

A PHARMACEUTICAL DISPENSING APPARATUS

Field

The invention relates to a pharmaceutical dispensing apparatus.

Background

It is common to package and dispense pharmaceuticals in the form of liquid, capsules or tablets. These are commonly packed in glass or plastic bottles and in boxes. Pharmaceutical drugs are mainly dispensed as syrup in pediatric hospitals. The reason being that majority of pediatric patients are incapable or have difficulty in swallowing capsules or tablets. When a doctor prescribes medicine to a patient, the prescription is interpreted by a pharmacist and the medicine, which may be in the form of syrup bottles, needs to be collected from various storage areas. The collected items are then labelled and verified. After which it is dispensed to patients. Such a process is labor 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 in a 24-hour Emergency Pharmacy Environment.

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 or worse, resulting in medication errors.

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

According to a 1st aspect, there is provided a pharmaceutical dispensing apparatus comprising: a control system; a transfer device arranged to transfer a pharmaceutical package to the apparatus for processing, based on operating instructions from the control system; a printer arranged to generate a first label based on print information from the control system, the first label including a first adhesive portion, a printed portion, and at least one second adhesive portion arranged on the printed portion, the second adhesive portion having a weaker adhesion relative to the first adhesive

portion; and a dispensing module arranged to apply the first label onto the pharmaceutical package having a second label; wherein the first label is applied over the second label using the first and second adhesive portions, and configured to be separable from and resealable with the second label via the second adhesive portion so that the second label is viewable while maintaining adhesion to the pharmaceutical package via the first adhesive portion.

Advantageously, the apparatus enables dispensing the pharmaceutical package with the first label over the second label, with the effect that the first label does not obstruct any critical information on the second label, and at the same time still carries all the necessary unique patient information and dosing instructions for a patient.

Preferably, the pharmaceutical package may be arranged to be in the form of a bottle or a box.

Preferably, the printed portion may include being configured to be adhesive free.

Preferably, the first label may be a dispensing label, and the second label is a manufacturer's label.

Preferably, the printed portion of the dispensing label may include personal information associated with a patient to whom the pharmaceutical package is to be issued, and prescription instructions issued by a medical practitioner for the patient.

Preferably, the dispensing module may include a first gripper to hold the first label, a second gripper to hold the pharmaceutical package, a paste roll, and a movable label transfer position table on which the pharmaceutical package is positioned to enable application of the first label onto the pharmaceutical package.

Preferably, the label transfer position table may be arranged to be movably rotated on its longitudinal axis using actuators to rotate the pharmaceutical package correspondingly to enable the first label to be applied onto the pharmaceutical package using the paste roll.

Preferably, the actuators may include pneumatic actuators.

Preferably, the paste roll may include being arranged to be freely displaced with a spring tension.

5 Preferably, the at least one second adhesive portion may include a plurality of adhesive portions, each configured as an adhesive spot.

According to a 2nd aspect, there is provided a pharmaceutical package comprising: a first label including a first adhesive portion, a printed portion, and at least one second adhesive portion arranged on the printed portion, the second adhesive portion having
10 a weaker adhesion relative to the first adhesive portion; and a second label. The first label is applied over the second label using the first and second adhesive portions, and configured to be separable from and resealable with the second label via the second adhesive portion so that the second label is viewable while maintaining adhesion to the pharmaceutical package via the first adhesive portion.

15 Preferably, the first label may be a dispensing label, and the second label may be a manufacturer's label.

20 Preferably, the printed portion of the dispensing label may include personal information associated with a patient to whom the pharmaceutical package is to be issued, and prescription instructions issued by a medical practitioner for the patient.

Preferably, the printed portion may include being configured to be adhesive free.

25 Preferably, the at least one second adhesive portion may include a plurality of adhesive portions, each configured as an adhesive spot.

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

30 These and other aspects of the invention will be apparent from and elucidated with reference to the embodiments described hereinafter.

Brief Description of the Drawings

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

Figure 1 is a schematic view showing a pharmaceutical dispensing apparatus including an array of dispensing shelves 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, 3a and 3b is an enlarged schematic view showing some of the array of dispensing shelves of Figure 1;

Figure 4 is an enlarged view of a circled area labelled "A" of the array of dispensing shelves of Figure 3 to show how more clearly how each of the adjustable cartridges receive and supports bottles or pharmaceutical boxes;

Figure 5 is a schematic view of carton box load module of Figure 1 to show how more clearly how carton boxes with bottles or boxes are loaded into the system;

Figure 6 is an enlarged view of a circled area labelled "B" of the carton box load module of Figure 5 to show more clearly how pick bottles are unloaded at a staging area and centered;

Figure 7 is a schematic view of the bottle unpacking module;

Figure 8 is a schematic view of interleave removal module of Figure 7 to show clearly how interleave is removed and disposed;

Figure 9 is a detail schematic view of a circled area labelled "A" of a bottle pick end effector module of Figure 7 to show more clearly how bottles or boxes are handled when picked from carton box;

Figure 10 is a schematic view of carton box, describing the various type of configurations that can be handled when loaded into the system;

Figure 11 is a schematic view of a proposed label describing the various parts of the label;

Figure 12 is a schematic view of the label shown in Figure 11, describing more clearly the label application on the bottle;

Figure 13 is a schematic of the pick-and-place mechanism of Figure 1 without showing the other components;

Figure 14 is a detail schematic view of a circled area labelled "A" of the bottle loading and unloading unit shown in Figure 13; and

Figure 15 is a schematic of the bottle labeling and placement module mechanism of Figure 1 without showing the other components.

Detailed Description of Preferred Embodiments

Figure 1 is a schematic view showing a pharmaceutical dispensing apparatus 100 according to a preferred embodiment. The pharmaceutical dispensing apparatus 100 includes an array of dispensing shelves 200 located at both the front and rear of the machine, a transfer device 300 (not shown in Figure 1 but see Figure 2), a printing and unload module 400

(which includes a printer (not shown)), a control system 500 and a basket output module 600. In this embodiment, the transfer device 300 is a main gantry robot 300, and will be referred to as such hereafter (but this is not to be construed as limiting, since using other alternative suitable devices are possible too). It is to be appreciated that the main gantry robot 300 is incorporated with a pick-and-place mechanism 320, i.e. see Figure 13. Broadly, each of the array of dispensing cartridges 201 is configured to receive a plurality of pharmaceutical bottles or boxes containing pharmaceuticals; and the main gantry robot 300 receives operating instructions from the control system 500 and picks up selected ones of the plurality of pharmaceutical packages removing them from the respective dispensing shelves 200, and sends them to the printing and unload module 400. Each pharmaceutical package may be in the form of a bottle or other types of suitable packaging, such as a box. It should be apparent that the definition of a bottle is also intended to include (and not limited) to a glass bottle and a plastic bottle. The printing and unload module 400 packs the pharmaceutical, prints information label based on print information (e.g. prescription and patient information) received from the control system 500 on to the innovative label and applies the printed label onto the bottle or box. The labeled bottle or box is then transferred (by the printing and unload module 400) to the basket output module 600. The carton box load module 700 facilitates direct loading of manufacturer carton boxes into the machines. This module 700 unloads individual bottles or boxes from the carton boxes and prepares it to be loaded to the dispensing shelves 200 via the pick and place mechanism 320 of the main gantry robot 300.

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 shelves 200, the main gantry robot 300, the printing and unload module 400, the carton box load module 700 and the control system 500 with the basket output module 600 aligned at an end of the support structure 102.

Figure 3 is an enlarged schematic view showing some of the dispensing shelves 200 of Figure 1 to reveal an arrangement of support brackets 202 for supporting each of the dispensing shelves 200 at different pitch distances, which will be discussed in further detail below. It should be apparent that each of the dispensing shelves 200 is similar in construction and structure and Figure 4, which is an enlarged view of a circled area labeled as "A" of the array of dispensing cartridges of Figure 3, shows these more clearly. As it can be appreciated from Figure 4, the dispensing shelves 200 are arranged to receive a plurality of pharmaceutical packages in the form of bottles or boxes 212. For ease of explanation, the

dispensing shelf 200 arranged to receive the bottles or boxes 212 are termed "dispensing cartridges" 201. Each dispensing shelf 200 is designed to have six supporting brackets 202. The supporting brackets 202 can be preset at 35mm intervals, which allow a user (of the pharmaceutical dispensing apparatus 100) to have the dispensing shelves 200 arranged for the optimum height based on bottle heights. The dispensing shelves 200, when configured together with a pair shelf divider 203, will be grouped as a dispensing cartridge 201. There is an array of features included in the shelves 204, 205 and 207, which allow the shelf dividers 203 to be firmly held in place without the use of any fasteners. In this manner the dispensing cartridges 201 of different sizes can be configured on the pharmaceutical dispensing apparatus 100 to receive pharmaceutical bottles or boxes 212 of different sizes and heights. The dispensing shelf 200 is designed for high load bearing versus weight ratio of 3: 1 maintaining with minimum deflection of 0.5mm to 1mm along axis adjacent to the shelf length, see Figure 3b. Figure 3a shows the cross section view of the dispensing shelf 200. The shelf height 207 is kept to a minimal height between 15mm to 18mm. Three reinforcement beams are spaced apart 210 between 40mm to 45mm interval taking the front edge as reference. Figure 3b shows two lateral reinforcement beams 209 spaced apart 211 between 400mm to 480mm referenced from the center of the shelf 200.

Figure 5, is the schematic view of the carton box load module 700, and Figure 6 is an enlarged view of a circled area labelled "B" of the carton box load module 700 of Figure 5 to show more clearly how pick bottles are unloaded at a staging area and centered. The purport of this module 700 is to allow direct loading of carton box 701 shown with more detail in Figure 10, containing pharmaceutical bottles and/or boxes. This reduces the effort of having to unpack bottles which are delivered in carton boxes 701 by pharmaceutical manufacturer(s). These carton boxes 701 come in different form and sizes. Some boxes are stacked in multiple levels with a cardboard interleaf 702 and cardboard dividers 703 between them. The carton box length 703 ranges from 200mm to 460mm length, depth 704 ranges between 65mm to 450mm depth and height 705 ranges between 90mm to 250mm height can be loaded directly onto the pharmaceutical dispensing apparatus 100 at any one time. As prior mentioned, the individual pharmaceutical packages in the carton box may be bottles or other types of packaging, such as boxes. Optionally, the array of bottles may be configured to be arranged in different types of carton boxes. The basic carton box configuration comprises of a single layer arrangement 706, where the bottles are closely packed against each other. The second configuration comprises of closely packed bottles packed in two layers or more 706 and 707. The third configuration comprises bottles placed between dividers 703 and packed in multiple layers 706 and 707.

The carton load module 700 allows a maximum of 3 cartons 701 to be loaded simultaneously. Loaded cartons 701 are moved to the staging conveyor 710. At this position the carton box 701, is reference to a datum edge. A barcode pasted on the carton box 701, is then read by a scanner (not shown) of the pharmaceutical dispensing apparatus 100.

Information from the barcode sends information to the control system 500, on the details of contents (e.g. the type of pharmaceutical packages and associated pharmaceuticals carried therein) in the associated carton box 701. It is further to be appreciated that based on information obtained from the scanned barcode, the pharmaceutical dispensing apparatus 100 is then arranged to assign a plurality of virtual locations (that are matched to physical locations) on selected dispensing shelves 200 for subsequent storing of the respective pharmaceutical packages after the pharmaceutical packages are unloaded from the carton box 701 by the main gantry robot 300.

A detailed view of a bottle unload axis 720 and an interleave removal unit 760 is shown in Figure 7. Bottles are removed from the carton box 701 by the bottle unload axis 720. The unique compact mechanism comprises two separately operable pick arms, a bottle pick arm 730 for picking bottles and a box pick arm 740 for picking boxes, which are activated when picking between bottles and boxes. The assemblage comprises a three stroke pneumatic actuator 722 coupled to a linear screw axis driven by a servo motor 721. This achieves the ability to be manipulated to discrete pick heights. Figure 9 is a detailed view of a circled area labeled as "A" in Figure 7, which clearly shows the bottle and box pick arms 730, 740 that are operated to pick bottles and boxes respectively. For the pickup of bottles a vacuum mechanism 733 latches on to the top surface of the bottles 732. Once adequate vacuum level is reached the bottle pick arm 730 will move to a safe height. At the safe height location the bottle 732 is further gripped by two pneumatic actuators 731 to prevent the bottle 732 from dropping as it is transported to a staging area 750 of the carton box load module 700, as shown in Figure 5. The designed mechanism is able to pick bottles ranging from 80grams to 520grams in mass. The bottle pick arm 730 is able to pick up bottles with diameters ranging from 35mm to 65mm in diameter and 78mm to 156mm in height. Figure 9 also shows the box pick arm 740. To have better stability in picking boxes, the box pick arm 740 is constructed to have twin vacuum grippers 741 and 742. The divider verification sensor mechanism 734 is attached to the box pick arm 740. This mechanism 734 verifies the absence of interleaf and dividers for carton boxes 701 with interleave 702 and dividers 706. Successful identification will prompt unloading of the bottom layer of bottles.

A detailed schematic view of the interleave removal unit 760 is shown in Figure 8. Once all the bottles 732 have been unloaded in the top layer 707, the x-axis bottle pick arm 724 and

y-axis bottle pick arm 723 positions the bottle pick arm 730 to the interleave pick position, which is the calculated center point of the interleave 702. In position the bottle pick arm 730 is activated to move to the desired height. The vacuum mechanism 733 latches on the interleave 702 and retracts to a predefined interleave dispose height. A pneumatic cylinder 761 is actuated to move a tray 762 forward which is coupled to a linear slide 763. The bottle pick arm 730 moves to dispose position with the interleave 702. The vacuum mechanism 733 checks to ensure the interleave 702 is still in position after reaching the dispose position. Upon successful detection, the vacuum mechanism 733 releases the interleave 702 onto the tray 762. The bottle pick arm 730 retracts to the safe height. Pneumatic actuator 764 is actuated to extend along direction 765. The tray 762 is then retracted by the pneumatic actuator 761. This sequence of actions provide the deterministic disposal of the interleave 702 from the carton box 701 to a disposal bin.

Figure 11 is the schematic view of a proposed innovative label 800. The proposed label 800 is designed to comprise two sections: a strongly adhesive layered transparent section 801 having an area ranging between 564 square millimeters to 940 square millimeters, and combined with a print area section 802 with an area ranging between 3600 square millimeters to 4800 square millimeters, which is adhesive free. The label 800 is designed to have three to five weak adhesive spots 803 each having an area ranging between 4.9 square millimeter to 12.6 square millimeters located along the tail end of the print area section 802. So, the label 800 is said to broadly include a first adhesive portion (i.e. the strongly adhesive layered transparent section 801), a printed portion (i.e. the print area section 802), and at least one second adhesive portion (i.e. the adhesive spots 803) arranged on the printed portion, in which the second adhesive portion configured to have a weaker adhesion relative to the first adhesive portion.

Figure 12a is a detailed schematic illustrating the label 800 applied to a medication bottle 732. This design may ensure that the pasted label 800 does not obstruct critical information on the medication bottle 732 and at the same time carries all the necessary unique patient information and dosing instructions for a patient the medication bottle 732 is to be dispensed to. The design allows for the label 800 to be snugly wrapped around the bottle 732 or box due to the weak adhesive spots 803, displaying the patient as well as prescription information which improves the product presentation while accommodating easier storage of the medication. During medication counseling, it is necessary for the pharmacy staff to show the actual medication container to a patient to enhance the patient's knowledge and recognition of the medication. The proposed label 800 can be easily peeled off on one end in the direction 804 (while still being adhered on the other end by means of the strongly

adhesive transparent section 801) as shown in Figure 12b, due to the weak adhesive spots 803 to reveal the underlying information on the medication container without defacing or causing damage to the original manufacturer's label. The weak adhesive spots 803 may be reattached (or resealed) snugly onto the bottle or box for easy storage thereby preserving the identity of the manufacturer's label and still having the required patient's unique identification and dispensing information. That is, the proposed label 800 is applied over the original manufacturer's label on the pharmaceutical bottle or box, and is beneficially configured to be separable from and re-sealable with the manufacturer's label using the adhesive spots 803 for access to the manufacturer's label, if necessary. This is so that the manufacturer's label is viewable, when the proposed label 800 is separated from the manufacturer's label (at the second adhesive portion) while yet still maintaining adhesion to the pharmaceutical bottle/box via the first adhesive portion.

The main gantry robot 300 is shown clearly in Figure 13. The gantry robot 300 has four degrees of motion namely the X-axis which is constructed using a pair x-axis linear drives 301. The pair of x-axis linear drives 301 is connected using a drive shaft 302 with a pair of intermediary couplings 306 located at the ends. A servo motor drive 303 provides the torque to the drive shaft 302. The z-axis linear drive 304 is mounted onto the pair of x-axis linear drives 301 through various fixtures and brackets. A servo drive 305 is connected directly to the z-axis linear drive 304. The pick and place mechanism 320 is mounted to the z-axis linear drive 304. Both the x-axis linear drives 301 and the z-axis linear drive 304 provide the major motions for the pick and place mechanism 320, by covering the complete area of the array of dispensing shelves 200, the bottle box staging area 750 and bottle labeling transfer 450. A circled area labelled as 'A' of the pick and place mechanism 320 is shown in Figure 14. A rotary drive 321 enables the pick and place mechanism 320 to pick and place bottles or boxes at various angles as required, such as at the front and rear array of dispensing shelves 200. In addition, the rotary drive 321 also provides angular positioning to access the staging area 750 and label transfer 450 which range from 80 degrees to 95 degrees clockwise and counterclockwise directions, when traversed in rotary motion taking reference to the dispensing shelves 200. A servo motor 322 is connected to a telescopic arm 323 through a belt transmission 324. The telescopic arm 323 is fitted with a compliance vacuum pick mechanism 325 (e.g. by way of a vacuum suction cup), which holds on to a (pharmaceutical) bottle or a box as it gets loaded to and removed from the dispensing shelves 200. When the bottle or box have been successfully picked, a gripper mechanism 326 is actuated to grip the said bottle or box, in which the gripper mechanism 326 comprises a pneumatic actuator 326a (which provides the motion for gripping and releasing), spring loaded grippers 326b (which ensure that the bottle or box is clamped within an allocated

squeeze force to not cause any dent or marks on the surface of the bottle or box), and a variable grip detect sensor mechanism 326c (which is able to sense positive bottle grip for bottle or box dimensions ranging from 38mm to 65mm in diameter or width, as in the case for a box). Once the bottle or box is firmly gripped, the x-axis linear drives 301 and the z-axis linear drive 304 are operated to move to the bottle labeling transfer 450 position. The rotary drive 321 then rotates clockwise or counter-clockwise depending on the dispensing shelf 200 (front shelves or rear shelves) the bottle or box was picked. The telescopic arm 323 then positions the bottle or box at a label transfer position table 451 through to label grip position 452 (i.e. see Figure 15). The bottle or box is then clamped by a pneumatic gripper 453. Simultaneously, the printer receives print information from the control system 500 and prints out a proposed label 800 (as per Figure 11) which is held in place by a Bernoulli gripper 454. Pneumatic actuators 456 and 457 are then actuated to move the label transfer position table 451 such that the bottle or box comes into contact with the printed label 801 and paste roll 455. The paste roll 455 is configured to be able to be freely displaced with a spring tension. The label transfer table 451 then rotates 360 degrees turn via a rotary pneumatic actuator 458. Consequently, the printed label 800 wraps around on the bottle or box as the paste roll 455 maintains a contact between the printed label 800 and bottle or box during the entire rotary motion. That is, the label transfer position table 451 is arranged to be movably rotated on its longitudinal axis using the rotary pneumatic actuator 458 to rotate the bottle or box correspondingly. The pneumatic actuators 456 and 457 then retract back to their original position. The labelled bottle or box is now ready to be unloaded into to a basket 951 for dispensing.

A bottle or box unloading unit 900 (i.e. see Figure 15), comprising a linear drive 901 driven by a servo motor 902, then transfers the bottle or box from the label transfer table 451 to the basket 951. The bottle or box unloading unit 900 comprises 3 drives linear drive 910 configured to provide variable discrete motions, a pneumatic actuator 911 arranged for bottle picking, and a pneumatic actuator 912 arranged for box picking.

For easy referencing, it is to be appreciated that the pneumatic gripper 453, the Bernoulli gripper 454, the paste roll 455, the label transfer position table 451, and the bottle or box unloading unit 900 may collectively be termed as a dispensing module (of the pharmaceutical dispensing apparatus 100).

A transfer unit 950 is also provided to transfer in empty basket 951 and transfer out loaded baskets 951 from and to the basket output module 600. The loaded baskets 951, which are

transferred out, are then routed to pharmacists at dispensing station(s) to be subsequently dispensed to respective patients intended for.

5 For completeness, a summary of different aspects of the pharmaceutical dispensing apparatus 100 is now set out below.

A first aspect of the invention relates to an assemblage of multiple modules. It is to be appreciated that pharmaceutical manufacturers typically pack and supply pharmaceutical bottles in carton boxes. These carton boxes come in different forms and sizes. Some boxes are stacked in multiple levels with a cardboard interleaf and cardboard dividers between them. Three carton boxes ranging from 200mm to 460mm length, 65mm to 450mm depth and 95mm to 240mm height can be loaded directly onto the pharmaceutical dispensing apparatus 100 at any one time. The pick and place mechanism 320 carrying the vacuum pick mechanism 325 moves into position to unload the bottles from the boxes into the staging area 750.

Optionally, the array of bottles may be configured to be arranged in different types of carton boxes. The basic carton box configuration comprises a single layer arrangement, where the bottles are closely packed against each other. A second configuration comprises closely packed bottles packed in two layers or more. A third configuration comprises bottles placed between dividers and packed in multiple layers. The pick-and-place mechanism 320 may also be configured to selectively remove the different types of pharmaceutical packages from the different configuration of carton boxes. When unloading the second type of box, the pick and place mechanism 320 removes the carton board interleaf after unloading the top layer of bottles and disposes it into a bin. Following which, the pick and place mechanism 320 resumes unloading of the bottom layer of bottles. When unloading the third type of carton box, the pick and place mechanism 320 unloads the top layer of bottles. Following which the box is moved to the loading zone. An operator is required to remove the interleaf and divider. Following the removal, the box is moved back into the unload area. At this point the pick and place mechanism 320 verifies the absence of interleaf and divider, successful identification will prompt unloading of the bottom layer of bottles. In this way, the pharmaceutical dispensing apparatus 100 is arranged with the flexibility to unpack different types of pharmaceutical bottles/boxes. It should be noted that the pharmaceutical dispensing apparatus 100 is able to identify successful removal of bottles from the carton boxes, in an event where there is a missing bottle or unsuccessful pick, the pick and place mechanism 320 is able to differentiate the event and continues to pick the next available bottle. At the

pick completion of the earlier described event, the pick and place mechanism 320 ejects the carton box out and will not remove the carton board interleaf automatically.

Bottles are removed from the carton box by the bottle unload axis 720. The unique compact mechanism comprises two separately operable arms 730, 740, which are respectively activated when picking between bottles and boxes. The assemblage comprises the three stroke pneumatic actuator 722 coupled to the linear screw axis driven by the servo motor 721. This achieves the ability to be manipulated to discrete pick heights. The designed mechanism is able to pick bottles of up to 500grams in mass. Particularly, the bottle pick arm 730 is able to pick up bottles with diameters ranging from 35mm to 65mm in diameter and 78mm to 156mm in height.

The removed bottles are placed at the staging area 750 of the carton box load module 700. A centering mechanism is employed to grip and center the bottle or box for the subsequent robot picking operation. The mechanism is able to detect, failed bottle placement or toppled bottle or box automatically and automatically signal an alarm for operator correction.

The second aspect of the invention is the main gantry robot 300, which is configured as a four axis system comprising of servo driven gantry axis. This advantageously enables the telescopic arm 323 to traverse in a parallel as well as perpendicular direction when referenced to the dispensing shelves 200. The rotary drive 321 allows the telescopic arm 323 to access the two rows of dispensing shelves 200 which are arranged on opposite sides, as well as positioning of various angles to pick and place the bottles. The y-axis of the telescopic arm 323 enables the pick and place mechanism 320 to load and unload bottles or boxes, which have been loaded into the dispensing cartridge 201. The telescopic arm 323 is fitted with an end effector using the vacuum pick mechanism 325 to adhere onto the bottle. The telescopic arm 323 then retracts with the adhered bottle or box to the return position, where the gripper mechanism 326 is employed. The gripper mechanism 326 firmly holds the bottle in place prior to the high speed movements of the gantry axis.

The third aspect of the invention relates to a storage module, which includes an array of dispensing shelves 200 which can be configured to different heights at an interval of 35mm, which provides flexibility to the user to configure different shelf heights for different bottle sizes. Each individual shelf 200 is designed to hold dividers 203 which can be arranged in intervals of 7.5mm. Thus adding these dividers 203 gives the flexibility to have dispensing cartridges 201 with different widths which cater to the various bottle or box sizes. This flexible design arrangement enables excellent space utilization for storage capacity.

The fourth aspect of the invention is directed at the Label Application process using the proposed label 800, which is applied onto the bottle or box. Pharmaceutical packages come with pre-labelled information such as: drug name, drug concentration, storage conditions, batch number, expiry date and other relevant drug information, as printed on a manufacturer's label. This information on the original manufacturer's drug container is important for pharmacy staff to countercheck that the correct medication is in a good condition to be dispensed to patients. Conventionally, when dispensing pharmaceutical packages to a patient, the Pharmacy manually pastes a Dispensing Label in such a way that the above-mentioned information on the manufacturer's label of the medication container is not obscured by the Dispensing Label. This is however time consuming and does not always prevent the occlusion of the vital information on the manufacturer's label. Furthermore, Pharmacy Dispensing Labels are paper-based and therefore subject to deterioration depending on handling and storage conditions. For a bottle kept in the refrigerator, the Pharmacy Dispensing Label may also deteriorate with moisture and condensation often leading to the loss or degradation of vital information on the label. The proposed label 800 overcomes these limitations, and is designed to comprise two sections: the strongly adhesive layered transparent section 801 having an area ranging between 564 square millimeters to 940 square millimeters, and the print area section 802 having an area ranging between 3600 square millimeters to 4800 square millimeters, which is adhesive free. The label 800 is further arranged to have three to five weak adhesive spots 803, each having an area ranging between 4.9 square millimeter to 12.6 square millimeters located along the tail end of the print area section 802. This design ensures that the proposed label 800 pasted over the manufacturer's label never obstructs any critical information on the medication container and at the same time carries all the necessary unique patient information and dosing instructions. The label design allows for the label 800 to be snugly wrapped around the bottle or box displaying the patient as well as prescription information which improves the product presentation, while accommodating easier storage of the medication. During medication counseling, it is necessary for the Pharmacy staff to show the actual medication container to the patient to enhance patient's knowledge and recognition of the medication. The disclosed label 800 can be easily peeled off on one end (while still being adhered on the other end by means of the strongly adhesive layered transparent section 801) by means of the weak adhesive spots 803 to reveal the underlying information on the manufacturer's label of the medication container without defacing or causing damage to the original manufacturer's label. The weakly adhesive end may be reattached snugly onto the bottle or box for easy storage thereby preserving the identity of the manufacturer's label and still having the required patient's unique identification and dispensing information.

The pharmaceutical dispensing apparatus 100 may further comprise a printing and unload module 400 (having the printer). The printer prints the patient information as well as pharmacy instructions onto the proposed label 800 and then the dispensing module applies the label 800 onto the bottle or box. The labelled bottle is then transferred into a basket (for example) containing other packages for a same patient. The loaded basket is then routed to a pharmacist, via a transport system (not shown), for dispensing.

Broadly speaking (with reference to the fourth aspect), the pharmaceutical dispensing apparatus 100 comprises the control system 500; the transfer device 300 arranged to transfer an (at least one) pharmaceutical package (from carton boxes) to the apparatus 100 for processing, based on operating instructions from the control system 500; the printer arranged to generate a first label (i.e. the proposed label 800) based on print information from the control system 500, the first label includes a first adhesive portion (i.e. the strongly adhesive layered transparent section 801), a printed portion (i.e. the print area section 802), and at least one second adhesive portion (i.e. the adhesive spots 803) arranged on the printed portion, the second adhesive portion having a weaker adhesion relative to the first adhesive portion; and the dispensing module arranged to apply the first label onto the pharmaceutical package having a second label (i.e. the manufacturer's label). It is to be appreciated that the first label is applied over the second label using the first and second adhesive portions, and is configured to be separable from and resealable with the second label via the second adhesive portion, so that the second label is viewable while allowing the first label to maintain adhesion to the pharmaceutical package via the first adhesive portion.

It is also to be highlighted that when the first label is separated from the second label (by way of the second adhesive portion), no damage (e.g. tearing) is caused to the second label as a result, since the second adhesive portion is configured to be weakly adhesive, and hence can easily be removed from the underlying surface without causing physical damage thereto.

While the invention has been illustrated and described in detail in the drawings and foregoing description, such illustration and description are to be considered illustrative or exemplary, and not restrictive; the invention is not limited to the disclosed embodiments. Other variations to the disclosed embodiments can be understood and effected by those skilled in the art in practising the claimed invention.

Claims

1. A pharmaceutical dispensing apparatus comprising:
a control system;
5 a transfer device arranged to transfer a pharmaceutical package to the apparatus for processing, based on operating instructions from the control system;
a printer arranged to generate a first label based on print information from the control system, the first label including a first adhesive portion, a printed portion, and at least one second adhesive portion arranged on the printed portion, the second
10 adhesive portion having a weaker adhesion relative to the first adhesive portion; and
a dispensing module arranged to apply the first label onto the pharmaceutical package having a second label;
wherein the first label is applied over the second label using the first and second adhesive portions, and configured to be separable from and resealable with
15 the second label via the second adhesive portion so that the second label is viewable while maintaining adhesion to the pharmaceutical package via the first adhesive portion.
2. The apparatus of claim 1, wherein the pharmaceutical package is arranged to
20 be in the form of a bottle or a box.
3. The apparatus of any preceding claims, wherein the printed portion includes being configured to be adhesive free.
- 25 4. The apparatus of any preceding claims, wherein the first label is a dispensing label, and the second label is a manufacturer's label.
5. The apparatus of claim 4, wherein the printed portion of the dispensing label includes personal information associated with a patient to whom the pharmaceutical
30 package is to be issued, and prescription instructions issued by a medical practitioner for the patient.
6. The apparatus of any preceding claims, wherein the dispensing module includes a first gripper to hold the first label, a second gripper to hold the
35 pharmaceutical package, a paste roll, and a movable label transfer position table on which the pharmaceutical package is positioned to enable application of the first label onto the pharmaceutical package.

7. The apparatus of claim 6, wherein the label transfer position table is arranged to be movably rotated on its longitudinal axis using actuators to rotate the pharmaceutical package correspondingly to enable the first label to be applied onto the pharmaceutical package using the paste roll.

8. The apparatus of claim 7, wherein the actuators include pneumatic actuators.

9. The apparatus of claim 6 or 7, wherein the paste roll includes being arranged to be freely displaced with a spring tension.

10. The apparatus of any preceding claims, wherein the at least one second adhesive portion includes a plurality of adhesive portions, each configured as an adhesive spot.

11. A pharmaceutical package comprising:

a first label including a first adhesive portion, a printed portion, and at least one second adhesive portion arranged on the printed portion, the second adhesive portion having a weaker adhesion relative to the first adhesive portion; and

a second label,

wherein the first label is applied over the second label using the first and second adhesive portions, and configured to be separable from and resealable with the second label via the second adhesive portion so that the second label is viewable while maintaining adhesion to the pharmaceutical package via the first adhesive portion.

12. The package of claim 11, wherein the first label is a dispensing label, and the second label is a manufacturer's label.

13. The package of claim 12, wherein the printed portion of the dispensing label includes personal information associated with a patient to whom the pharmaceutical package is to be issued, and prescription instructions issued by a medical practitioner for the patient.

14. The package of any of claims 11-13, wherein the printed portion includes being configured to be adhesive free.

15. The apparatus of any of claims 11-14, wherein the at least one second adhesive portion includes a plurality of adhesive portions, each configured as an adhesive spot.