delivers the pharmaceutical packages to a delivery area. However, it has been found that such an apparatus is still prone to errors, sometimes picking up more or fewer of the pharmaceutical packages than prescribed, creating confusion and inconvenience. Further, such an apparatus may be suitable for picking pharmaceuticals packed in boxes but is not suitable to pick pharmaceuticals packed in a different packaging.

It is an object of the present invention to provide a pharmaceutical dispensing apparatus which alleviates at least one of the disadvantages of the prior art and/or to provide the public with a useful choice.

Summary of the Invention

In accordance with a first aspect of the present invention, there is provided a pharmaceutical dispensing apparatus for dispensing pharmaceutical packages containing pharmaceuticals, the apparatus comprising: an array of dispensing cartridges adapted to receive a plurality of individual pharmaceutical packages; each dispensing cartridge having a longitudinal axis and arranged to support the individual pharmaceutical packages at a load angle of between 20° and 38°, the load angle being an angle formed between the longitudinal axis and a horizontal axis of the apparatus; and a pick-and-place mechanism operable to selectively remove at least one pharmaceutical package from the array of dispensing cartridges.

By having the load angle of between 20° and 38°, it has been found that such an angle optimizes inventory to space constraints in the apparatus and yet enables reliable picking or removal of the pharmaceutical packages in the dispensing cartridges. Optionally, the load angle may be between 21° and 37°, between 20° and 36°, between 19° and 35°, between 18° and 34°, between 17° and 33° etc. Advantageously, the load angle may be between 23° and 35°.

The individual pharmaceutical packages may be blister packs or other types of packaging, such as boxes. It should be apparent that blister packs are intended to include (and not limited) to blister strips, blister card or sometimes called Push-Through-Pack (PTP).

Optionally, the array of dispensing cartridges may be configured to receive different types of pharmaceutical packages. The pick-and-place mechanism may also be configured to selectively remove the different types of pharmaceutical packages from the array of dispensing cartridges. In this way, the apparatus has the flexibility to dispense different types of pharmaceutical packages.

Advantageously, at least some of the dispensing cartridges of the array are configured to receive individual blister packs, and at least one pharmaceutical package includes at least one individual blister pack. The pick-and-place mechanism may include a pick head having two or more suction cups, which are separately operable for removing said individual blister pack from the dispensing cartridge. The suction cups may be actuated using vacuum.

Preferably, the pick head comprises a gripper for gripping and lifting a said pharmaceutical package from one of the dispensing cartridges. The pharmaceutical package may be in the form of a pharmaceutical box.

Optionally, the pick-and-place mechanism comprises guide rails for moving the pick head along two non-parallel directions to positions adjacent to the array of

dispensing cartridges for removing the at least one pharmaceutical package. Advantageously, each of the dispensing cartridges includes first and second spaced apart gate members arranged to define an opening through which a said pharmaceutical package in the form of a blister pack is removable from the cartridge; wherein the first and second gate members are further arranged to support respectively first and second support portions of a first one of the plurality of blister packs at the opening, each of the first and second support portions being between 11mm and 16mm. Each of the first and second gate members may include a roller arranged to enable a said blister pack to be extracted through the opening. The rollers may be arranged to contact the first one of the plurality of blister packs. The first gate member may be slidable to adjust the opening's size. Preferably, each dispensing cartridge comprises a counterweight for urging the plurality of blister packs to the opening.

Each dispensing cartridge may include a storage channel which defines the longitudinal axis, the dispensing cartridge including an adjustable wall for adapting the storage channel for supporting different sizes of the pharmaceutical packages. The pharmaceutical dispensing apparatus may further comprise a hopper bin for collecting pharmaceutical packages removed by the pick-and-place mechanism.

The pharmaceutical dispensing apparatus may further comprise a packaging and printing module arranged to bag the collected pharmaceutical packages in a bag and to label the bag with information relating to the pharmaceutical package.

In a second aspect of the invention, there is provided pick-and-place mechanism for removing blister packs from an array of dispensing cartridges, the pick and place mechanism including a pick head having two or more suction cups, which are capable of being separately actuated to suck at least one selected blister pack and to remove the at least one selected blister pack from the array of dispensing cartridges.

In this way, the pick-and-pace mechanism has the flexibility and compatibility to pick blister packs of different sizes.

Preferably, the pick-and-place mechanism further comprises extendable guide arms arranged to control the movement of the two or more suction cups. The two or more suction cups may be operable by vacuum to create the suction. The pick-and-place mechanism may further comprise a drive belt arranged to move the pick head selectively between a picking position next to one of the dispensing cartridges and a drop position for dropping the selected blister pack. The pick-and-place mechanism may further comprise a hopper bin for collecting the dropped selected blister packs.

The two or more suction cups may be capable of being separately actuated to suck a bundle of blister packs having two or more individual blister packs bundled together and to remove the bundle from the array of dispensing cartridges. In addition or as an alternative, the two or more suction cups may be

capable of being separately actuated to suck the blister packs individually and to remove the bundle from the array of dispensing cartridges.

In a third aspect of the invention, there is provided a dispensing cartridge for dispensing blister packs in a pharmaceutical dispensing apparatus, the cartridge comprising a storage channel for receiving a plurality of individual blister packs in upright positions; and first and second spaced apart gate members arranged to define an opening through which a said blister pack is removable from the cartridge; wherein the first and second gate members are further arranged to support respectively first and second support portions of a first one of the plurality of blister packs, each of the first and second support portions being between 11mm and 16mm.

Each of the first and second gate members may include a roller arranged to enable a said blister pack to be extracted through the opening. The rollers may be arranged to contact the first one of the plurality of blister packs. The first gate member may be slidable to adjust the opening's size. Advantageously, the dispensing cartridge further comprises a counterweight for urging the plurality of blister packs to the opening. The dispensing cartridge may further comprise an adjustable wall for adapting the storage channel for receiving different sizes of the blister packs.

It should be appreciated that features relevant to one aspect may also be relevant to the other aspects.

Brief Description of the Drawings

An example of the invention will now be described with reference to the accompanying drawings, in which:

Figure 1 is a photograph showing a pharmaceutical dispensing apparatus including an array of dispensing cartridges and a pick and place mechanism according to a preferred embodiment of the invention;

Figure 2 is a schematic view of the pharmaceutical dispensing apparatus of Figure 1 without housing to illustrate components of the apparatus more clearly;

Figure 3 is an enlarged schematic view showing some of the array of dispensing cartridges of Figure 1;

Figure 4 is a further enlarged perspective view of one of the dispensing cartridges of Figure 3 arranged to receive blister packs;

Figure 5 is an enlarged view of area A of the array of dispensing cartridges of Figure 3 to show how more clearly how each of the dispensing cartridges receive and supports blister packs or pharmaceutical boxes;

Figure 6 is a side view of the array of dispensing cartridges of Figure 3 to illustrate a load angle of the dispensing cartridges;

Figure 7 is a close-up view of an end of one of the dispensing cartridges of Figure 5;

Figure 8 is a schematic of the pick-and-place mechanism of Figure 1 without showing the other components;

Figure 9 is a close up view of a pickup device and a hopper of the pick and place mechanism of Figure 8;

Figure 10 is an enlarged view of the pickup device of Figure 9 to illustrate a clearer view of a pick head having two suction heads;

Figure 11 is a side view of the pickup device of Figure 10 and a side view of one of the dispensing cartridges of Figure 3 to illustrate how the pickup device is arranged to travel along an axis aligned with the load angle of the dispensing cartridge;

Figure 12 is a perspective enlarged schematic view of the packaging and printing module of Figure 1;

Figure 13a is a top plan view of the dispensing cartridge of Figure 4;

Figure 13b is an enlarged view of portion C of Figure 13a;

Figure 13c is an enlarged view of portion D of Figure 13b;

Figure 14 is a further enlarged perspective view of one of the dispensing cartridges of Figure 3 arranged to receive pharmaceutical boxes;

Figure 15a illustrates the pickup device of Figure 11 arranged to pick a blister pack from one of the dispensing cartridges having a plurality of blister packs, and with suction cups of the pickup device extended ready for the picking operation;

Figure 15b is a close-up view of the portion E of Figure 15a;

Figure 16a illustrates the pickup device of Figure 15a with the suction cups in contact with the blister pack and the suction cups are retracted to create a vacuum to extract the blister pack out of the dispensing cartridge; and

Figure 16b is a close-up view of the portion F of Figure 16a.

Detailed Description of Preferred Embodiment

Figure 1 is a photograph showing a pharmaceutical dispensing apparatus 100 according to a preferred embodiment. The apparatus 100 includes an array of dispensing cartridges 200, a pick-and-place mechanism 300 (not shown in Figure 1 but see Figure 2), a packaging and printing module 400, a control system 500 and a basket output module 600. Broadly, each of the array of dispensing cartridges 200 is configured to receive a plurality of pharmaceutical packages containing pharmaceuticals; and the pick-and-place mechanism 300 receives instructions from the control system 500 and picks up selected ones of the plurality of pharmaceutical packages removing them from the respective dispensing cartridges 200, and sends them to the packaging and printing module 400. The packaging and printing module 400 packs the selected pharmaceutical packages in a bag, prints information label based on prescription and patient information received from the control system 500 directly on to the bag, and sends the bag to the basket output module 600. The basket output module 600 collects the bag for distribution to the patient based on the information label.

Figure 2 is a schematic view of the pharmaceutical dispensing apparatus 100 of Figure 1 without housing to illustrate components of the apparatus more clearly. The pharmaceutical dispensing apparatus 100 includes a support structure 102 made of heavy duty aluminum for supporting the array of dispensing cartridges 200, the pick-and-place mechanism 300, the packaging and printing module 400 and the control system 500 with the basket output module 600 aligned at

an end of the support structure 102. The basket output module 600 includes a plurality of baskets 602 stacked one top of another which are used for containing the bags of pharmaceutical packages (although the baskets 602 are not shown in Figure 1).

Figure 3 is an enlarged schematic view showing some of the dispensing cartridges 200 of the array of Figure 1 to reveal an arrangement of support brackets 202 for supporting each of the dispensing cartridges 200 at a load angle 104 which will be discussed in further detail below. It should be apparent that each of the dispensing cartridges 200 is similar in construction and structure and Figure 5, which is an enlarged view of area A of the array of dispensing cartridges of Figure 3, shows these more clearly. As it can be appreciated from Figure 5, some of the dispensing cartridges 200 are arranged to receive a plurality of pharmaceutical packages in the form of blister packs 212 and some of the dispensing cartridges 200 are arranged to receive a plurality of pharmaceutical packages in the form of pharmaceutical boxes 213. For ease of explanation, the dispensing cartridges 200 arranged to receive the blister packs 212 are termed "blister pack dispensing cartridges" 200a and the dispensing cartridges 200 arranged to receive the pharmaceutical boxes 213 are termed as "box dispensing cartridges" 200b. It should be appreciated that the blister pack dispensing cartridges 200a and the box dispensing cartridges 200b are similar in structure and function, and the different names are used to represent the contents which the dispensing cartridges carry. One of the blister pack dispensing cartridges 200a will be used as an example to explain the structure of the dispensing cartridges 200.

Figure 3 also shows the blister pack dispensing cartridge 200a in different positions of removal from the corresponding brackets 202. Figure 4 is a further enlarged perspective view of the blister pack dispensing cartridge 200a of Figure 3. The blister pack dispensing cartridge 200a includes a planar base 205 cooperating with first and second side walls 206,208 to create an elongate storage channel 210 for receiving and storing the blister pack 212 is shown as an example in Figure 4. The blister pack dispensing cartridge 200a has a longitudinal axis 106 which runs along the length of the elongate storage channel 210.

The blister pack dispensing cartridge 200a further includes a pair of adjusting bars 214 coupled to a side adjustable wall 216 (Figure 13a shows the pair of adjusting bars 214 more clearly). The side adjustable wall 216 runs the entire length of the storage channel 210 and has an engagement edge 216a so that when the adjusting bars 214 are adjusted linearly, this also moves the side adjustable wall 216 correspondingly to accommodate different sizes of pharmaceutical packages with the engagement edge 216a engaging with the pharmaceutical packages. The blister pack dispensing cartridge 200a includes a package removal section 218 near one end, and a cover plate 220 near the other end. The blister pack dispensing cartridge 200a includes a handle 222 mounted to the cover plate 220 and these are seen more clearly in Figure 1.

The package removal section 218 includes a barcode carrier plate 224 for displaying a barcode 226 which is used to identify the cartridge 200a uniquely,

and more importantly the cartridges' contents. In other words, this identification is important as it enables the pick-and-place mechanism 300 to identify where to locate and pick the required pharmaceutical packages from the array of dispensing cartridges 200.

The package removal section 218 also includes a support fixture 228 and two gate members 230,232 arranged spaced apart from each other to create an opening 234 therebetween. The first gate member 230 is connected to the adjusting bars 214 which are coupled to the side adjustable wall 216. In order words, moving the adjusting bars 214 adjust the position of the side adjustable wall 216 which in turn moves the first gate member 230. The second gate member 232 is fixedly mounted to the second side wall 208, as shown in Figure 4.

Sliding the first gate member 230 adjusts the width of the opening 234 and also moves the adjusting bars 214 to adjust the width of the channel 210. It is envisaged that the second gate member 232 may be movably coupled to the adjusting bars 214 and the first gate member 230 fixed, or both may be movably mounted.

The flexibility is that the opening 234 between two gate members 230,232 is adjustable by adjusting the position of the first gate member 230 to accommodate to the removal or extraction of different sizes of the blister pack 212 (or the boxes 213 in the case of the box dispensing cartridge 200b). Each of the gate members 230,232 is substantially C-shape to create upper and

lower flanges 236,238,240,242 so that a roller 244,246 is attached to the respective upper and lower flanges 236,238,240,242. The rollers 244,246 are useful to facilitate easier removal of the blister pack 212 from the dispensing cartridge 200a by the pick-and-place mechanism 300 and to minimize damage to the blister pack 212. Figures 13b and 13c illustrate how the blister pack 212 rest on the rollers 244,246 prior to extraction.

In this embodiment, the dispensing cartridge 202a is specifically configured to receive individual blister packs, one of which 212 is shown in Figure 4 which means that the blister packs are separated and not connected to each other. The individual blister pack 212 has first and second long edges 212a,212b, and first and second short edges 212c,212d to define a substantially rectangular body (although it may come in other shapes and sizes) with a flat back portion 212e and front portion 212f carrying blisters containing unit-dose pharmaceuticals. The individual blister pack 212 is arranged in an upright position with its two long edges 212a,212b traversing the storage channel 210 and its two short edges 212c,212d resting on the respective gate member 230,232 so that the flat back portion 212e faces the opening 234. This position also enables a plurality of blister packs 212 to be arranged one on top of another along the storage channel 210 of the cartridge 200a, as shown in Figure 5.

It is found that how the first and second gate members 230,232 support the blister pack 212 is particularly advantageous. To elaborate, the upper flange 236 and the lower flange 238 of the first gate member 230 define a first

outermost engagement edge 248, and the upper flange 240 and the lower flange 242 of the second gate member 232 define a second outermost engagement edge 250.

As it can be appreciated from Figure 7, the first gate member 230 is arranged to support a first support portion 252 of the blister pack 212 near the first short edge 212c and width of the first support portion 252 is defined as a distance between the first short edge 212c and the first outermost engagement edge 248 which is between 11mm and 16mm. Since the first short edge 212c of the blister pack 212 is engaged by the side adjustable wall 216 and thus, the measurement of 11mm and 16mm may also be considered as between the engagement edge 216a of the side adjustable wall 216 and the first outermost engagement edge 248. The second gate member 232 is arranged to support a second support portion 254 of the blister pack 212 near the second short edge 212d and width of the second support portion 254 is defined as a distance between the second short edge 212d and the second outermost engagement edge 250 which is also between 11mm and 16mm. Likewise, the second short edge 212d of the blister pack 212 is aligned with the inner surface of the second side wall 208 and thus, the measurement of 11mm and 16mm may also be considered to be between the inner surface of the second side wall 208 and the second outermost engagement edge 250.

It should be apparent that the widths of the first support portion 252 and the second support portion 254 are preferably the same, although this may not necessary. As shown in Figure 13c, the first support portion 252 of the blister

pack 212 is arranged to engage or rest on the roller 244 of the first gate member 230, and the second support portion 254 is arranged to engage or rest on the roller 246 of the second gate member 232. Also, if the rollers 244,246 are not flushed with the first and second outermost engagement edges 248,250, then the dimensions of 11mm-16mm is measured between the engagement edge 216a of the adjustable wall 216 (or the inner surface of the second side wall 208) and the outermost edge of the respective rollers 244,246.

It has been found that the width between 11mm and 16mm provides surprising and unpredictable effects. For example, it has been found that the width provides sufficient support to retain the blister pack 212 in the dispensing cartridge 200a and yet facilitates easy extraction or removal of the blister pack 212 from the blister pack dispensing cartridge 200a by the pick-and-place mechanism 300, especially when the blister pack dispensing cartridge 200a is inclined at the load angle 104. Such a dimension also minimizes damage to the blister pack 212 during the extraction process. Further, the blister pack 212 may be warped prior to loading and the width is found to retain the blister pack 212 even if it is warped.

Referring to Figure 4, the dispensing cartridge 200a includes a counterweight 256 having an engagement body 258 configured to push the blister pack 212 towards the opening 234. The counterweight 256 includes a pair of rollers 260 (only one is shown in Figure 4), with each roller arranged at either side of the engagement body 258. The rollers 260 are arranged to roll freely and under gravity along respective tracks 262 (see Figure 13a) adjacent to the first and

second side walls 206,208. The tracks 262 are extensions of the first and second side walls 206 208. The counterweight 256 is arranged to hold the blister pack 212 (in actual case, there is more than one such blister packs as shown in Figure 5 during transport of the blister pack dispensing cartridge 200a and to exert a force to push the blister pack 212 against the support fixture 228 when the dispensing cartridge 200a is supported at the load angle 104.

The blister pack dispensing cartridge 200a also includes a box restraint guide arm 266 for restraining pharmaceutical boxes when the dispensing cartridge 200 is configured to receive and support such boxes, an example of which is shown in Figure 14, which shows one of dispensing cartridges 200 being configured as the box dispensing cartridge 200b. Like parts in Figure 14 uses the same reference as Figure 4 with the addition of 1000. As shown in Figure 14, the box dispensing cartridge 200b also includes an elongate storage channel 1210 with a far end enclosed with a cover plate 1220, and a near end having a package removal section 1218. The box dispensing cartridge 200b also includes a pair of adjusting bars 1214 to accommodate to different box sizes. The package removal section 1218 also includes a first gate member 1230 and a second gate member 1232, both spaced apart to create an opening 1234. The box dispensing cartridge 200b is arranged to receive a plurality of pharmaceutical boxes 213 and a counterweight 1256 is arranged to push the plurality of pharmaceutical boxes 213 toward the first and second gate members 1230,1232 just like the blister pack dispensing cartridge 200a. The box restraint guide arm 1266 of the box dispensing cartridge 200b is configured to ensure that the pharmaceutical boxes 213 are fed level towards the package

removal section 1218 and to prevent a second box 213" from lifting when a first box 213' (which is the box 213 closest to the opening 1234) is being lifted and picked/extracted from the box dispensing cartridge 200b by the pick-and-place mechanism 300.

Referring to Figure 4, the blister pack dispensing cartridge 200a (and also the box dispensing cartridge) also includes a dampener 264 mounted to an outer surface of the second side wall 208 and the dampener 264 is configured to engage the support brackets 202 (shown in Figure 6) to enable smooth loading of the dispensing cartridge 200a into the pharmaceutical dispensing apparatus 100.

Figure 6 is a side view of the array of dispensing cartridges of Figure 3 in the direction B which shows the dispending cartridge 200a in various positions of being loaded into the pharmaceutical dispensing apparatus 100 and supported by a corresponding set of brackets 202. Using a second dispensing cartridge 2200 as an example, which is similar as the dispensing cartridge 200a, except that this second dispending cartridge 1200 is arranged at a higher level. As explained above, all the dispensing cartridges 200 are inclined at the load angle 104 with respect to respective horizontal axis 106 of the pharmaceutical dispensing apparatus 100. As illustrated by the second dispensing cartridge 1200, the load angle 104 is between 20° to 38° and this is the angle between the longitudinal axis 106 of the second dispensing cartridge 2200 and a horizontal axis 108 of the pharmaceutical dispensing apparatus 100 at the position of the second dispensing cartridge 2200. It has been found that the

load angle 104 achieves a balance of optimizing space for the array of dispensing cartridges and an advantageous effect of reliable picking of the contents of the dispensing cartridges 200 by the pick-and-place mechanism 300.

Figure 8 is a schematic of the pick-and-place mechanism 300 of Figure 1 without showing the other components and the pick-and-place mechanism 300 includes a pickup device 330 and a hopper bin 380. The pickup device 330 and the hopper bin 380 are mounted independently to a rack and pinion mechanism 302 which includes a horizontal guide rail 304 and a vertical guide rail 306. The horizontal guide rail 304 defines an X-axis of movement and the vertical guide rail 306 defines a Z-axis of movement for the pickup device 330 and the hopper bin 380 along two non-parallel axes. The pickup device 330 and the hopper bin 380 are movable along the X-axis and Z-axis.

Movement of the pickup device 330 along the horizontal guide rail 304 is achieved by a first servo motor drive 308 coupled to a pinion 305. The pick-up device 330 is mounted to the horizontal guide rail 304 supported by four bearing blocks 310. For added stability during high speed motion, a top rail 312 supported by top rail bearing blocks 314 is added. The Z-axis is provided by a belt module 316 powered by a second servo motor 318 , which means that the pickup device 330 is driven by different mechanisms to move along the X-axis and Z-axis.

Figure 9 is a close-up view of the pickup device 330 and the hopper 380 of the pick and place mechanism 300 and Figure 10 is an enlarged view of the pickup device 330 of Figure 9 to illustrate a clearer view of a pick head 332 having two suction heads 334,336. The pickup device 330 includes a scanner 338 arranged to scan the barcodes 226 carried by the respective barcode carrier plates 224 of the dispensing cartridges 200. The scanned information is transmitted back to the control system 500 to identify the dispensing cartridge 200.

The pick head 332 is movably mounted to a drive belt 340 to advance or retract the pick head 332 along a Y-axis which moves the pick head 332 between a picking position and a drop position for dropping the picked blister pack (or box) into the hopper bin 380. It should be appreciated that the Y-axis is aligned to the load angle 104 of one of the dispensing cartridge 200 as shown in Figure 11 so that the pick head 332 (i.e. the two suction heads 334,336) moves in a direction along the load angle 104.

The pickup device 330 includes timing pulleys 342 driven by a servo motor 344 and the timing pulleys 342 are arranged to drive the drive belt 340 and as explained above, the drive belt 340 is arranged to move the pick head 332 along the Y-axis.

The pick head 332 includes two spring guided arms 352,354 (Figure 10, one arm hidden from view). The spring guided arms 352,354 each guides a suction head 334,336 which in turn is fitted with suction cups 348,350. When actuated

by the drive belt 340, the pick head 332 moves along the Y-axis until contact is made between suction cups 348,350 and the blister strip 212 (or box). The spring guided arms 352,354 provide over travel by allowing the suction heads 334,336 to retract inside the spring guided arms 352,354.

An operation of the pickup device 330 will be explained in further detail with reference to Figures 15a and 15b. Figure 15a shows the pickup device 330 aligned to the load angle 104 of one of the blister pack dispensing cartridges 200a which carries a number of blister packs 212. A first one of the blister packs 212' is the one at the opening 314 and ready to be picked with a second blister pack 212" arranged behind the first one. In Figure 15a, the suction cups 348,350 are in extended positions (when actuated by the spring guided arms 352,354) ready for "picking up" the first blister pack 212' and this can be seen more clearly in Figure 15b. With the suction cups 348,350 in the extended positions, the pick head 332 is actuated to move along the Y-axis towards the dispensing cartridge 200a until the suction cups 348,350 contact the back portion 212e of the first blister pack 212'. This is the picking position.

Next, the suction cups 348,350 are retracted as shown in Figures 16a and 16b to create a vacuum at the suction cups 348,350 and this enables the suction cups 348,350 to suck or attach to the back portion 212e of the first blister pack 212'. The pick head 332 is then moved back along the Y-axis to the drop position and as the pick head 332 moves away from the blister pack dispensing cartridge 200a, the first blister pack 212' is extracted out through the opening 234 of the blister pack dispensing cartridge 200a and the second blister pack

212" is next supported by the first and second gate members 230,240 at the opening 234 (due to the counterweight 256).

In this way, the vacuum suction created at the suction cups 348,350 enables the suction cups 348,350 to suck the flat back portion 212e of the blister pack 212 to create a secured hold and when the suction head 334,336 is retracted, the suction cups 348,350 draws or extracts the blister pack 212 out of the dispensing cartridge 200a.

When the suction heads 334,336 are retracted, along the Y-axis to the drop position, the vacuum suction at the suction cups 348,350 is released to drop the extracted blister pack 212 into the hopper bin 380. The hopper bin includes a flap 382 which is rotatable to transfer its contents to the packaging and printing module 400.

It should be appreciated that the spring guided arms 332 are operable independently/separately to extend or extract the suction cups 348,350 independently/separately or both simultaneously. Selection of which or both to operate depends on the size of the blister pack – just one of the suction cups 348,350 may be actuated for smaller blister packs and for larger ones, both suction cups 348,350 may be actuated. As to how the control system 500 determines which or both suction cups to actuate, the dimensions of the blister packs 212 are entered into control system 500 during the loading process of the dispensing cartridges including other information such as medicine name etc,

and for association with the barcode assigned to the specific dispensing cartridge.

The pick head 332 includes a gripper 356 having a lower gripping member 358 and an upper gripping member 360. The lower gripping member 358 is substantially rectangle and is retractable within the pick head's body 361 and this is achieved by coupling the lower gripping member 358 to a pneumatic cylinder arm 363 (see Figure 10) for extending or retracting the lower gripping member 358. The upper gripping member 360 is also substantially rectangular and is movable in a linear motion along a vertical axis (as represented by arrow AA) of the pick head's body 361. The gripper 356 is actuated for picking pharmaceutical boxes 213 which are stored in one of the dispensing cartridges 200 such as the box dispensing cartridge 200b of Figure 14. The lower gripping member 358 is actuated to extend under the first box 213' and the top gripper lowered to clamp the first box 213' and the first box is lifted up and out of the box dispensing cartridge 200b. The pick head 332 next drops the picked box 213' into the hopper bin 380, just like when a blister pack is being picked.

As it can be appreciated from the above, the hopper bin 380 collects the picked pharmaceutical packaging and transports them to the packaging and printing module 400 and this is shown in Figure 12.

The packaging and printing module 400 includes zipper storage bag roll-stock (consumables) 402 which provides the material for making bags. The packaging and printing module 400 also includes bag feeders 404, a bag opener 406,

post-loading tensioning device 408, pre-seal tensioning device 410, seal and cut device 412 and a printer 414.

The bag feeders 404 is arranged to create correct tension of the bags from the roll-stock 402 during feeding and sealing, and the bag opener 406 is arranged to open the bag ready for the hopper bin 380 to arrive and pour or drop its contents into the bag. The post-loading tensioning device 408 tensions the bag after the contents from the hopper bin 380 are dropped into the bag to prepare the bag to be processed by the pre-sealing tensioning device 410. The pre-sealing tensioning device 410 is arranged to pull the bag tight before sealing by the seal and cut module 412 which also cuts the bag away from the roll-stock 402. The printer 414 is arranged to print information provided by the control system 500 relating to the order details directly on the bag. Once the bag is sealed and cut, the bag is transferred to one of the plurality of baskets 602 of the basket output module 600.

The plurality of baskets 602 are "singulated" and automatically positioned to collect the sealed and cut bags as explained above and the basket output module 600 transfers the baskets 602 to a delivery system, for example by conveyor, for delivery to a pharmacist for distribution to the patients. The packaging and printing module 500 is particularly advantageous since the bag sizes may be adjusted depending on quantity of pharmaceutical packages to be kept within one bag.

An operation of the pharmaceutical dispensing apparatus 100 will now be described. Prior to actual operation, pre-operation actions are carried out by a user to load the pharmaceutical packages into at least some of the array of dispensing cartridges 200. Details relating to the pharmaceutical packages for example, type of medicine, quantity, size of packaging are programmed into the control system and stored in association with respective barcodes of the dispensing cartridges 200. It should be appreciated that the dispensing cartridges 200 are configurable to accommodate to different types of pharmaceutical packages (as explained above, sliding the adjusting bar 214) and also the width of opening 234 to adjust the distance between the first and second gate members 230,232 and information relating to the type of package associated with the dispensing cartridge 200 is also uploaded to the control system 500. For example, some of the dispensing cartridges 200 may be adapted to receive and support blister packs 212; whereas some may be adapted to receive pharmaceutical boxes.

Once information relating to one of the cartridges is uploaded into the Control system 500, that dispensing cartridge 200 is loaded into the respective brackets 202. The pick-and-place mechanism 300 is initialized to scan the barcode 226 to register the location of the dispensing cartridge 200 in the array corresponding to the scanned barcode 226 (and thus, the contents of the dispensing cartridge) in a memory or database of the control system 500. Other cartridges 200 are loaded in the same manner.

When the pharmaceutical dispensing apparatus 100 receives a prescription order, the control system 500 checks its memory/database and actuates the pick-and-place mechanism 300 to move along the X-axis and Z-axis to position the pick head 332 adjacent the dispensing cartridge 200 which stores the pharmaceutical package corresponding to the prescription order.

If the package to be picked is defined as a blister pack in the control system which requires both suction cups 348,350, the pickup device 330 actuates the pick head 332 to advance the suction cups 348,350 along the path of the load angle 104 to extract the first blister pack from the dispensing cartridge 200. The pickup device 330 then moves the pick head 332 to the drop position and releases the picked blister pack into the hopper bin 380.

When the control system 500 sends a signal to operate the pick-and-place mechanism 300, the control system 500 also sends another signal to the packaging and printing module 600 to prepare an appropriate bag which can contain the picked prescription order. In this respect, the roll-stock 402 is routed through the bag feeders 404 and the bag is pulled to the required size. The printer 414 next carries out label printing directly on the bag and the bag opener 406 is activated to open the bag, ready to receive the contents of the hopper bin 380.

When the hopper bin 380 arrives at the packaging and printing module 400, the flap 382 of the hopper bin 380 is activated to open so that the picked blister pack is dropped into the open bag. The hopper bin 380 is then moved to rest position waiting for the next command.

After the picked blister pack is dropped into the bag, the post-loading tensioning device 408 is activated to tension the bag into position and the pre-seal tensioning device 410 tensions the bag ready for sealing. The bag is next sealed and cut by the seal and cut device 412 and the cut bag is dropped into one of the baskets 602 for delivery as explained above.

The pick-and-place mechanism 300 next moves the pickup device 330 to pick up a next prescription order and if this is a pharmaceutical box, the pickup device 330 operates the gripper 356 to grip the box, lift the box up and clear of the dispensing cartridge 200, and similarly drops the box into the hopper bin 380. Likewise, the hopper bin 380 is arranged to send the pharmaceutical box to the packaging and printing module 600 to be packed.

In this way, the pharmaceutical dispensing apparatus 100 is configured to treat each pharmaceutical package (containing the same pharmaceutical) as one prescription order and this is packed separately from other types of pharmaceuticals. This avoids mixing packages containing different pharmaceuticals and is particularly useful to avoid confusion among patients, such as elderly people. Of course, it can be appreciated that the pharmaceutical dispensing apparatus 100 may be configured to treat a prescription order as being all the medicine for one patient and if the prescription order has two or more different pharmaceuticals, these are picked and bagged in the same bag.

It would be appreciated that the described pharmaceutical dispensing apparatus 100 is more flexible since it is capable of dispensing a combination of different pharmaceutical packages such as boxes or blister packs. The arrangement of the array of the dispensing cartridges also improves the pick reliability and minimizes false picking or picking of more packages than what is indicated in the prescription order. The described pick up device also ensure that one package is removed at a time and this arrangement is simpler and more economical to implement than other devices, for example using vision recognition to identify and count the number of packages before extracting the required amount.

The described embodiment is not to be construed as limitation. For example, although the pharmaceutical dispensing apparatus 100 includes the packaging and printing module 400 and the basket output module 600, these may not be necessary if for example, manual packing and delivery is envisaged.

In the described embodiment, the pharmaceutical packages such as the blister packs 212 and the pharmaceutical boxes 213 are each provided individually and separated. However, it is envisaged that two or more of these packages may be bundled together (for example, as a minimum prescription order) and the pick and place mechanism 300 is configured to pick the bundled packages from the dispensing cartridges 200. Of course, the dispensing cartridges 200 may require modifications to accommodate such a change.

Further, the rollers 244,246 are provided to provide easier extraction of the blister packs 212 and to minimise damage. However, it is envisaged that these rollers 244,246 may not be necessary and profiles of the first and second gate members 230,232 may be adapted accordingly (for example rounded edges) to enable extraction, although this may not be preferred.

Although it is preferred for the dispensing cartridges 200 to include the side adjustable wall 216, it is envisaged that this may not be necessary, and at least some of the dispensing cartridges 200 in the array may not have the side adjustable wall 216. This may mean that such dispensing cartridges do not have the flexibility of accommodating to different size pharmaceutical packages but this may not be a problem if these dispensing cartridges are loaded with pharmaceuticals which are commonly prescribed.

Having now fully described the invention, it should be apparent to one of ordinary skill in the art that many modifications can be made hereto without departing from the scope as claimed.

CLAIMS

1. A pharmaceutical dispensing apparatus for dispensing pharmaceutical packages containing pharmaceuticals, the apparatus comprising:
an array of dispensing cartridges adapted to receive a plurality of individual pharmaceutical packages; each dispensing cartridge having a longitudinal axis and arranged to support the individual pharmaceutical packages at a load angle of between 20° and 38°, the load angle being an angle formed between the longitudinal axis and a horizontal axis of the apparatus; and
a pick-and-place mechanism operable to selectively remove at least one pharmaceutical package from the array of dispensing cartridges.

2. A pharmaceutical dispensing apparatus according to claim 1, wherein the array of dispensing cartridges is configured to receive different types of pharmaceutical packages.

3. A pharmaceutical dispensing apparatus according to claim 2, wherein the pick-and-place mechanism is configured to selectively remove the different types of pharmaceutical packages from the array of dispensing cartridges.

4. A pharmaceutical dispensing apparatus according to any preceding claim, wherein at least some of the dispensing cartridges of the array are

configured to receive individual blister packs, and the at least one pharmaceutical package includes at least one individual blister pack.

5. A pharmaceutical dispensing apparatus according to claim 4, wherein the pick-and-place mechanism includes a pick head having two or more suction cups, which are separately operable for removing said individual blister pack from the dispensing cartridge.

6. A pharmaceutical dispensing apparatus according to claim 5, wherein the suction cups are actuated using vacuum.

7. A pharmaceutical dispensing apparatus according to claim 5 or 6, wherein the pick head comprises a gripper for gripping and lifting a said pharmaceutical package from one of the dispensing cartridges.

8. A pharmaceutical dispensing apparatus according to claim 7, where the pharmaceutical package is in the form of a pharmaceutical box.

9. A pharmaceutical dispensing apparatus according to any preceding claim, further wherein the pick-and-place mechanism comprises guide rails for moving the pick head along two non-parallel directions to positions adjacent to the array of dispensing cartridges for removing the at least one pharmaceutical package.

10. A pharmaceutical dispensing apparatus according to any preceding claim, wherein each of the dispensing cartridges includes first and second spaced apart gate members arranged to define an opening through which a said pharmaceutical package in the form of a blister pack is removable from the cartridge; wherein the first and second gate members are further arranged to support respectively first and second support portions of a first one of the plurality of blister packs at the opening, each of the first and second support portions being between 11mm and 16mm.

11. A pharmaceutical dispensing apparatus according to claim 10, wherein each of the first and second gate members includes a roller arranged to enable a said blister pack to be extracted through the opening; and wherein the rollers are arranged to contact the first one of the plurality of blister packs.

12. A pharmaceutical dispensing apparatus according to claim 10 or 11, wherein the first gate member is slidable to adjust the opening's size.

13. A pharmaceutical dispensing apparatus according to any of claims 10 to 12, wherein each dispensing cartridge comprises a counterweight for urging the plurality of blister packs to the opening.

14. A pharmaceutical dispensing apparatus according to any preceding claim, wherein each dispensing cartridge includes a storage channel

which defines the longitudinal axis, the dispensing cartridge including an adjustable wall for adapting the storage channel for supporting different sizes of the pharmaceutical packages.

15. A pharmaceutical dispensing apparatus according to any preceding claim, further comprising a hopper bin for collecting pharmaceutical packages removed by the pick-and-place mechanism.

16. A pharmaceutical dispensing apparatus according to any preceding claim, further comprising a packaging and printing module arranged to bag the collected pharmaceutical packages in a bag and to label the bag with information relating to the pharmaceutical package.

17. A pick-and-place mechanism for removing blister packs from an array of dispensing cartridges, the pick and place mechanism including
a pick head having two or more suction cups, which are capable of being separately actuated to suck at least one selected blister pack and to remove the at least one selected blister pack from the array of dispensing cartridges.

18. A pick-and-place mechanism according to claim 17, further comprising extendable guide arms arranged to control the movement of the two or more suction cups.

19. A pick-and-place mechanism according to claim 17 or 18, wherein the two or more suction cups are operable by vacuum to create the suction.

20. A pick-and-place mechanism according to any of claims 17 to 19, further comprising a drive belt arranged to move the pick head selectively between a picking position next to one of the dispensing cartridges and a drop position for dropping the selected blister pack.

21. A pick-and-place mechanism according to claim 20, further comprising a hopper bin for collecting the dropped selected blister pack.

22. A pick-and-place mechanism according to any of claims 17-21, wherein the two or more suction cups are capable of being separately actuated to suck a bundle of blister packs having two or more individual blister packs bundled together and to remove the bundle from the array of dispensing cartridges.

23. A pick-and-place mechanism according to any of claims 17-22, wherein the two or more suction cups are capable of being separately actuated to suck the blister packs individually and to remove the bundle from the array of dispensing cartridges.

24. A dispensing cartridge for dispensing blister packs in a pharmaceutical dispensing apparatus, the cartridge comprising

a storage channel for receiving a plurality of individual blister packs in upright positions; and

first and second spaced apart gate members arranged to define an opening through which a said blister pack is removable from the cartridge; wherein the first and second gate members are further arranged to support respectively first and second support portions of a first one of the plurality of blister packs, each of the first and second support portions being between 11mm and 16mm.

25. A dispensing cartridge according to claim 24, wherein each of the first and second gate members includes a roller arranged to enable a said blister pack to be extracted through the opening; and wherein the rollers are arranged to contact the first one of the plurality of blister packs.

26. A dispensing cartridge according to claim 24 or 25, wherein the first gate member is slidable to adjust the opening's size.

27. A dispensing cartridge according to any of claims 24 to 26, further comprising a counterweight for urging the plurality of blister packs to the opening.

28. A dispensing cartridge according to any of claims 24 to 27, further comprising an adjustable wall for adapting the storage channel for receiving different sizes of the blister packs.

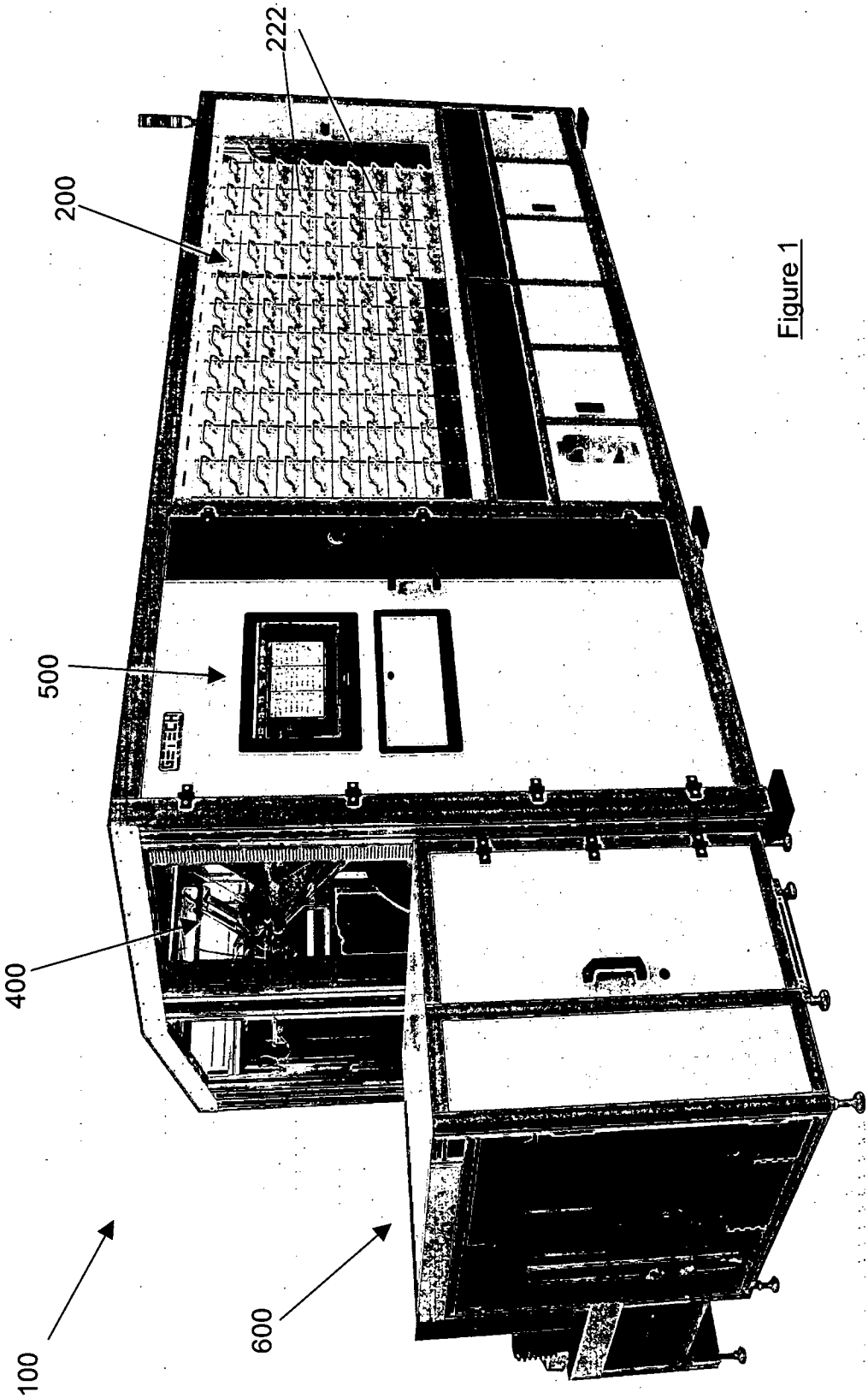


Figure 1

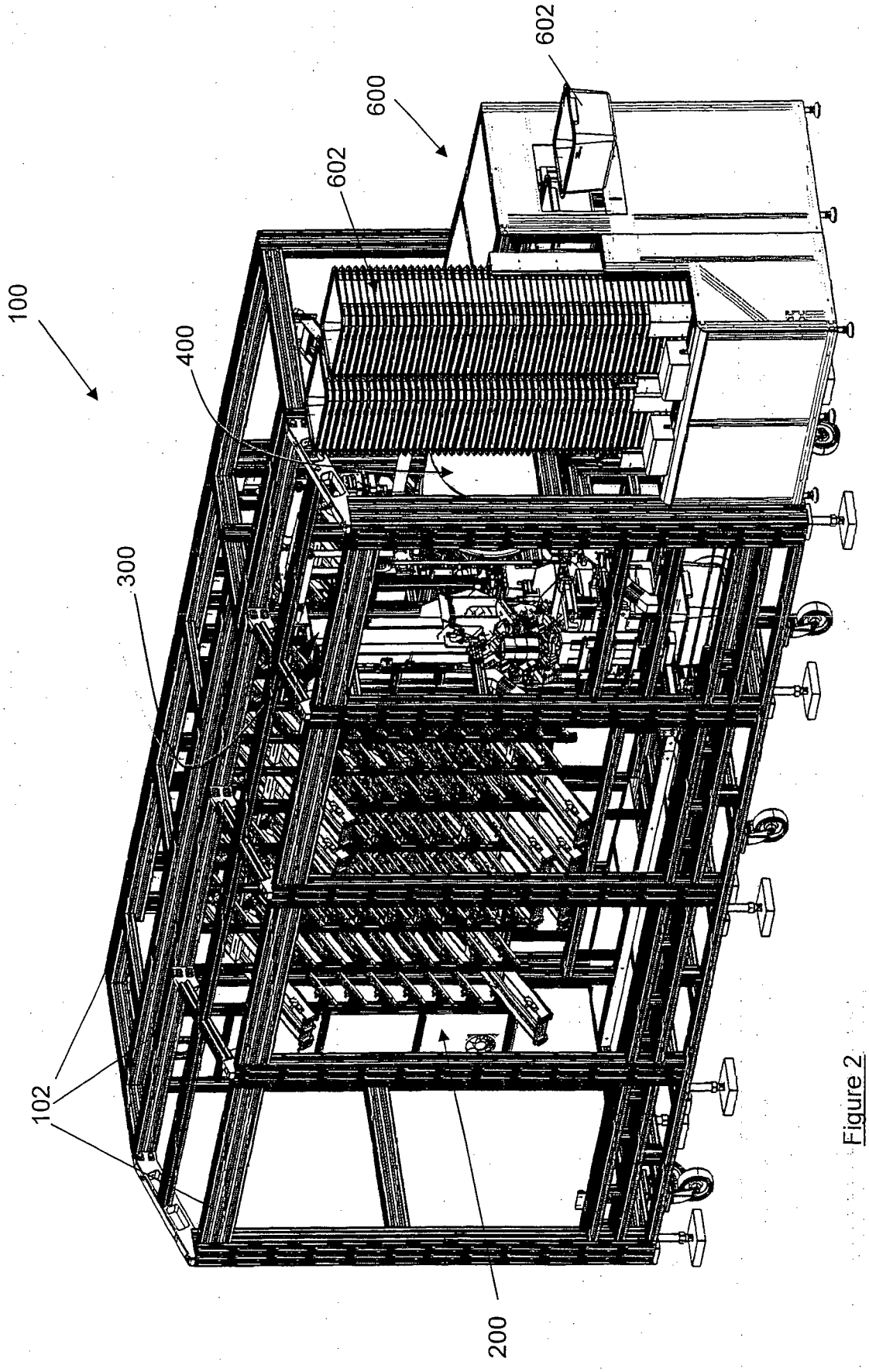


Figure 2

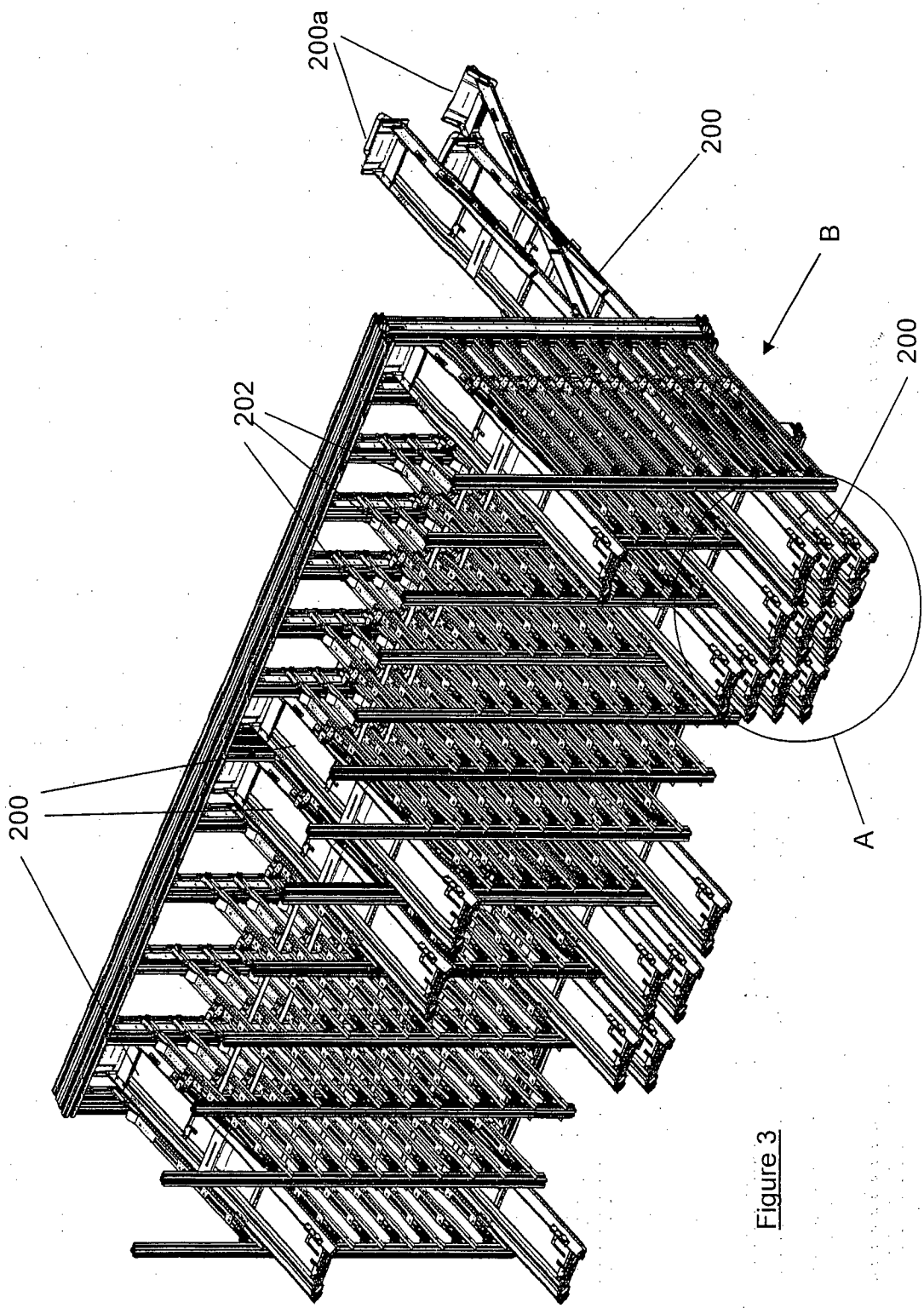


Figure 3

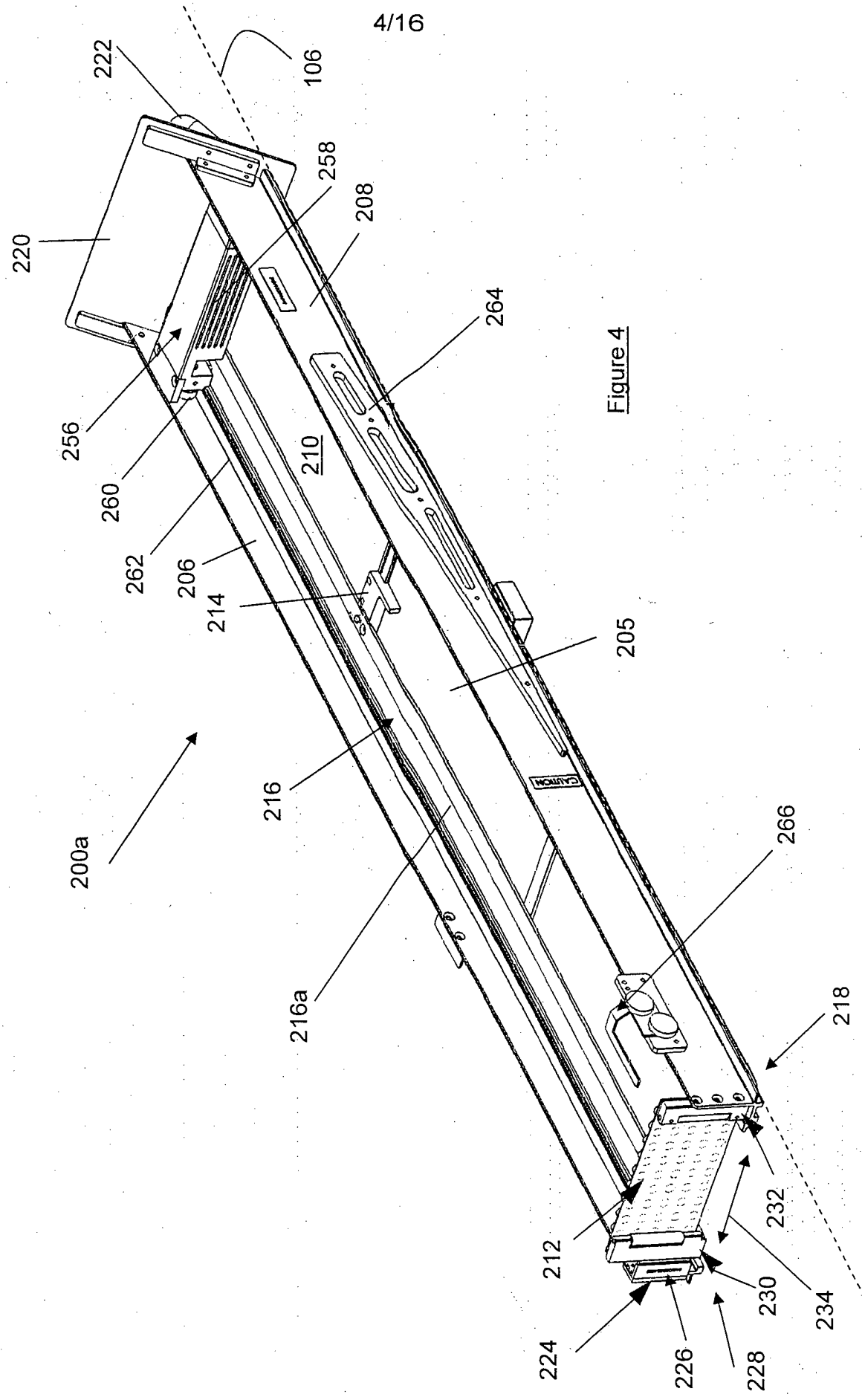
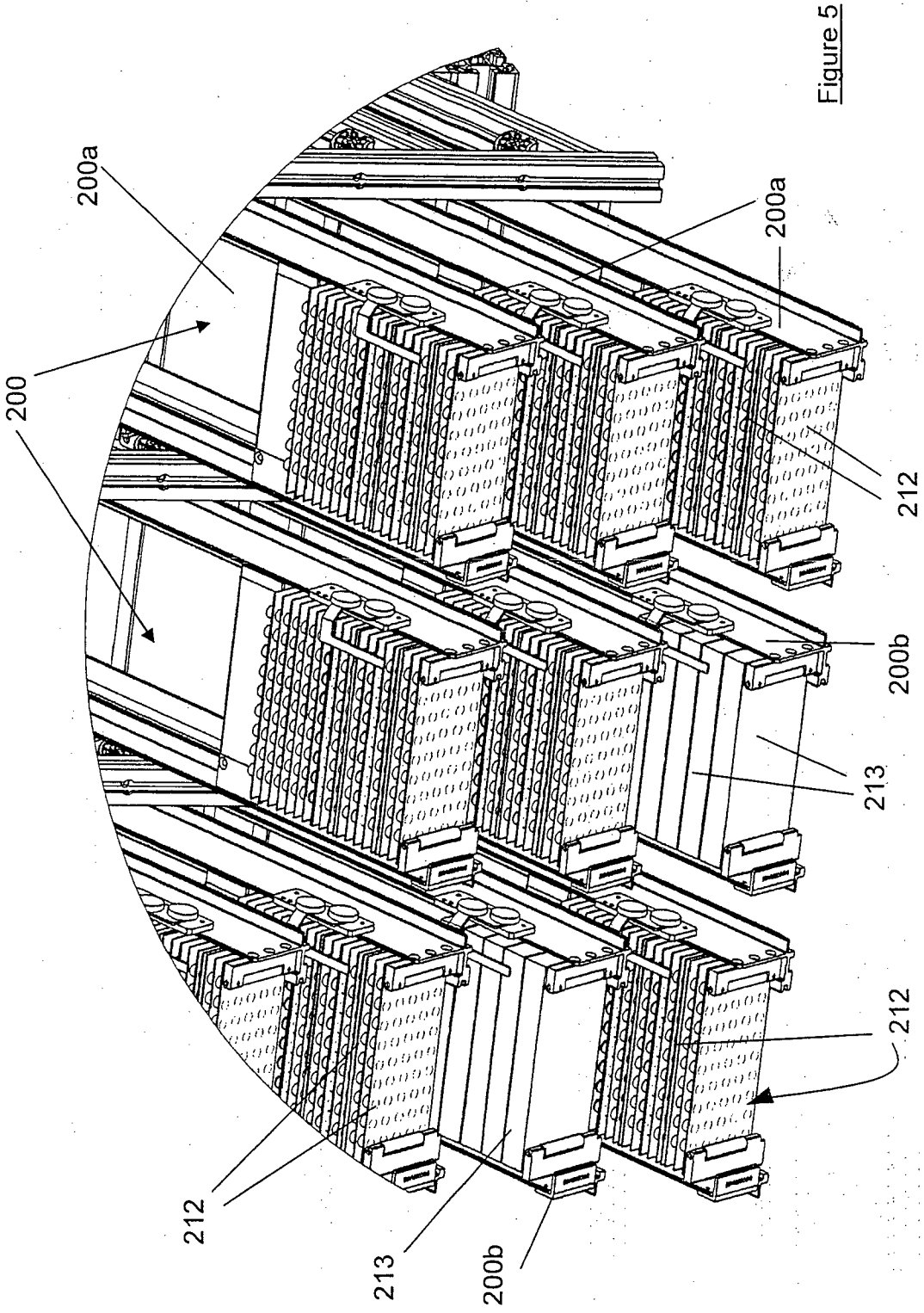

222
106
258
208
220
264
256
210
260
262
206
214
205
216
200a
266
216a
218
212
232
230
234
224
226
228

Figure 4

Figure 5



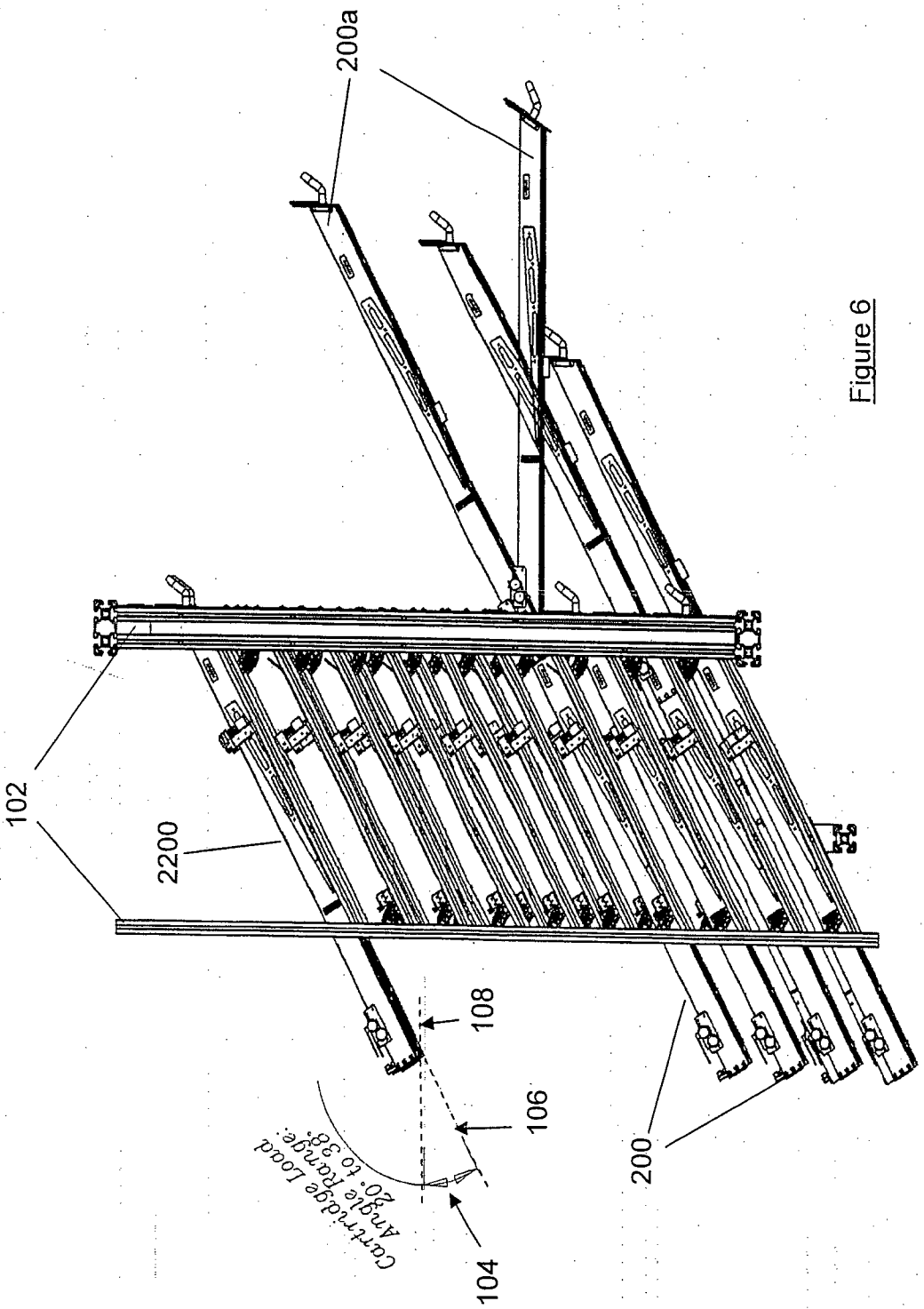

200a
102
2200
108
106
104
200
Centroidal load
Angle range:
20° to 38°

Figure 6

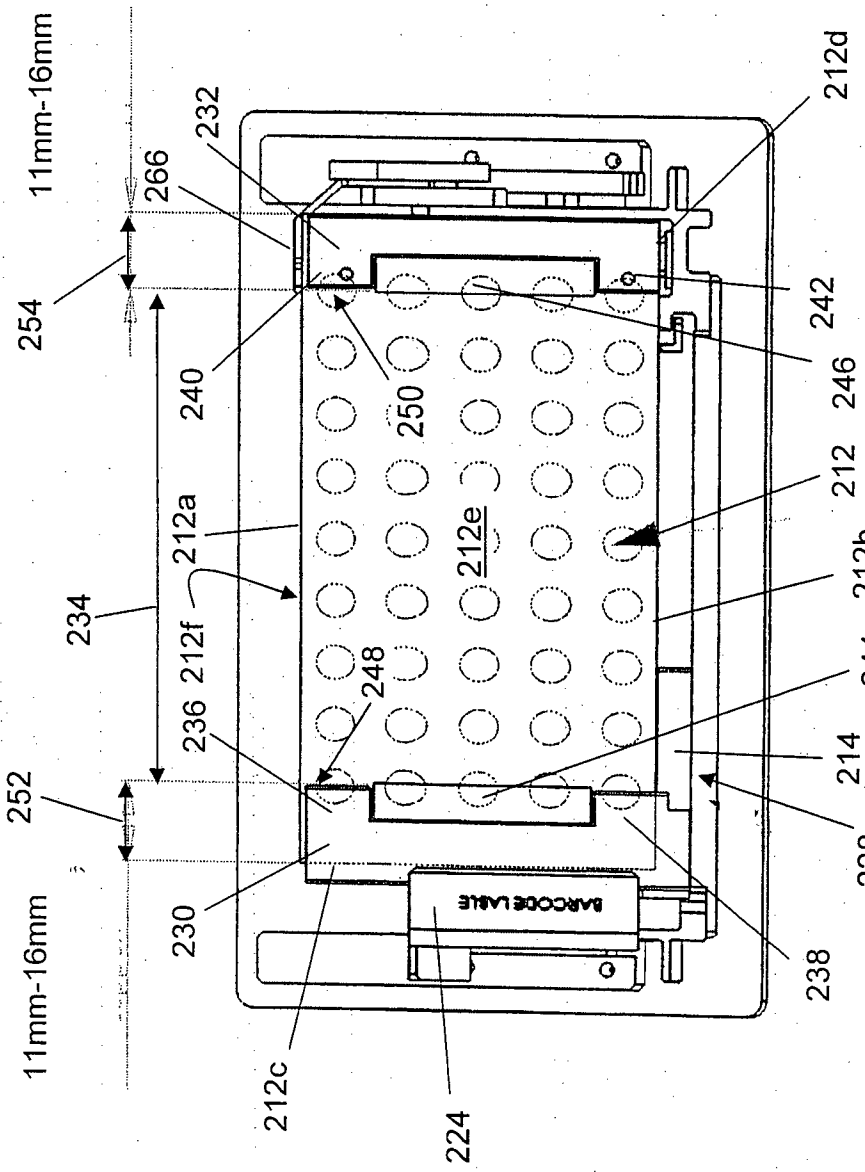

11mm-16mm
266
232
212d
254
242
240
250
246
212
212a
212e
212b
234
212f
248
244
236
214
252
228
230
238
11mm-16mm
212c
224
BARCODE LABEL

Figure 7

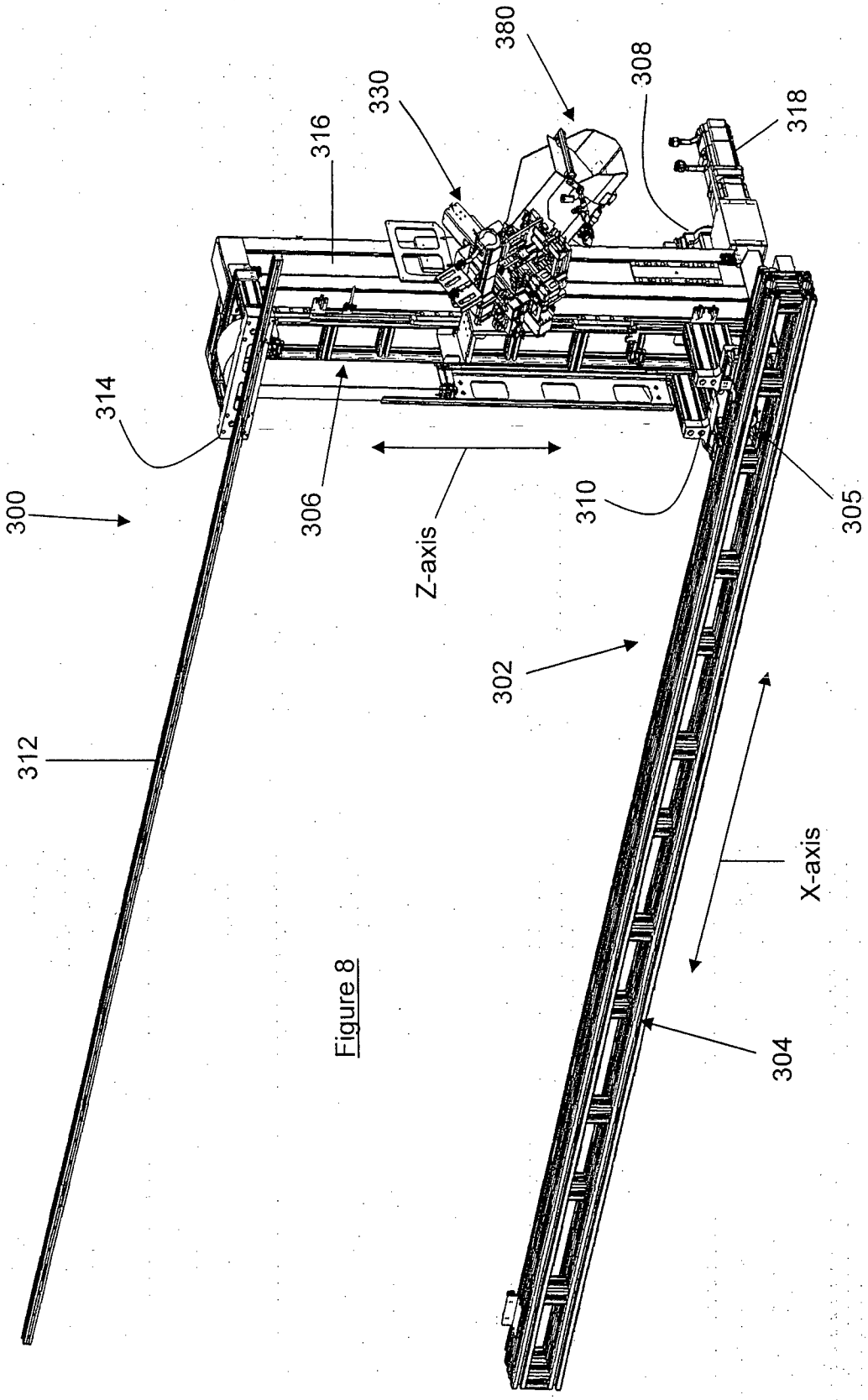


Figure 8

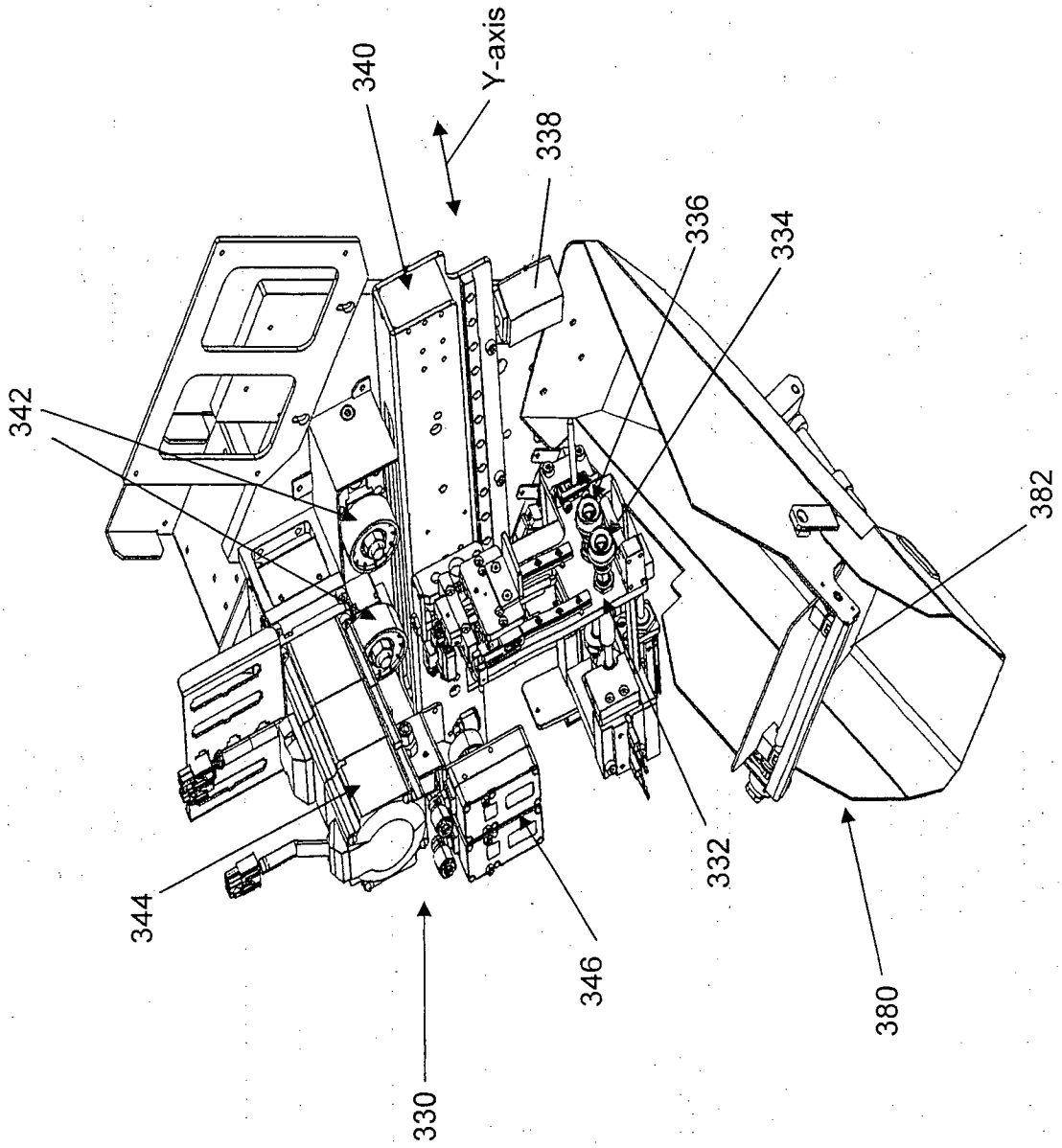


Figure 9

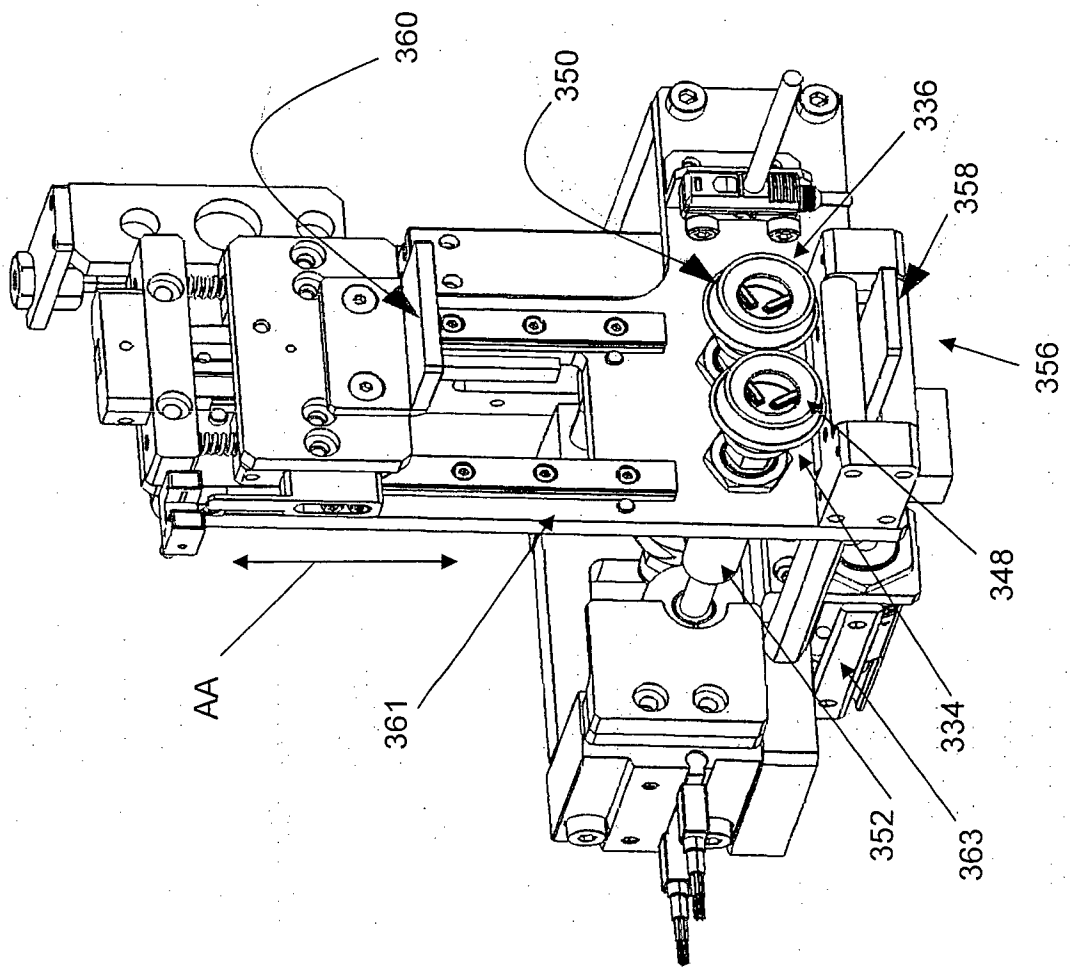


Figure 10

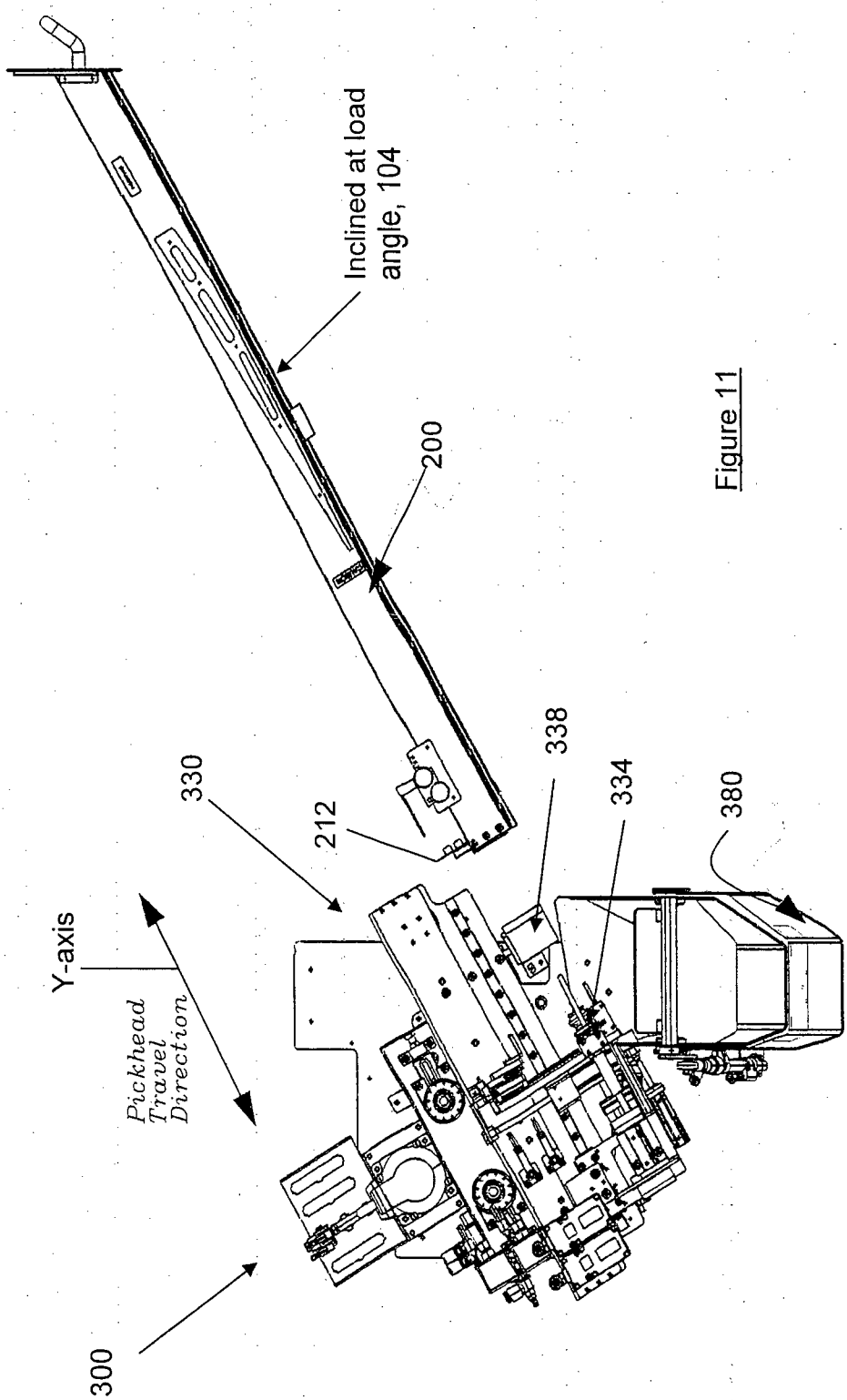

Inclined at load angle, 104
200
330
212
338
334
380
Y-axis
Pickhead Travel Direction
300

Figure 11

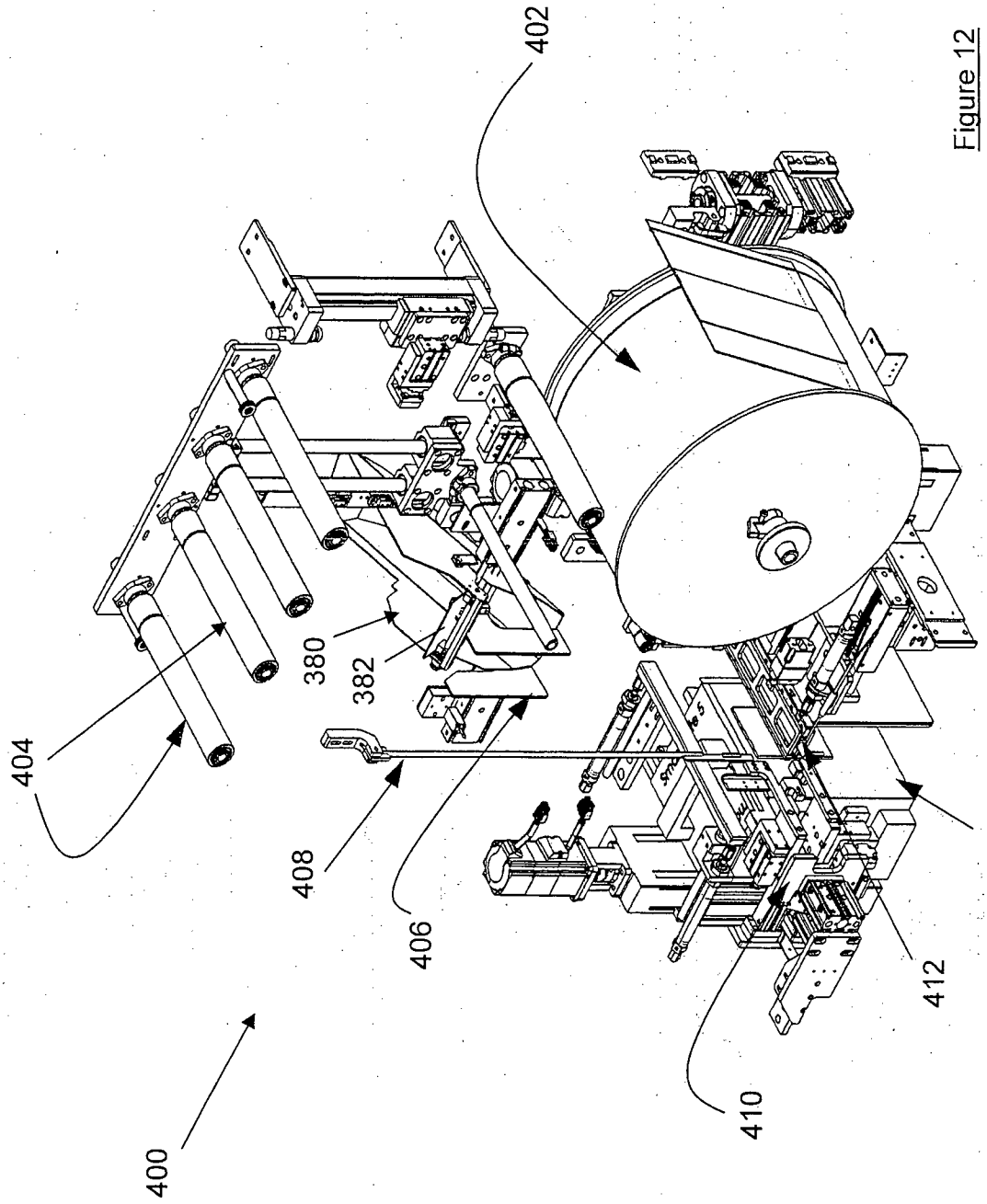


Figure 12

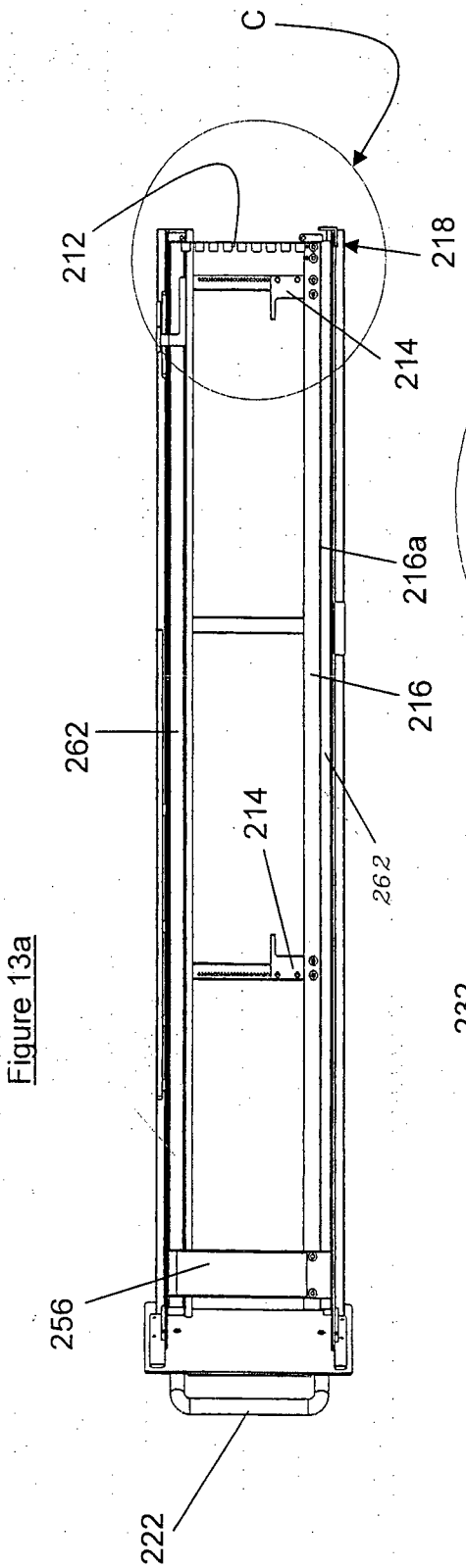


Figure 13a

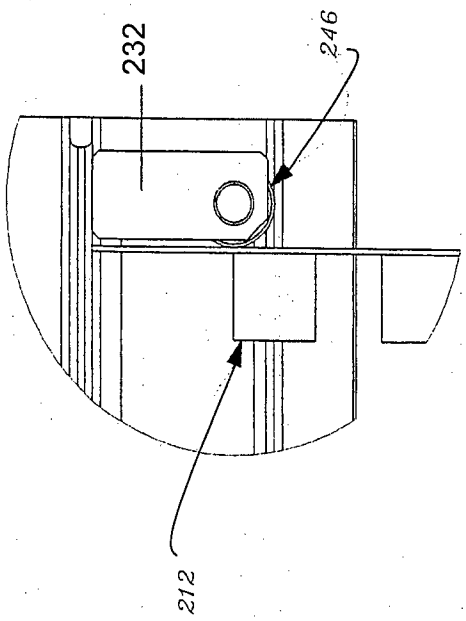


Figure 13c

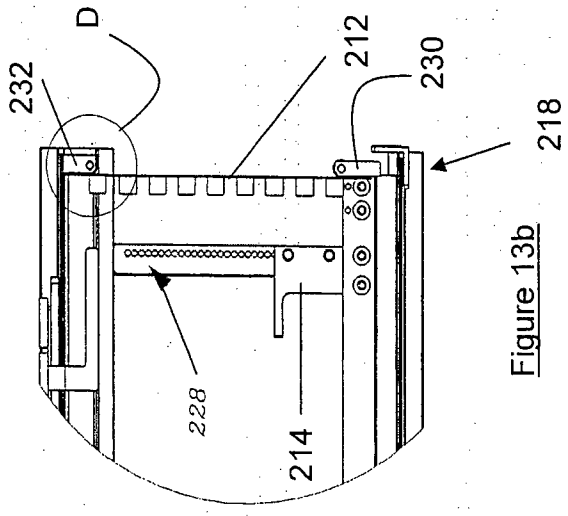


Figure 13b

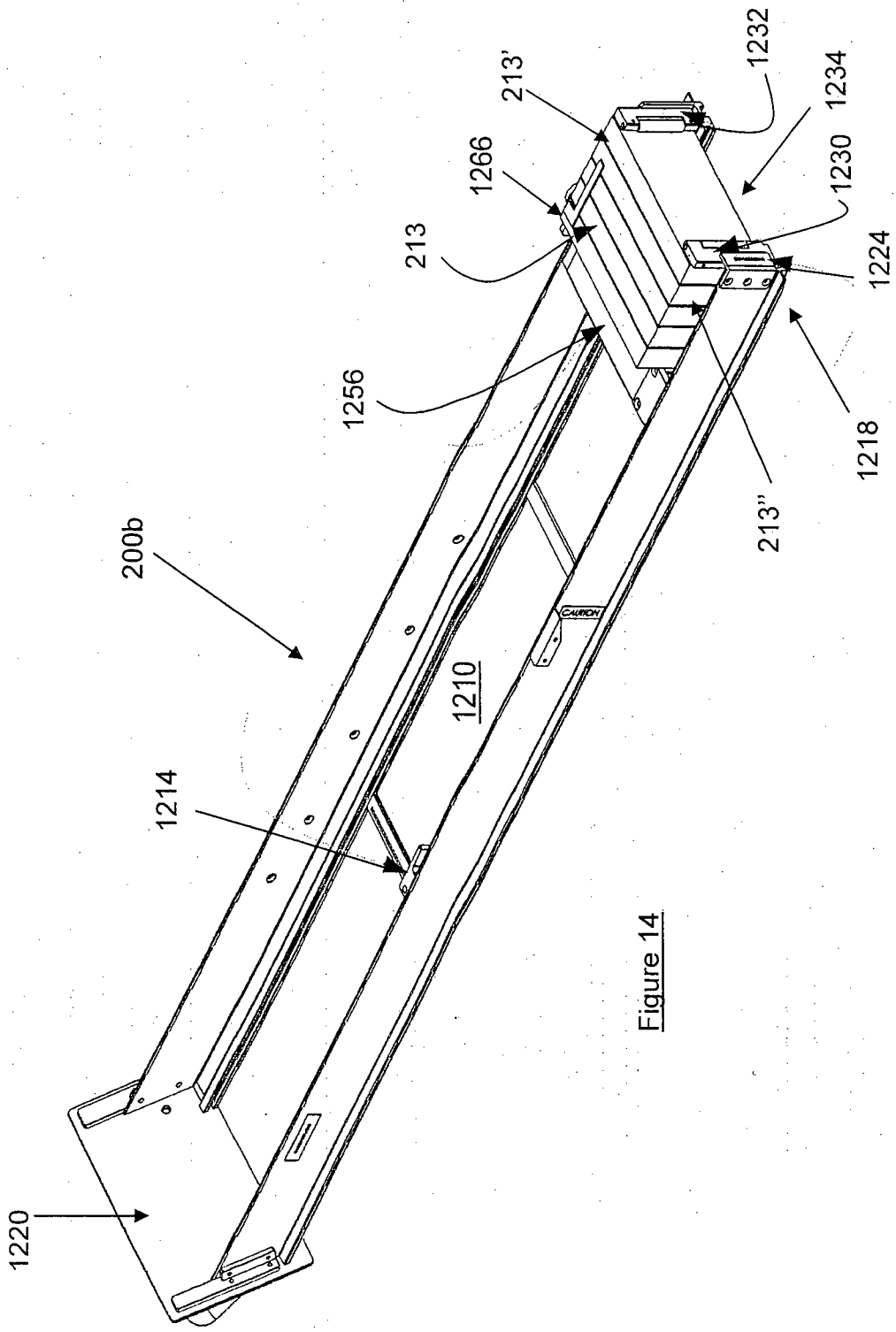

1232
213'
1234
1266
1230
213
1224
1256
1218
213''
200b
1210
1214
1220

Figure 14

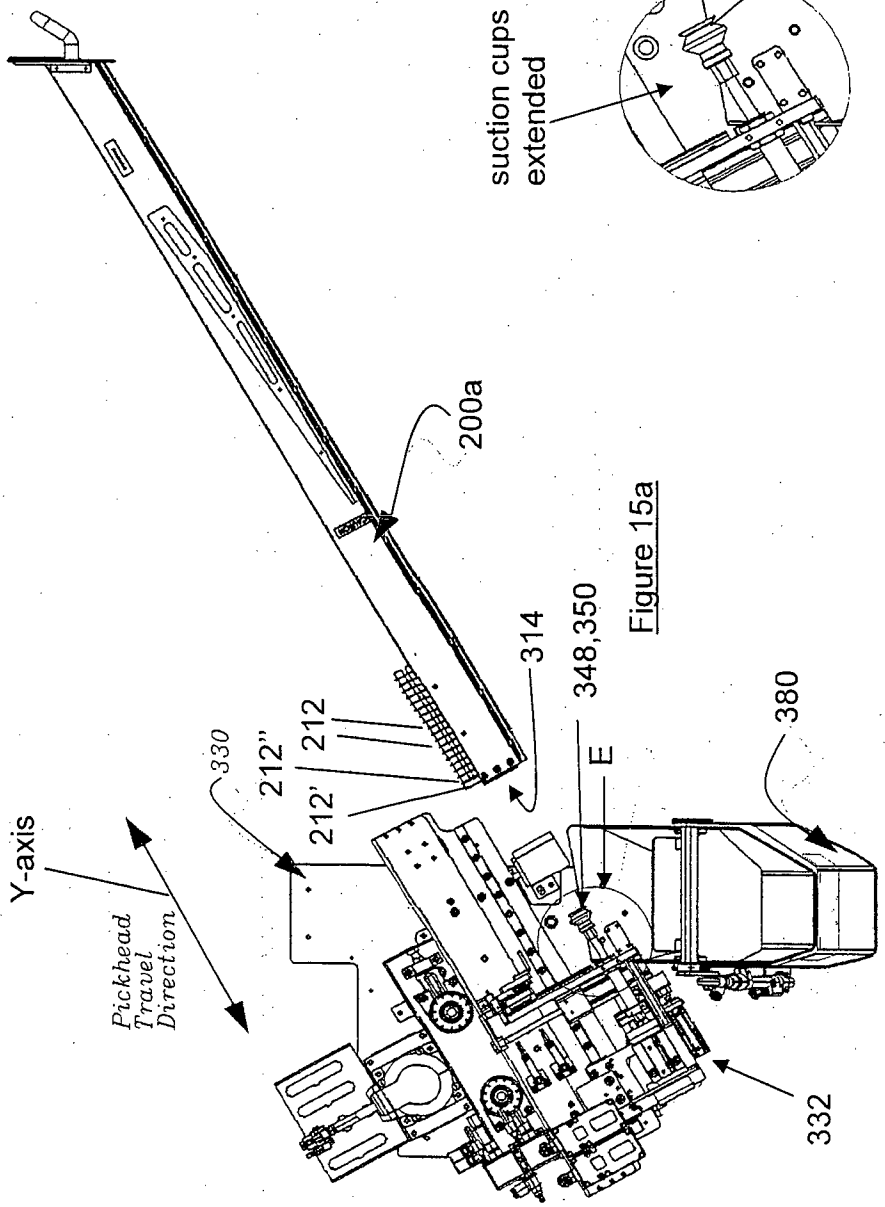


Figure 15a

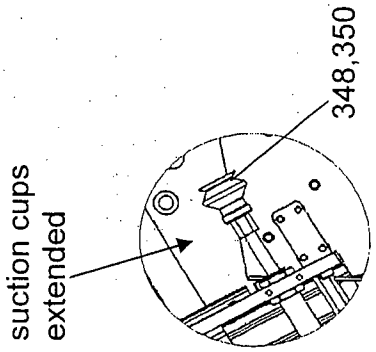


Figure 15b

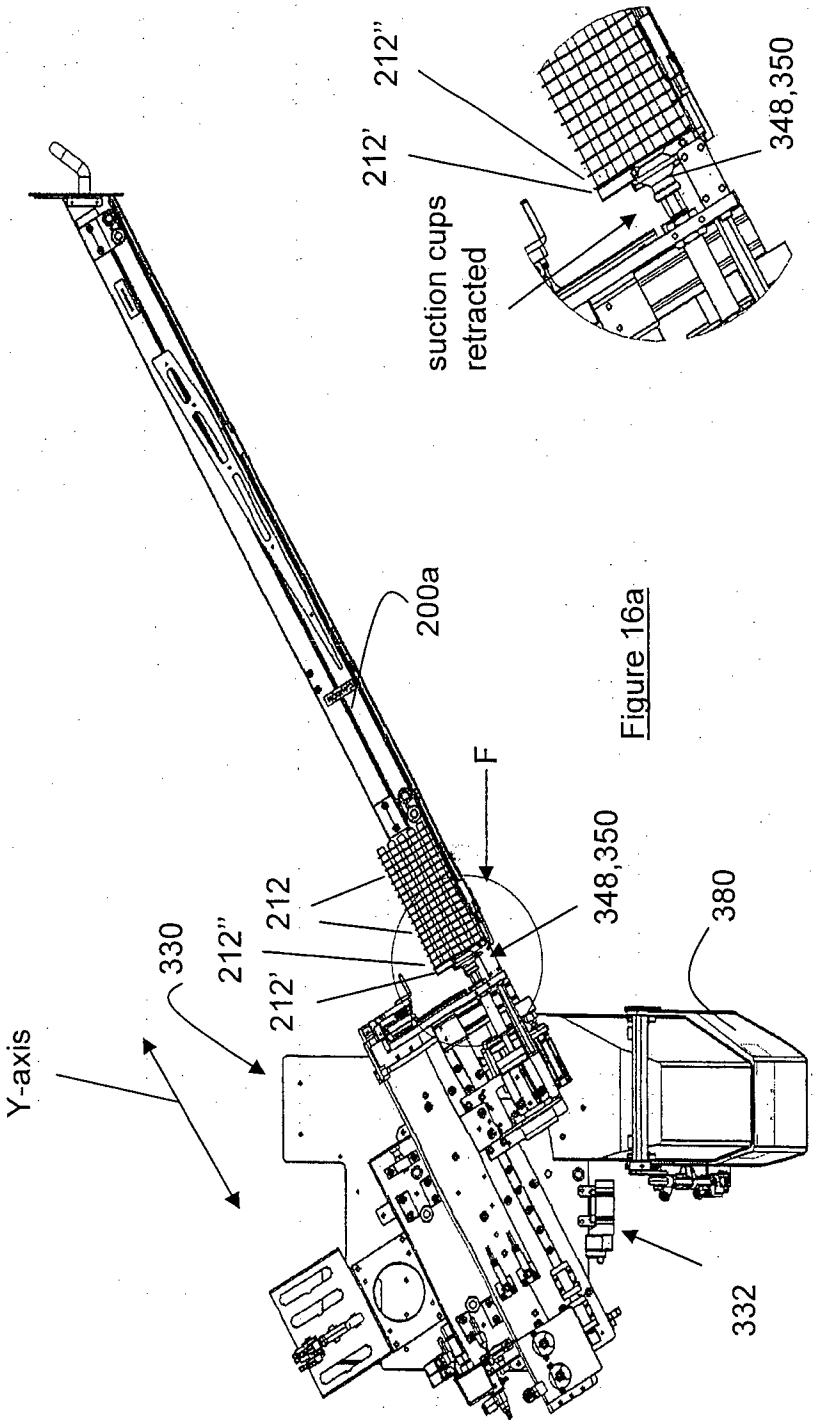


Figure 16a

Figure 16b

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SG2011/000092

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl.

G07F 11/28 (2006.01) ***B65D 83/08*** (2006.01)

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
WPI; Google, Patent Lens; Keywords (vend, dispense, pharmaceutical, drug, medicine, cartridge, tray, cassette, carousel, magazine, angle, angular, incline, slant, slope, gradient, gravity, tilt, chute, bin, robot, pick and place, select, pick, choose, suction, suck, vacuum, blister, through-pack) + similar keywords

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2010/0172724 A1 (HAWKES ET AL) 8 July 2010 See whole document; in particular abstract, paragraphs [0011],[0043],[0044],[0046], [0047],[0049],[0050],[0052],[0053],[0056],[0058]; figs. 2-7,10B,12B	1-13,15
Y		14,16
Y	WO 2008/085673 A1 (IDS ACQUISITION, LLC) 17 July 2008 See whole document; in particular abstract, paragraphs [0006],[0011],[0044]-[0046], [0107]; fig. 2	14,16
A	US 2009/0114672 A1 (SCHIFMAN ET AL) 7 May 2009 See whole document; in particular abstract, paragraphs [0004],[0023]; figs. 3,16	1-16

☐ Further documents are listed in the continuation of Box C ☒ See patent family annex

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
13 May 2011	17 MAY 2011
Name and mailing address of the ISA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA E-mail address: pct@ipaustralia.gov.au Facsimile No. +61 2 6283 7999	Authorized officer **OLUTOPE OMOGBENIGUN** AUSTRALIAN PATENT OFFICE (ISO 9001 Quality Certified Service) Telephone No : +61 2 6283 2876

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SG2011/000092

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a)

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

[See Supplemental Sheet]

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:
1-16

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☐ No protest accompanied the payment of additional search fees.

Supplemental Box
(To be used when the space in any of Boxes I to IV is not sufficient)

Continuation of Box No: III

This International Application does not comply with the requirements of unity of invention because it does not relate to one invention or to a group of inventions so linked as to form a single general inventive concept.

This International Searching Authority has found that there are different inventions as follows:

- Claims 1-16 are directed to a pharmaceutical dispensing apparatus. The feature of *a dispensing cartridge arranged to support individual packages at a load angle of between 20° and 38°* is specific to this group of claims.

- Claims 24-28 are directed to a dispensing cartridge. The feature of *first and second gate members arranged to support first and second portions respectively of blister packs with each of the first and second support portions being between 11 mm and 16 mm* is specific to this group of claims.

PCT Rule 13.2, first sentence, states that unity of invention is only fulfilled when there is a technical relationship among the claimed inventions involving one or more of the same or corresponding special technical features. PCT Rule 13.2, second sentence, defines a special technical feature as a feature which makes a contribution over the prior art.

When there is no special technical feature there is no unity of invention.

In the above groups of claims, the identified features may have the potential to make a contribution over the prior art but are not common to all the claims and therefore cannot provide the required technical relationship. The only feature common to all of the claims in the above groups of claims and which provides a technical relationship among them is *a cartridge having a longitudinal axis for receiving a plurality of pharmaceutical packages*. However this feature does not make a contribution over the prior art because it is disclosed in:

US 2010/0172724 A1 (HAWKES ET AL) 8 July 2010

(paragraphs [0047],[0048], figs. 5-7)

WO 2008/085673 A1 (IDS ACQUISITION, LLC) 17 July 2008

(stacked rows 21 of channels 24 for holding pharmaceutical packages, see paragraphs [0044],[0046]; fig. 2)

Therefore in the light of this document this common feature cannot be a special technical feature. Therefore there is no special technical feature present in the claims and the requirements for unity of invention are consequently not satisfied *a posteriori*.

Further, this International Searching Authority has found a third invention as follows.

- Claims 17-23 are directed to a pick-and-place mechanism. The feature of *a pick head having two or more suction cups capable of being separately actuated to suck and remove a selected blister pack* is specific to this group of claims.

Claims 17-23 do not share any feature with claims 1-16 and claims 24-28 which could satisfy the requirement for being a special technical feature. Because there is no common special technical feature it follows that there is no technical relationship between the three identified inventions. Therefore the claims do not satisfy the requirement of unity of invention *a priori*.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/SG2011/000092

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Member					
WO	2008085673	NONE					
US	2010172724	US	2010174552	US	2010176145	WO	2010065845
US	2009114672	US	2008264967	US	2009108017		

Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001.

END OF ANNEX