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(54) **Apparatus for automatically fulfilling beverage orders**

(57) Method and apparatus for automatically fulfilling a beverage order. An input describing a beverage order is received (904) and an empty receptacle (630) is positioned (910) at a location for receiving a dispensing nozzle (620) configured to dispense a beverage corresponding to the order, and/or a dispensing nozzle is positioned (910) at a location for dispensing a beverage corresponding to the order into an empty receptacle. The beverage from the nozzle can then be dispensed (916) into the empty receptacle.

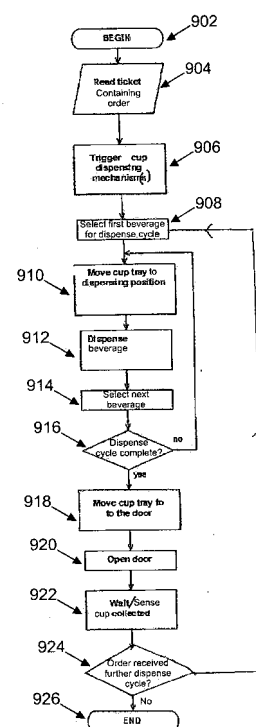


Fig. 9

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Description

[0001] The present invention relates to automatically fulfilling beverage orders.

[0002] Beverage orders, including orders for alcoholic drinks, are traditionally fulfilled manually by bar or waiting staff. However, there are some situations where this is a limitation on the number of drinks that can be served, e.g. at large events, such as concerts or race meets, where there may be hundreds or thousands of potential customers.

[0003] An alternative known method of purchasing a drink is via a vending machine. However, to date such machines are not widely used for dispensing alcoholic drinks and are also limited to dispensing cans of beverages and/or one drink at a time rather than orders comprising more than one drink selected from a range. Thus, currently available vending machines are not suitable for fulfilling a large number of beverage orders, particularly alcoholic drinks, quickly.

[0004] Embodiments of the present invention are intended to address at least some of the shortcomings of existing techniques.

[0005] According to one aspect of the present invention there is provided apparatus adapted to automatically fulfil a beverage order including:

a plurality of dispensing nozzles configured to dispense at least one type of beverage;
 a receptacle positioning device for moving at least one receptacle to/from a dispensing position of at least one of the dispensing nozzles, and/or
 a nozzle positioning device for moving at least one of the dispensing nozzles;
 a dispensing device for actuating a said dispensing nozzle to dispense the beverage into a said receptacle;
 an order receiving device for receiving an input describing a beverage order;
 wherein the apparatus is configured to:
 use the receptacle positioning device to position an empty said receptacle at a dispensing position of a said dispensing nozzle configured to dispense a beverage corresponding to the order, and/or
 use the nozzle positioning device to position a said nozzle at a location for dispensing a beverage corresponding to the order into an empty said receptacle; and then
 use the dispensing device to dispense the beverage into the empty receptacle.

[0006] Some embodiments will include the nozzle positioning device and the receptacle positioning device. Normally, if there is a further beverage specified in the beverage order, the apparatus will:

select the further beverage;
 use the receptacle positioning device to position an-

other empty said receptacle at a dispensing position of a said dispensing nozzle configured to dispense the selected beverage, and/or

use the nozzle positioning device to position a said nozzle at a location for dispensing the selected beverage into an empty said receptacle; and then
 use the dispensing device to dispense the further selected beverage into the empty receptacle.

[0007] The apparatus may repeat these steps until all beverages specified in the order have been dispensed into respective receptacles.

[0008] The apparatus may include a holding member configured to hold a plurality of said receptacles, the holding member being connected to the receptacle positioning device so that the device can position a plurality of said receptacles held by the holding member. The apparatus may repeat the use of the receptacle/nozzle positioning device(s) and the dispensing device for all the receptacles held in the holding member. The holding member may include an elongate member including a plurality of (aligned) spaced apart apertures, each said aperture configured to fit around a diameter of (at least part of) a said receptacle. There may be at least one elongate member that extends upwardly and at an outward angle from a said aperture.

[0009] The apparatus may be configured to use the receptacle positioning device and/or the nozzle positioning device to position a said receptacle and/or a said nozzle at a specific coordinate representing where the empty receptacle is to be positioned for receiving the selected beverage from the appropriate nozzle. The nozzle positioning device may include a moveable member on which some or all of the nozzles are fitted. In one embodiment the nozzles are arranged spaced apart in a line in a first axis and the receptacles held by the holding member are arranged spaced apart in a line in a second axis, with the second axis being generally transverse/perpendicular to the first axis.

[0010] The nozzle positioning device may further position at least one said nozzle in an active dispensing position, where at least part of the nozzle is located within a said receptacle, and a non-dispensing position, where the receptacle positioning device can normally reposition a said receptacle and/or the nozzle positioning device can normally reposition a said nozzle without contact between a said nozzle and a said receptacle.

[0011] The apparatus may include a weighing device configured to weigh a said receptacle after a beverage has been dispensed into it. The apparatus may be configured to re-dispense beverage into the receptacle if the weight measured by the weighing device indicates that the amount of beverage dispensed is below a predetermined threshold. In some embodiments, the apparatus is configured to release a said receptacle from the holding member to rest on the weighing device. The receptacle may be released from an aperture in the holding member by being placed on top of the weighing device, with the

holding member moving relative to the receptacle to a point where the receptacle diameter is smaller than that of the holding member aperture.

[0012] The apparatus may include a plurality of storage containers containing the at least one type of beverage. The apparatus may further include a cooling mechanism configured to keep beverage in the apparatus at a cool temperature, such as around 1 - 2°C. The cooling mechanism may include compressors, etc. The cooling mechanism may cool a shell that contains the storage containers, the nozzles and/or the positioning device(s). The (outer) shell may be formed of an insulating material, e.g. a polyurethane foam sandwiched between layers of rigid plastic or metal material such as aluminium.

[0013] The apparatus may include an aperture open to outside, or located behind an outer door which opens on order fulfilment, for allowing filled receptacles to be collected, and a portion for sealing the aperture to reduce temperature increase inside the apparatus. The dispensing location of the plurality of nozzles may be located within a cooled interior of the apparatus and the receptacle positioning device may move the receptacles between the dispensing location and the outer aperture. The apparatus may further include an automatic door that opens/closes the aperture.

[0014] The order receiving device may include a device for reading a ticket or card having the beverage order encoded in or upon it, e.g. a ticket with the order printed/punched on it. The beverage order may be encoded in the form of a barcode. Alternatively, the order may be encoded by means of a magnetic strip or memory device on a smart card or the like. In alternative embodiments, the order receiving device may include an input device, such as a keypad/keyboard/touch screen, or a speech recognition device. The order receiving device may receive a ticket or card encoded with the order at a remote device/location.

[0015] The apparatus may include a storage device for storing information regarding a plurality of orders.

[0016] A plurality of said apparatus may be included as dispensing modules fitted within a frame, the dispensing modules being capable of fulfilling separate said beverages orders substantially simultaneously.

[0017] The apparatus may further include at least one flow regulator with electronic pressure control (fixed or proportional) fitted to at least some of the dispensing nozzles. The apparatus may include at least one detector (e.g. liquid level detector) configured to determine if a first beverage storage container connected to at least one of the dispensing nozzles is/approaching empty, the apparatus further including an arrangement configured to automatically connect another beverage storage container to the at least one dispensing nozzle without user intervention when the at least one detector indicates that the first container is/approaching empty.

[0018] According to another aspect of the present invention there is provided a method of automatically fulfilling a beverage order, the method including:

receiving an input describing a beverage order; positioning an empty receptacle at a location for receiving a dispensing nozzle configured to dispense a beverage corresponding to the order, and/or positioning a dispensing nozzle at a location for dispensing a beverage corresponding to the order into an empty receptacle; and then dispensing the selected beverage from the nozzle into the empty receptacle.

[0019] According to yet another aspect the present invention there is provided a system adapted to automatically fulfil a beverage order including dispensing apparatus substantially as described herein and remote apparatus adapted to receive an order and produce a device, e.g. a ticket, encoded with the order that provides the input for the order receiving device of the dispensing apparatus.

[0020] According to further aspects of the present invention there are provided computer program products including code for configuring a computer device to control apparatus substantially as described herein.

[0021] According to another aspect of the present invention there is provided apparatus adapted to process beverage orders, the apparatus configured to store information required for fulfilling a said beverage order and additional information relating to a said beverage order that is not required for fulfilling the order.

[0022] According to yet another aspect of the present invention there is provided apparatus for dispensing a predefined amount of beverage, the apparatus including a device for weighing a receptacle into which an ordered beverage has been dispensed and a device for checking if the weight measured by the weighing device indicates that the amount of beverage dispensed corresponds to the predefined amount.

[0023] According to a further aspect of the present invention there is provided apparatus adapted to automatically fulfil a beverage order, the apparatus including:

a housing;
beverage dispensing components located within the housing, and
a cooling device for cooling the contents of the housing.

[0024] The housing may also include at least one storage container containing a beverage.

[0025] Whilst the invention has been described above, it extends to any inventive combination of features set out above or in the following description. Although illustrative embodiments of the invention are described in detail herein with reference to the accompanying drawings, it is to be understood that the invention is not limited to these precise embodiments. As such, many modifications and variations will be apparent to practitioners skilled in the art. Furthermore, it is contemplated that a particular feature described either individually or as part

of an embodiment can be combined with other individually described features, or parts of other embodiments, even if the other features and embodiments make no mention of the particular feature. Thus, the invention extends to such specific combinations not already described.

[0026] The invention may be performed in various ways, and, by way of example only, embodiments thereof will now be described, reference being made to the accompanying drawings in which:

Figure 1 is a schematic representation of a beverage order fulfilment system including a point of sale terminal and a beverage dispensing terminal;

Figure 2 illustrates the beverage dispensing terminal in more detail;

Figure 3 is an exploded diagram showing the construction of an example of an outer shell of the dispensing terminal;

Figure 4 is another view of a dispensing terminal, showing some of its inner components;

Figure 5 illustrates an inner frame and some inner components of the dispensing terminal;

Figure 6 further details components shown in Figure 5;

Figure 7 is a perspective view of components of the system that are used to position receptacles and dispensing nozzles;

Figure 8 is a flow chart showing steps performed at the point of sale terminal;

Figure 9 is a flow chart showing steps performed at the dispensing terminal;

Figures 10A to 10H are schematic side views of components of the dispensing terminal showing an example of the sequence of operations involved in dispensing a beverage to a customer;

Figure 11 is a perspective view of components of an alternative embodiment of the dispensing terminal;

Figure 12 is a perspective view of the components of Figure 11 housed within an outer shell, and

Figure 13 is a perspective view detailing a receptacle holder and associated components of the alternative embodiment.

[0027] Referring to Figure 1, an example of the beverage order fulfilment system is shown. The system illustrated includes a beverage dispensing terminal 100 and a point of sale terminal 101. It will be appreciated that this arrangement is exemplary only and the number and locations of the terminals can vary according to particular requirements. The point of sale terminal 101 is intended to allow customers to order drinks and pay for them. The terminal 101 issues a ticket which the customer then takes to the dispensing terminal 100 where the ordered beverage(s) is/are dispensed automatically. Fencing 103 or the like may be provided to channel customers to/from either or both of the terminals and assist with orderly queuing.

[0028] In the illustrated embodiment, when a customer places an order at the point of sale terminal 101 data representing the order is communicated to the dispensing terminal 100. This communication can be achieved by any suitable means, e.g. using wireless or wire-based communications hardware. Details of the order placed are then stored within a database in an electronic storage device, e.g. a hard drive, that is in communication with a processor also located within the dispensing terminal 100. When an order ticket is presented to the dispensing terminal details of its order can be cross referenced with the order data held in the database so that the correct beverage(s) is/are automatically dispensed. In another embodiment, data relating to the order may be stored in a storage device within the point of sale terminal 101 and/or in another separate device.

[0029] In some embodiments, the order database may be accessible to other software/computers, e.g. by complying with Open Database Connectivity standards. The database may also store information that is not directly required for fulfilling a beverage order, but which may be used for other purposes, e.g. obtaining statistics regarding sales of various products, which can be useful for marketing or re-stocking purposes. In some cases the database may store information including a reference number unique to the order; the beverage(s) specified in the order; the cost of the order; the payment method and time/date that the order was made. Additionally, the database may store data relating to the fulfilment of an order, e.g. the time the order was fulfilled at the dispensing terminal 100. Thus, the database may be used to gather/collate information including the following: total sales; quantity of sales of each type of beverage; card types used for payment; throughput; average dispensing time (e.g. starting from order placement to removal of filled cups from dispensing terminal); total takings over a given period; profit over a given period; number of users; most popular choice(s) of beverage. If the customer is using a "top up"/reward card for payment then details of his previous order(s) may be stored and retrieved to enable him to place a repeat order quickly.

[0030] It will be appreciated that the point of sale terminal 101 can take various forms. In one example the terminal 101 includes a cabinet housing a computer with a touch screen that presents a menu of beverages and is capable of receiving payment in the form of cash or a credit/bank card. Alternatively, if the system is only configured to dispense one type of beverage then only the number of drinks required may need to be specified in the order by the customer, with the type of beverage being implicit in such an order. The touch screen can display the cost of the order as it is made by the customer and may allow the customer to cancel/modify the order at any time before payment is made. A limit on the number of (different) beverages that can be specified in a single order may be put in place. The terminal can also include a numeric keypad to allow entry of a PIN number when a card is being used to make the payment. It will be ap-

parent to the skilled person that many variations are possible, e.g. the user interface could take a different form, such as electromechanical buttons or speech recognition, and different types of payment could be processed, e.g. a "top-up" card with a magnetic strip or chip. In alternative embodiments, the payment terminal may be integrated within the dispensing terminal and so a step of producing a ticket and then presenting it to the dispensing terminal may be omitted; however, it has been found that having the point of sale and dispensing terminals located remotely from each other can be beneficial in terms of throughput and also offers more flexibility to customers. It will also be understood that alternative payment schemes could be implemented, e.g. a customer could pre-pay for drinks remotely, e.g. via a website or telephone line, and print out/be posted a ticket, or a customer could pre-order/pay-pay for drink at the time of buying an event ticket, with a separate ticket being used at that time (or the drink payment/order may be encoded on the event ticket).

[0031] Figure 2 is a perspective view of an example of the dispensing terminal 100. The terminal 100 includes an outer shell 102 which houses components for processing and fulfilling beverage orders. In the illustrated example the terminal includes four service points 104A-104D, each of which includes/is located adjacent a respective ticket reader 105A-105D. A video screen 106A-106D is located above each service point and may display order-related information or other material such as advertisements.

[0032] In use, a customer stands next to one of the service points 104 and presents the order ticket produced by the point of sale terminal 101 and then waits for the ordered beverage(s) to be dispensed. Each of the service points is associated with a separate dispensing module inside the shell 102, which will be described in detail below. Thus, the example dispensing apparatus is capable of fulfilling up to four beverage orders at a time. However, it will be understood that this number is exemplary only and alternative versions of the terminal 100 can be built to fulfil different numbers of orders simultaneously.

[0033] The terminal 100 further includes a first control cabinet 108 containing cooling apparatus (shown schematically at 108A) for keeping beverages within the terminal 100 at a low temperature, e.g. about 1 - 2°C. The terminal 100 also includes a second control cabinet 109 that contains computer equipment (shown schematically at 109A), which can include a PC and circuit boards, for controlling the dispensing system, processing orders and maintaining the order database, etc. The locations of the cabinets in the Figure is exemplary only and either or both could be integrated within the main body of the shell 102 or be at least partially separate from the main body.

[0034] Figure 3 is an exploded diagram (rear perspective aspect) showing an example of how the shell 102 of the dispensing terminal 100 can be constructed. The example shown in Figure 3 shows a slightly different construction to the example of Figure 2, and it will be under-

stood that the appearance and construction of the dispensing terminal 100 can vary and it need not have the same shape, dimensions or configuration shown. The example shell of Figure 3 comprises a set of floor panels 110 (e.g. 2.0 mm Aluminium 5 bar sheets over 9mm plywood) that, when assembled, are held between floor beams 112. Internal skirting boards 113 may also be provided. In use, the floor panels can be mounted upon chevrons 111 for stability, as the terminal may be placed in use on an uneven lawn, etc.

[0035] The side walls of the shell can be formed by a series of vertical panels 116 held together between vertical beams 114. Various construction techniques can be used to secure the various panels together, e.g. they may include a tongue/groove formation. The entire terminal may be constructed so that it can be easily assembled/dissembled to make the system conveniently relocatable so that it can be hired to/placed at different venues. The upper surface of the terminal can be formed of a series of ceiling panels 120 fixed between elongate ceiling beams 122 and PVC external corner pieces 124. Components 126 for suspending the ceiling from an overhead construction may also be provided. A lockable, insulated hinged door 118 (or other suitable sealable apparatus) may be provided to allow access to the inside of the shell for maintenance purposes.

[0036] As mentioned above, the external appearance and dimensions of the shell may be selected on an individual basis, but the external dimensions of the example shown in the Figures are: height 2,400 mm, width 3,460 mm and depth 2,160 mm, and the internal dimensions are 2,240 x 3,000 x 2,000 mm (all approximate). The dimensions of the apertures forming each of the service points 104 may be around 300 x 500 mm, with the apertures being spaced apart by about 300 mm and the door 118 may have dimensions of around 0.7 m x 1.92 m.

[0037] The shell 102 in the example is intended to contain cooling apparatus and so is insulated and effectively acts as a cool room. At least some of the shell panels may be formed of pieces of rigid material, e.g. a metal, such as aluminium or steel, that form a sandwich with an insulating material filling, such as polyurethane injected. The resulting thickness of such panels may be between around 70 to 80 mm. The panels may have coatings, e.g. an external finishing such as the "Colour Coat HPS 200" range produced by Corus. The internal surfaces of the panels may have a food safe finish.

[0038] An example of a suitable cooling/refrigeration system 108A is "MAS221N118S Uniblock Weather" produced by Zanotti Spa of Italy. An associated control system will also be used to configure settings such as the temperature, defrost management, time and temperature termination, fan control and alarm function. The cooling apparatus may be mounted through the wall or ceiling of the shell and can include a compressor crank case heater, high pressure switch for condenser fan control, and twin solenoid valves for hot gas defrost and automatic condensate water evaporation. The power source

for the cooling apparatus and/or other electrical components of the system may be external or the system may contain its own power source, e.g. batteries, for at least some of the components.

[0039] Figure 4 includes a partial view of the shell 102 that illustrates how an inner frame 130 and other components contained inside it. The inner frame 130 and some of the components are also shown in Figure 5. The inner frame 130 can be formed of any suitable rigid material, e.g. 80 x 40 steel box, connected together using appropriate means, e.g. nuts/bolts, screws, adhesives or welding. The frame comprises a lower framework 132 and a plurality of upper frameworks. Each of the upper frameworks contain components that can be considered to be dispensing modules associated with each of the service points 104A-104D, each module being capable of independently fulfilling different orders. For clarity, only one of the upper frameworks 134A and dispensing modules (located at the left hand end of the frame in Figure 5) is shown.

[0040] The lower framework 132 contains a plurality of storage containers, e.g. kegs 502, that are used to supply the upper dispensing modules. The various kegs 502 may contain one or more different types of beverages, e.g. lager, bitter, cider or stout. Pipes and pumping apparatus (not shown) connect some of the kegs to dispensing nozzles that are part of the dispensing modules. These components comprise ancillary dispensing equipment that can be controlled by the system control computer and typically include pressure regulators, pneumatic controllers/actuators, pumping components, (automated) line cleaning components and in-line cooling components (e.g. glycol based).

[0041] The system may incorporate an automatic keg changeover arrangement (not illustrated) that enables more than one keg (normally of the same product type) to be connected to a single dispensing nozzle. When a detector (e.g. liquid level detector) determines that a first keg is/approaching empty (e.g. only enough fluid left in the keg to fulfil a certain number, e.g. one, of further order (s)), the arrangement automatically changes to another keg without user intervention, thereby ensuring continuous supply of product. This can be achieved, for example, by pinch valves mechanically closed with springs and opened by linear actuator, or a manifold system, in communication with the detectors fitted to the kegs. Components of the dispensing module within the upper framework 134A can be seen in more detail in Figure 6. The dispensing module includes an access door 602 that, in use, opens/closes the aperture in the shell 102 at the left-hand end service point 104A. The door 602 can be slid open/closed in a vertical or horizontal direction by virtue of being connected to a lifting device 604 (e.g. a roundline cylinder, cog, belt or pulley system or similar), which is controlled by code executing on the computer 109A. The access door 602 forms a front cover for a cuboid-shaped thermal cut-off chamber 606 located within the framework 134A. The base of the chamber is formed by an

elongate platform 607. In use, a customer retrieves dispensed beverage(s) from this chamber.

[0042] Part of the rear vertical wall of the chamber 606 is formed by a vertical panel 608 that is mounted on a moveable tray 610. The tray 610 is mounted on a set of rails 614 and can be moved horizontally by means of actuators (under the control of the computer 109A) away from/towards the thermal chamber 606 relative to the opposite wall of the dispensing terminal. This direction will herein be referred to as the X axis. It will be appreciated that instead of a solid tray 610, a frame-type elongate member could be provided, formed out of one or more pieces.

[0043] The rails 614 can also be moved vertically (this direction will herein be referred to as the Y axis) by virtue on being mounted on a set of lifting cylinders, with one cylinder located at/adjacent each end of the rails. Cylinder 616A is visible on the rear end of the left-hand rail 614 in Figure 6. In the example four 25 mm bore double acting compact pneumatic cylinders (such as the NZ series produced by Hoerbiger-Origa UK of Tewkesbury, Gloucestershire, United Kingdom) are used to move the two rails simultaneously over a vertical distance of around 30 mm, and so are capable of adjusting the height of the rails and all attached components, including the tray 610.

[0044] The dispensing module further includes a set of dispensing nozzles 620. In the example three nozzles 620A-620C depend from the lower surface of an elongate tubular bar 622. The nozzles (approximately 245 mm in length) are arranged spaced apart by gaps of around 40 - 45 mm in a line along the bar. The bar 622 contains pipes that are connected to the kegs in the lower framework. The bar is attached to a member 624 that is slidably mounted on a vertical post 625. The member 624 is moveable up/down on that post (i.e. along the Y axis) by means of actuators (not shown). The pipes in bar 622 run through the inside of post 625, down out of the bottom of the framework 134A and to the kegs. The post 625 (and attached components) is moveable horizontally/sideways between the ends of a pair of parallel rails 626A, 626B upon which it is mounted. The rails extend in a direction substantially perpendicular to that of the post 625. The horizontal directions along which the post 625 can move over the rails 626 will herein be referred to as the Z axis.

[0045] The example dispensing module of Figure 6 also includes three stacks of receptacles 630A-630C that are releaseably held by respective dispensers 632A-632C; however, it will be understood that this is exemplary only and different numbers/configurations of receptacle stores could be provided, e.g. a 4 x 4 grid-arrangement of stacks (as in the alternative embodiment of Figure 11 discussed below). The receptacles can be open containers, such as frusto-conical cups formed of any suitable material, e.g. plastic, starch or cardboard. As will be described below, each dispenser can release the lowermost cup in its respective stack into the tray 610. The

tray 610 is an elongate flat body including three apertures 611, each aperture being located and dimensioned to receive one of the cups from the stacks when the tray is correctly positioned. The diameter of each aperture corresponds to the diameter of an upper (wider) region of a cup. It will be appreciated that the components of the dispensing module can be modified so that a different number of cups, e.g. four, can be processed.

[0046] The dispensing module further includes three weighing devices (the leftmost one 640 visible in the Figure) connected to computer 109A, each weighing device being located below the operating location of a respective one of the three nozzles 620.

[0047] In an alternative embodiment, the system can include a (fixed or proportional) flow regulator with electronic pressure control (fixed or proportional). The flow rate is monitored with one or more flowmeters per nozzle. In-line pressure and product temperature is measured in order that an electronic adjustment may be made if needed to ensure that the correct volume of beverage is dispensed. Each of these elements is fed into the control system and adjustments are made to ensure product is dispensed in the appropriate quantity and quality, e.g. Pint (0.568 litre), half-pint (0.284 litre), Litre or half-Litre, etc.

[0048] Figure 7 is a perspective view of one example of the mechanisms that are used to position the tray 610 and the set of nozzles 620. The tray rails 614 can each include a toothed belt and internal bearing guide (not shown) that are driven by actuators (e.g. with 2:1 belt gear reduction gearbox) connected to a drive shaft 703 operated by a stepper or servo or DC or linear motor 704. This arrangement (or similar) can enable the tray, when it is fitted on mountings 702A, 702B that are connected to the belt, to travel along the X axis. Suitable components can be obtained from Hoerbiger-Origa UK.

[0049] Similar suitable components for the traverse (over rails 626) and vertical (over post 625) movement may also be obtained from the same manufacturer. For example, the vertical movement of the member 624 on post 625 can be achieved by a Hoerbiger "OSP-E32ST" trapezoidal screw drive linear actuator with an internal bearing guide, driven by a stepper or servo or DC linear motor. The skilled person will understand that alternatives to the tray and nozzle positioning device described are available, which may include electromechanical or hydraulic movement means. It will be understood that the mechanisms for moving the nozzles and the cups described are exemplary only. In alternative embodiments, components may be provided that allow sets of cups to be moved independently of other sets of cups, e.g. to different nozzles. This means that in some cases the nozzles may not need to be moveable/repositioned during a dispensing operation. Similarly, components may be provided for moving sets of nozzles independently of other sets of nozzles within a single dispensing module. In some cases this can mean that the cups do not need to be moved in a horizontal direction during a

dispense operation, e.g. they are filled at the service point. In some embodiments, the system may be capable (in a single dispensing module) of dispensing more than one beverage specified in an order. In this case more than one beverage specified in the order will be selected for substantially simultaneous dispensing.

[0050] An example of the operation of the dispensing system will now be given. Figure 8 illustrates exemplary steps that a customer can perform in conjunction with the point of sale terminal 101. The interaction begins at step 802, e.g. the customer touches a "welcome" screen on the terminal, and at step 804 the customer proceeds to select the type/quantity of beverage(s) required. At step 806 the customer is given a chance to confirm his selection and then at step 808 he chooses the payment method. If the chosen payment method is cash then at step 810 the terminal 101 is configured to accept bank notes and/or coins. This can be achieved using known apparatus such as supplied by Money Controls of Cleaveland Ohio, USA/Oldham, UK. If the money receiving component indicates at step 812 that the required amount has been received then at step 814 a ticket is printed (and change may be given if appropriate). An Epic 950 device produced by Ithaca may be used for this operation. At this point the system's order database can be updated with details of the order placed.

[0051] It will be understood that a printed ticket is only one example of a means of allowing a customer to present an order that has been paid for to the dispensing terminal 100. The order details may be encoded on the ticket, or the ticket may simply include a reference number/code that acts as a key for looking up the order details in the database of the dispensing terminal. The ticket may be formed of any suitable material, such as card or lightweight plastic, and the details may be formed on it by means of a printed bar code or other suitable method, e.g. punch holes. Alternatively, customers may be provided with a card (e.g. a "top up" card) having a magnetic strip or a smart card that can be used for the transaction.

[0052] If the payment method selected at step 808 is a credit/debit/bank card then at step 816 a prompt is displayed for the customer to insert his card into an appropriate card reader, such as one supplied by YESPay International Limited of Barnet, UK on the terminal 101. The card is then read and checked at step 818 and if the result is positive then control is passed to step 814, where a ticket is printed as described above. If the card is rejected then at step 820 an appropriate message is displayed to the customer and the order is rejected. The customer interaction at the ordering terminal 101 terminates at step 822, following step 814 or step 820.

[0053] Figure 9 illustrates schematically exemplary steps that can take place during user interaction at the dispensing terminal 100. Reference will also be made to the sequence of actions shown in Figures 10A to 10H, which illustrate the components of one dispensing module in the terminal 100. The interaction begins at step 902,

which typically involves the customer presenting the printed ticket to a ticket reading device 105A-105D at one of the service points 104A-104D. The position/configuration of some of the components of the dispensing module at this point is shown in Figure 10A. At this stage, the door 602 is closed and the tray 610 is located adjacent it (at a first position 1001 in the X axis), so that the panel 608 substantially seals the chamber 606.

[0054] At step 904 the ticket reading device either reads the beverage order details from the ticket, or uses reference information read from the ticket to obtain details of the order from the database. After reading an order/reference from the ticket, the database entry for that order may be deleted or flagged so that it can only be fulfilled once.

[0055] At step 906 a number of cups corresponding to the number of beverages specified in the order (or the maximum number that can be filled in one dispensing sequence if the amount of beverages specified in the order exceeds that) is/are placed in the tray 610. In order to achieve this, the tray 610 moves from its first location 1001 to a second location 1002 (see Figure 10B) beneath the cup dispensers 632. Up to three of the dispensers release the lowermost cup from their respective stacks, as appropriate. As Figures 10A-10H are side views, only the cup 631 nearest to the viewer can be seen.

[0056] At step 908 the dispensing of a first beverage specified in the order is commenced. The first beverage will typically be the first one as entered by the customer on the point of sale terminal 101, although it could be selected in some other manner, e.g. taking into account relative positions of nozzles associated with the various types of beverages, a prior operation of the apparatus, or the settling time of any particular beverage.

[0057] At step 910 the cup tray and nozzles are moved to appropriate positions for dispensation of the first beverage. Typically, the cup in the leftmost aperture in the tray 610 will be the first to be filled, but it will be understood that this could be varied. The three nozzles 620A - 620C will normally be configured to deliver different types of beverage, although in some cases at least one of the nozzles could dispense the same type of drink as another one of the nozzles, e.g. be connected to an additional keg of a popular drink. Thus, three points/coordinates in the X axis, labelled 1003A, 1003B and 1003C in Figure 10C are associated with the dispensing positions of nozzles 620A, 620B and 620C, respectively. The computer 109A obtains the appropriate coordinate for the nozzle that dispenses the specified beverage and transmits a signal to the tray positioning components, e.g. motor 704 actuator, to move the tray to the appropriate location. In the example of Figure 10C, the tray 610 moves so that cup 631 is positioned beneath the middle nozzle 620B, i.e. at location 1003B.

[0058] The positioning of the tray/cup also involves placing the cup to rest on the weighing device 640 associated with the nozzle that performed the dispensing operation, which is used to check that the correct amount

of beverage has been dispensed. To achieve this, the tray frame/rail 614 is moved, under the control of the computer, downwards along the Y-axis (see arrows 1004 in Figure 10D) using the cylinders 616 so that the cup is no longer supported by the tray 610 and instead rests directly on the weighing device 640.

[0059] The processor will also arrange for the appropriate nozzle to be positioned above the cup that is to be filled. The locations of the three cups/ apertures in the tray beneath the appropriate nozzle are associated with three respective coordinates in the Z-axis. The computer obtains this coordinate for the cup that is to be filled and transmits a signal to the nozzle positioning components to move the nozzles along rails 626 to the appropriate location above the cup. Thus, the cup and nozzle can be positioned very precisely for dispensation of the beverage.

[0060] At step 912 the appropriate beverage is dispensed into the cup 631. To achieve this, the bar 620 is moved downwards along the Y-axis (by means of relative movement of member 624 on post 625 under the control of the computer) so that nozzle 620B is at least partially positioned within the cup 631, as shown in Figure 10E. Having the nozzle in this position is particularly suitable for dispensing alcoholic beverage such as bitter, but it will be understood that in some cases the nozzle could be positioned above the cup and need not be located within it. The nozzle 620B is then actuated and fills the cup for a predetermined period of time. The period of time will be determined by various factors, including the temperature of the liquid, the specific gravity of the beverage, the configuration of the dispensing pump, etc. This information can be taken into account and a look-up table or the like can be stored by the control computer, e.g. indicating the dispense time for each type of beverage having a certain specific gravity. Typically, this dispense operation will vary between 1.9 and 3.6s. The components in the example can dispense around 38 litres of beverage per minute (in continuous use), which typically allows one pint (0.473 litres) of beer to be dispensed in around 1.9 seconds. It will be appreciated that the apparatus can be modified to dispense any required volume of liquid.

[0061] Figure 10E does not illustrate part of the tray rail 614 to show the cup 631 resting directly on top of the weighing device 640. In order to ensure that the correct amount of liquid is dispensed into the cup (e.g. to comply with UK Weights and Measures regulations), the cup is then weighed using device 640, with the measurement being relayed to the computer. Having the beverage in the system maintained at a constant temperature by the cooling apparatus, plus the ability to accurately position the empty cup for filling means that the system can accurately fill a cup with the correct amount of beverage. However, if the weighing operation indicates that the cup is not sufficiently full (in the UK, for example, it is not acceptable for the weight of an alcoholic beverage sold as 1 pint (0.473 litres) to be outside a threshold that cor-

responds to around 2.8 grams when weighed) then the nozzle actuator is again activated to fill the cup with a predetermined amount. Further weight checks may be performed, followed by further refilling operations if necessary. Using the weight of a dispensed beverage/cup is not commonplace for determining whether the correct amount of beverage has been dispensed and it has been found to be quicker (and requires less complex/costly components) than attempting to measure the volume of liquid dispensed in the present system.

[0062] At step 914 the dispensation of the next beverage (if any) specified in the order for the current dispensation cycle is commenced. The "next" order may be simply the next one in the series as input by the customer at the payment terminal, or other considerations, similar to the ones discussed above, may be used to determine it. Steps 910 - 914 are repeated for this order (but not described, for brevity), with the nozzles 620/bar 622 moving first upwards in the Y direction (see Figure 10F) to be clear of the cups before moving across along the Z-axis to be positioned above the next cup that is to be filled. The tray 610 is also moved back up so that it holds the cup(s).

[0063] When all of the beverages specified in the order (or the maximum that can be dispensed within a single dispensing cycle) have been dispensed (step 916) then the tray 610 is moved (at step 918) along rail 614 back to position 1001 adjacent the access door 602, as shown in Figure 10G. At this point the panel 608 attached to the tray 610 substantially closes the gap in the rear wall of the thermal chamber 606 to mitigate temperature increase from outside. It will be understood that further temperature maintenance could be achieved by blocking the aperture in the rear wall of the chamber 606 when the panel 608 is not present, e.g. by means of a further moveable panel that slides up/down to fill the aperture.

[0064] The access door 602 is opened at step 920, as shown in Figure 10H, and at step 922 the tray 610 moves down so that the cups rest on platform 607, making them easier to collect. The user is then allowed to take the filled cup or cups. At least one sensor (illustrated schematically at 1010) may be provided to detect removal of the cups from the tray 610 and/or that it is clear for the door 602 to close again.

[0065] If there are more than three beverages in the order being processed then at step 924 the dispensing cycle, e.g. steps 908 onwards, starting with the next beverage in the order that has not yet been dispensed, will be performed for the next three (or less) beverages, otherwise processing of the current order ends at step 926 and the apparatus is ready to receive another order ticket. It will be appreciated that the sequence of operations described above is exemplary only and it is possible that the order of some of the steps could be varied and/or some could be omitted. For instance, the nozzles could be moved to above the appropriate position for filling a cup before the cup is positioned there.

[0066] Figure 11 illustrates components of an alterna-

tive version of the dispensing apparatus. In this version, the position of the cup stacks 630' are substantially fixed in position and the cup holder 610' moves between the front and rear faces of the terminal in order to fulfil the beverage orders. There is also a rear door 1102 for the cuboid shaped chamber 606' at the front of the device that acts as safety device so that the operator/customer is not endangered by any moving parts.

[0067] Figure 12 shows an example of an outer shell 1202 that can be fitted around the inner components shown in Figure 11. It will be understood that other components, e.g. kegs, will also be included in use.

[0068] Figure 13 details the cup holder 610' of the second embodiment. The holder includes one or more (six in the example) elongate members 1302 ("guide pegs") that extend upwardly and at an outward angle from ring-shaped components 1304 that are configured to hold the base of the receptacles. Each (of up to four) filled receptacle is held within this arrangement ready for collection by the customer from the chamber 606'. The cups with dispensed product are presented on the members/pegs. There is one peg for each filled cup, so in this embodiment four pegs are included.

Claims

1. Apparatus (100) adapted to automatically fulfil a beverage order including:

a plurality of dispensing nozzles (620) configured to dispense at least one type of beverage; a receptacle positioning device (610) for moving at least one receptacle to/from a dispensing position (1003) of at least one of the dispensing nozzles, and/or a nozzle positioning device (624) for moving at least one of the dispensing nozzles; a dispensing device (109A) for actuating a said dispensing nozzle to dispense the beverage into a said receptacle; an order receiving device (105) for receiving an input describing a beverage order;

wherein the apparatus is configured to:

use the receptacle positioning device to position an empty said receptacle at a dispensing position of a said dispensing nozzle configured to dispense a beverage corresponding to the order, and/or use the nozzle positioning device to position a said nozzle at a location for dispensing a beverage corresponding to the order into an empty said receptacle; and then use the dispensing device to dispense the beverage into the empty receptacle.

2. Apparatus according to claim 1, further including a plurality of storage containers (502), each said container containing one of a plurality of different types of beverages and wherein the beverage order specifies at least one beverages selected from the plurality of different types and the apparatus is configured to dispense the type of beverage or beverages specified in the beverage order.
3. Apparatus according to claim 1 or 2, wherein the apparatus is configured so that if there is a further beverage specified in the beverage order, the apparatus will:
 - select the further beverage;
 - use the receptacle positioning device (614) to position another empty said receptacle (630) at a dispensing position of a said dispensing nozzle (620) configured to dispense the selected beverage, and/or
 - use the nozzle positioning device (624) to position a said nozzle at a location for dispensing the selected beverage into an empty said receptacle; and then
 - use the dispensing device to dispense the further selected beverage into the empty receptacle.
4. Apparatus according to any one of the preceding claims, further including a holding member (610) configured to hold a plurality of said receptacles (620), the holding member being connected to the receptacle positioning device so that the device can position a plurality of said receptacles held by the holding member.
5. Apparatus according to claim 4, wherein the apparatus repeats the use of the receptacle/nozzle positioning device(s) and the dispensing device for all the receptacles held in the holding member.
6. Apparatus according to claim 4 or 5, wherein the holding member includes an elongate member (610) including a plurality of spaced apart apertures, each said aperture configured to fit around a diameter of a said receptacle.
7. Apparatus according to claim 6, including at least one elongate member (1302) that extends upwardly and at an outward angle from a said aperture.
8. Apparatus according to any one of the preceding claims, wherein the apparatus is configured to use the receptacle positioning device (614) and/or the nozzle positioning device (624) to position a said receptacle and/or a said nozzle at a specific coordinate representing where the empty receptacle is to be positioned for receiving the selected beverage from the appropriate nozzle.
9. Apparatus according to any one of the preceding claims, wherein the nozzle positioning device includes a moveable member (624) on which some or all of the nozzles (620) are fitted and wherein the nozzles are arranged spaced apart in a line in a first axis (Z) and the receptacles (620) held by the holding member (610) are arranged spaced apart in a line in a second axis (X), with the second axis being generally transverse/perpendicular to the first axis.
10. Apparatus according to claim 9, wherein the nozzle positioning device (614) further re-positions at least one said nozzle between 1) an active dispensing position, where at least part of the nozzle is located within a said receptacle (620), and 2) a non-dispensing position, where the receptacle positioning device can normally reposition a said receptacle and/or the nozzle positioning device can normally reposition a said nozzle without contact between a said nozzle and a said receptacle.
11. Apparatus according to any one of the preceding claims, further including at least one flow regulator with electronic pressure control (fixed or proportional) fitted to at least some of the dispensing nozzles (620).
12. Apparatus according to any one of the preceding claims, further including a cooling mechanism (108A) configured to keep beverage in the apparatus at a cool temperature, such as around 1 - 2°C, wherein the cooling mechanism cools an outer shell (102) that contains the storage containers (502), the nozzles (630) and the positioning device(s) (614, 624).
13. Apparatus according to claim 12, wherein the outer shell is formed of an insulating material, e.g. a polyurethane foam sandwiched between layers of rigid plastic or metal material such as aluminium.
14. Apparatus according to any one of the preceding claims, including an aperture (104) open to outside for allowing filled receptacles (630) to be collected from the apparatus, and a moveable portion (608) for sealing the aperture to reduce/prevent temperature change inside the apparatus.
15. Apparatus according to claim 13, wherein the dispensing locations of the plurality of nozzles (620) is located within a cooled interior of the apparatus and the receptacle positioning device (614) moves the receptacles between the dispensing location and the aperture (104).
16. Apparatus according to any one of the preceding claims, wherein the order receiving device (105) in-

cludes a device for reading a ticket or card having the beverage order encoded in or upon it, e.g. a ticket with the order printed/punched on it.

17. Apparatus according to claim 16, wherein the order receiving device (105) receives a ticket or card that has been encoded with the order at a remote device/location. 5
18. Apparatus according to any one of the preceding claims, including at least one detector (e.g. liquid level detector) configured to determine if a first beverage storage container (502) connected to at least one of the dispensing nozzles (620) is/approaching empty, the apparatus further including an arrangement configured to automatically connect another beverage storage container to the at least one dispensing nozzle without user intervention when the at least one detector indicates that the first container is/approaching empty. 10
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19. A method of automatically fulfilling a beverage order, the method including:

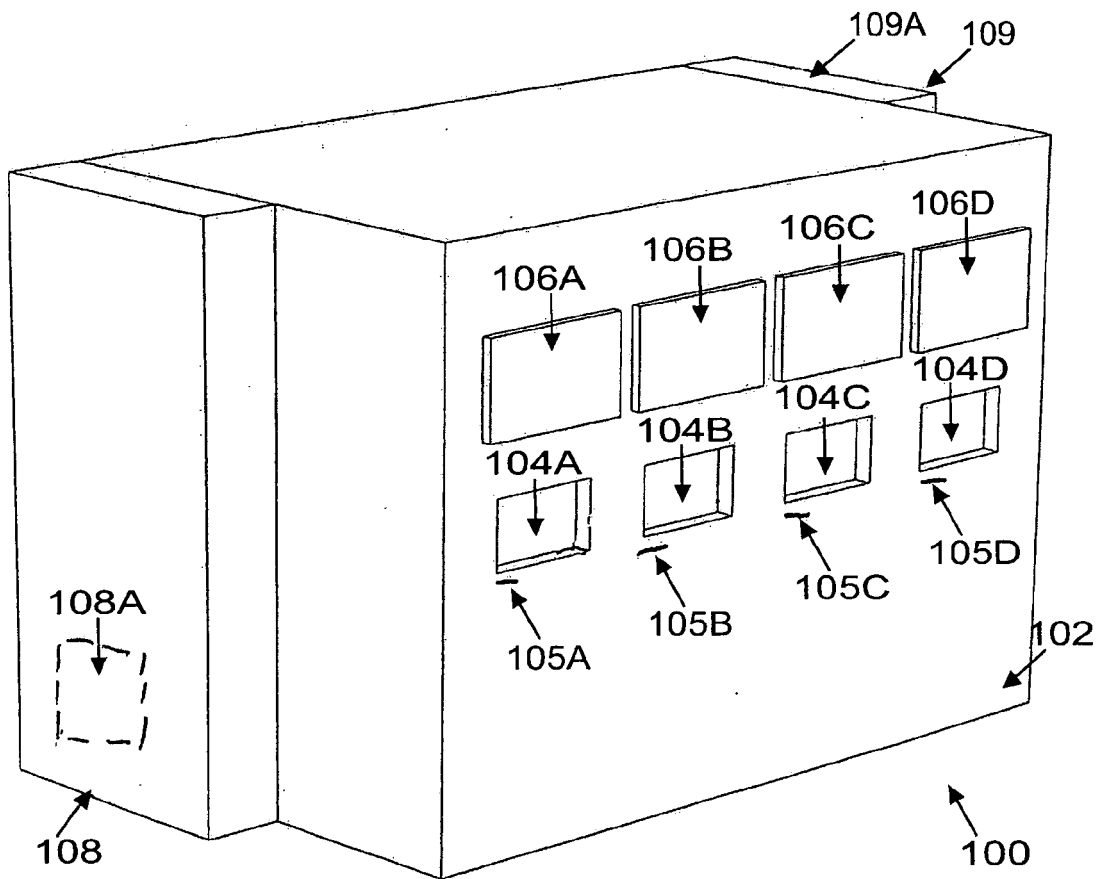
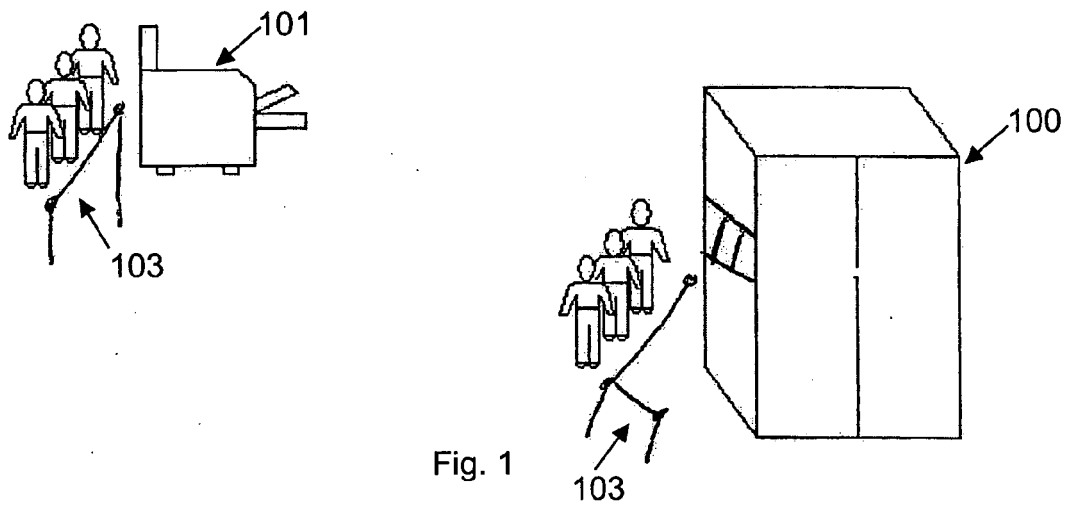
receiving (904) an input describing a beverage order; 25
positioning (910) an empty receptacle (630) at a location for receiving a dispensing nozzle (620) configured to dispense a beverage corresponding to the order, and/or 30
positioning (910) a dispensing nozzle at a location for dispensing a beverage corresponding to the order into an empty receptacle; and then dispensing (916) the beverage from the nozzle into the empty receptacle. 35

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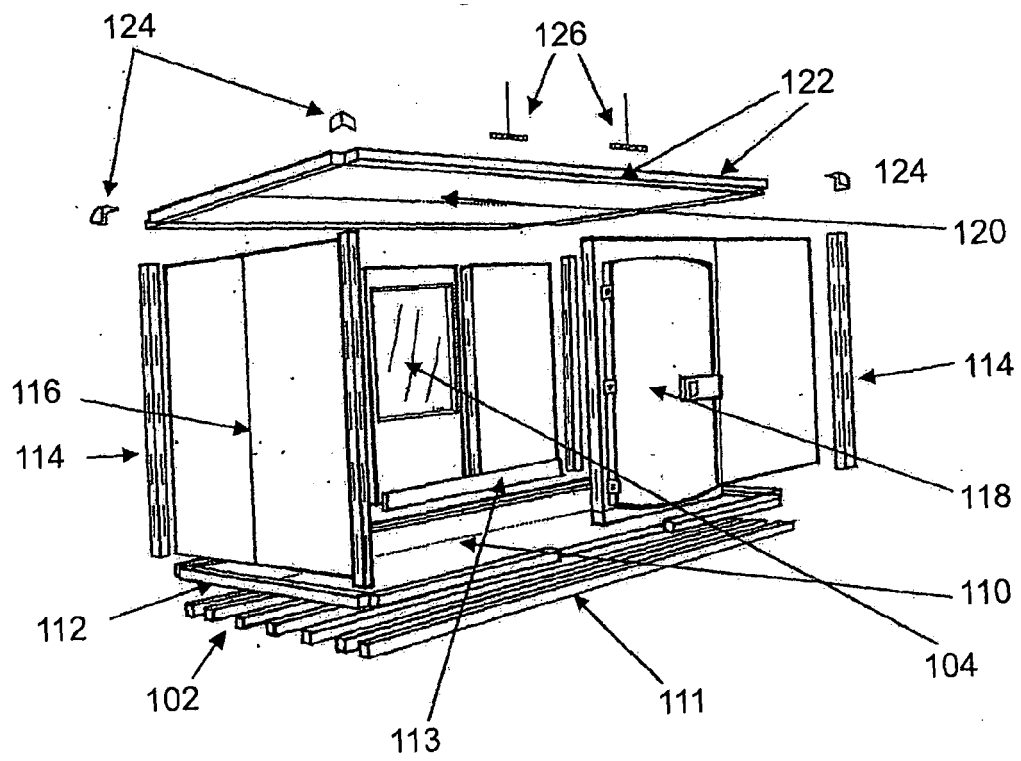


Fig. 3

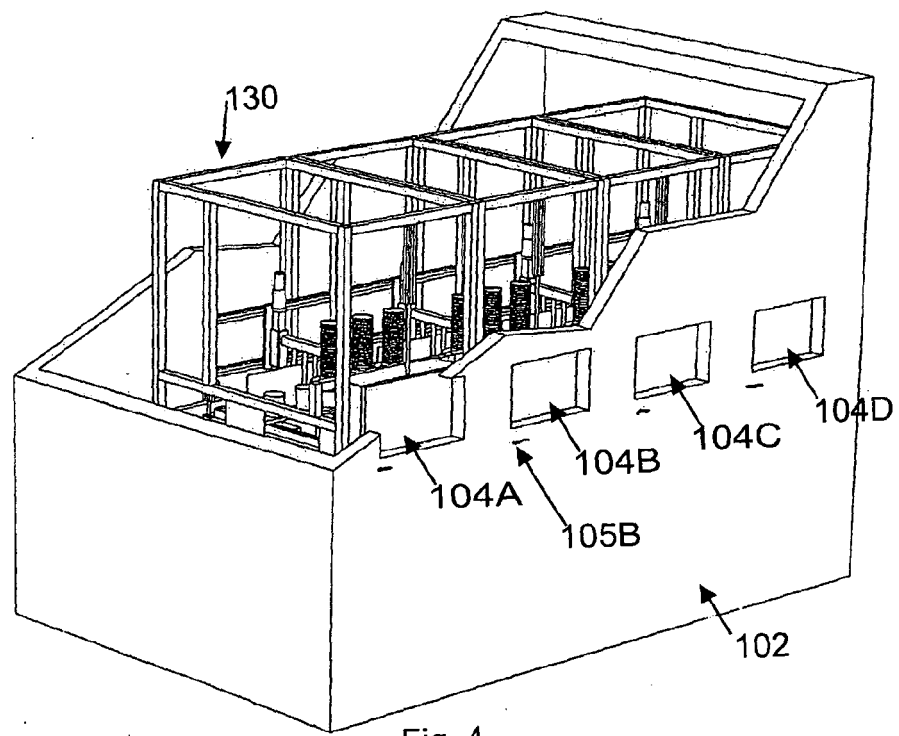
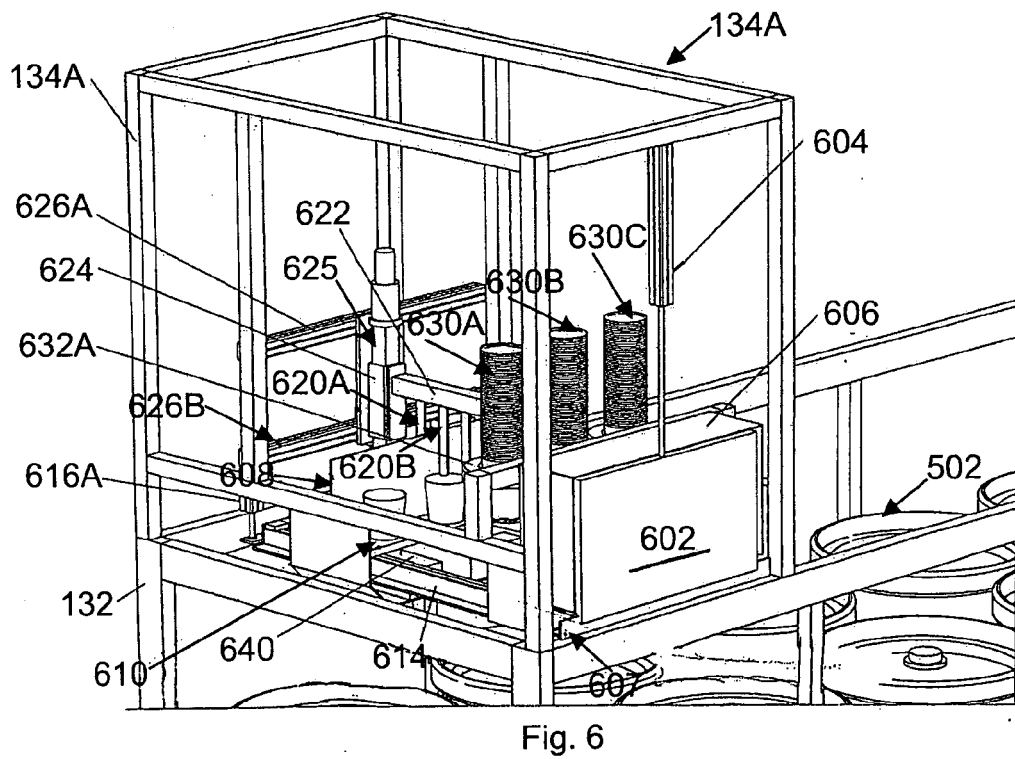
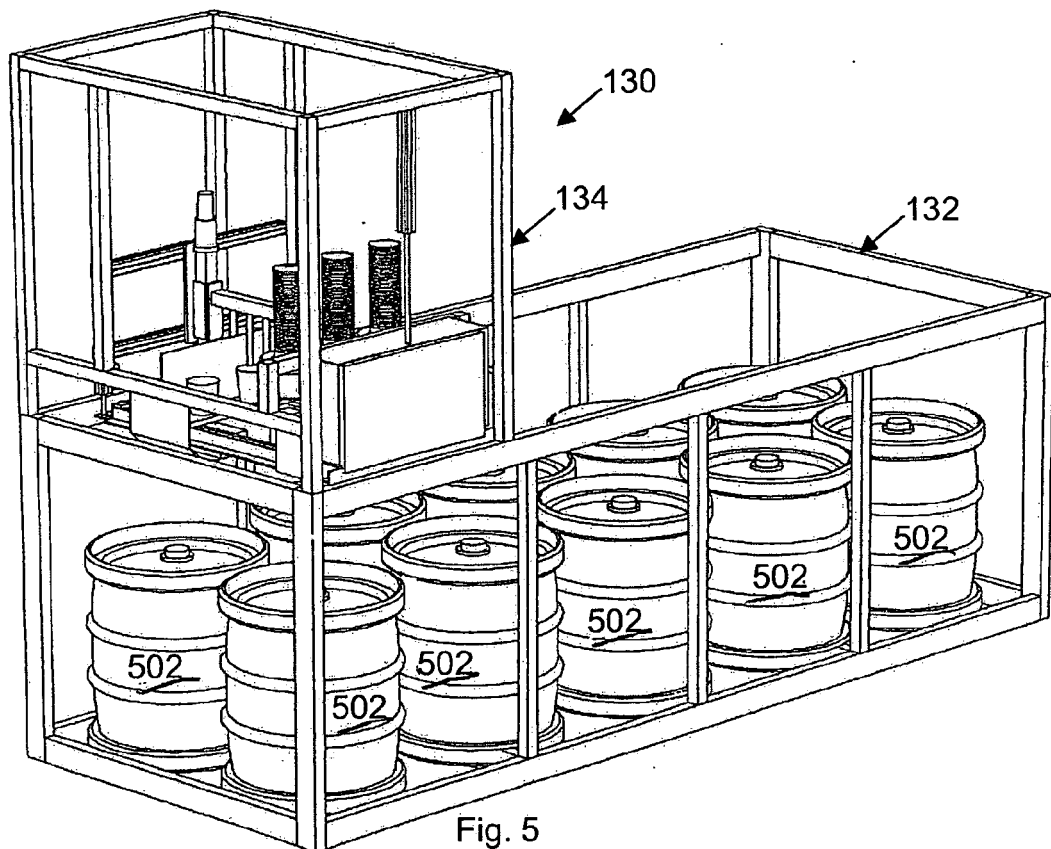


Fig. 4



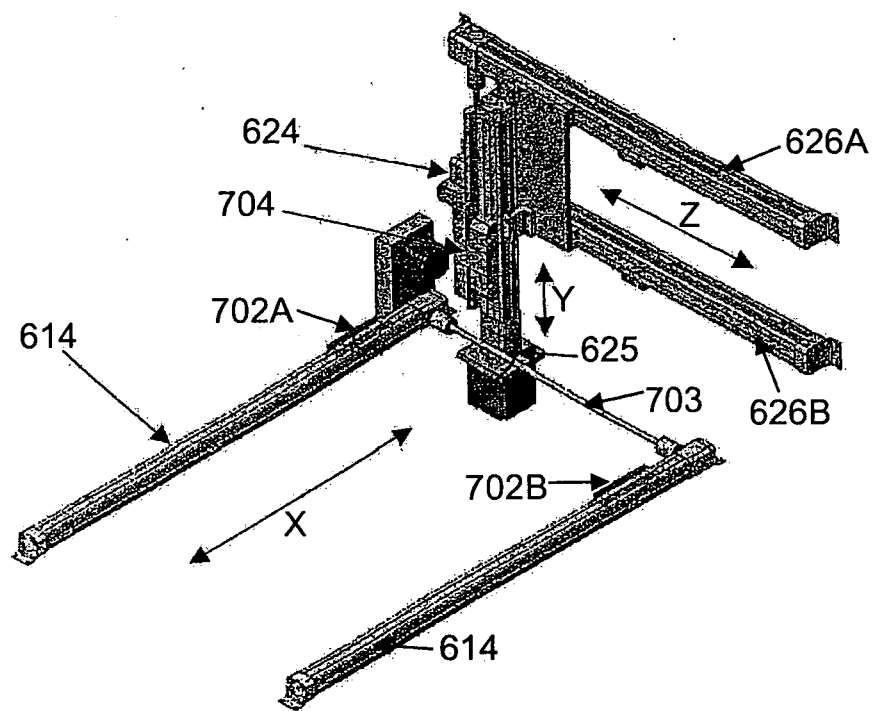


Fig. 7

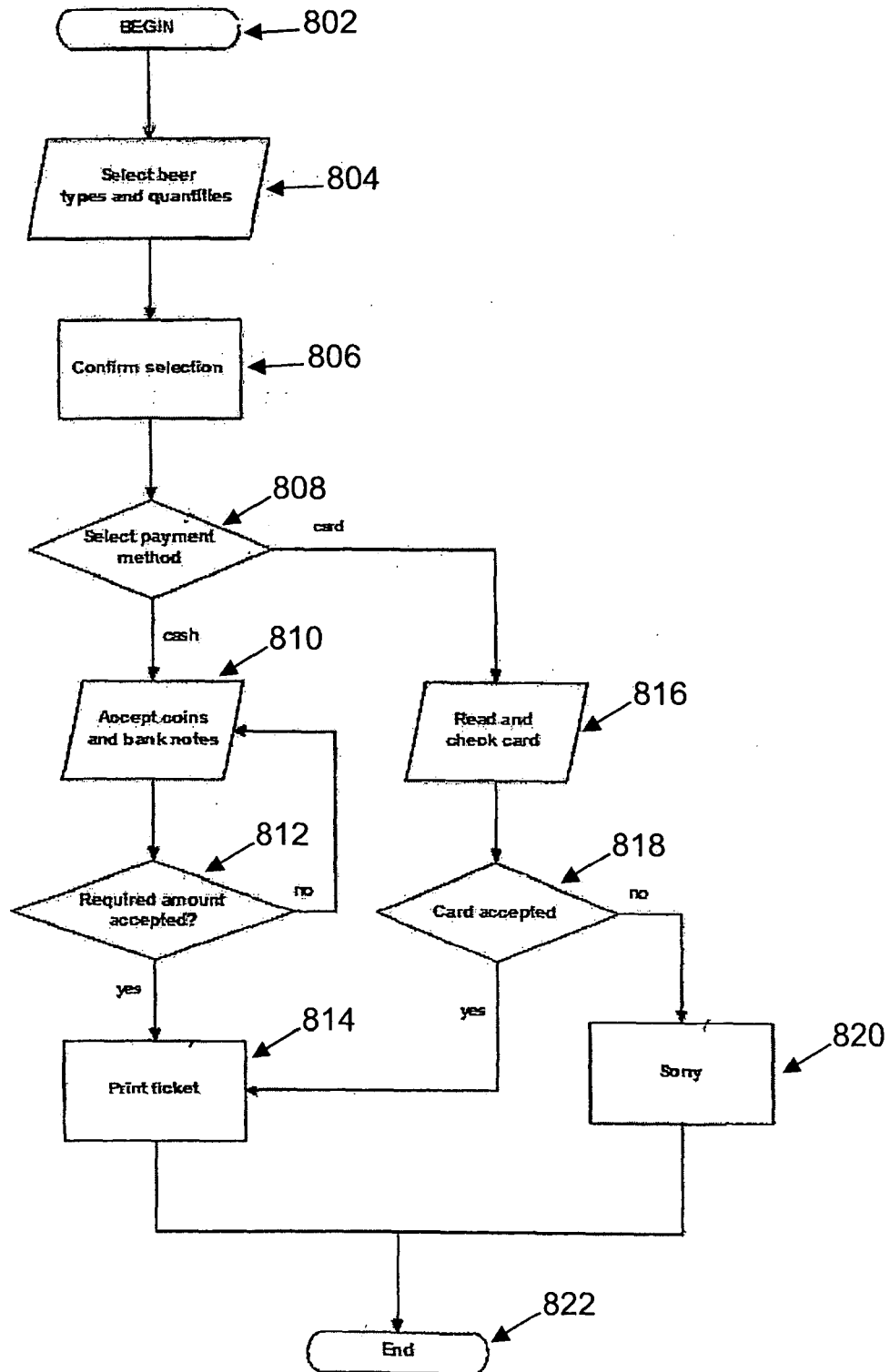


Fig. 8

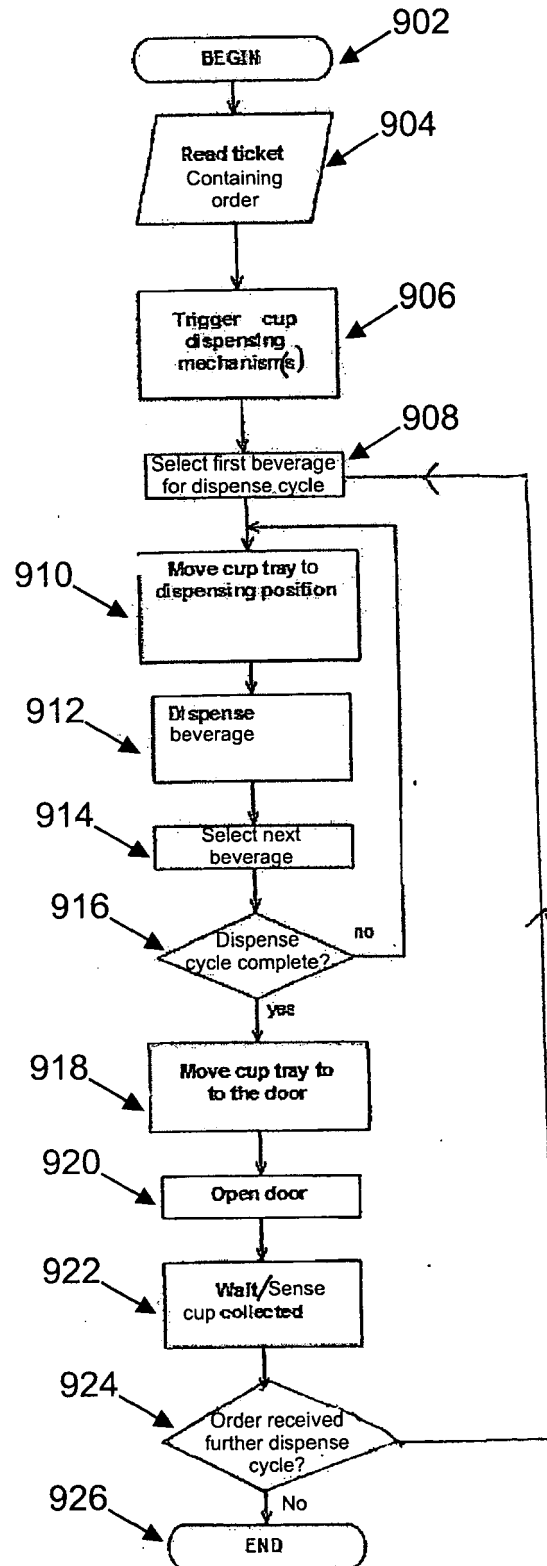
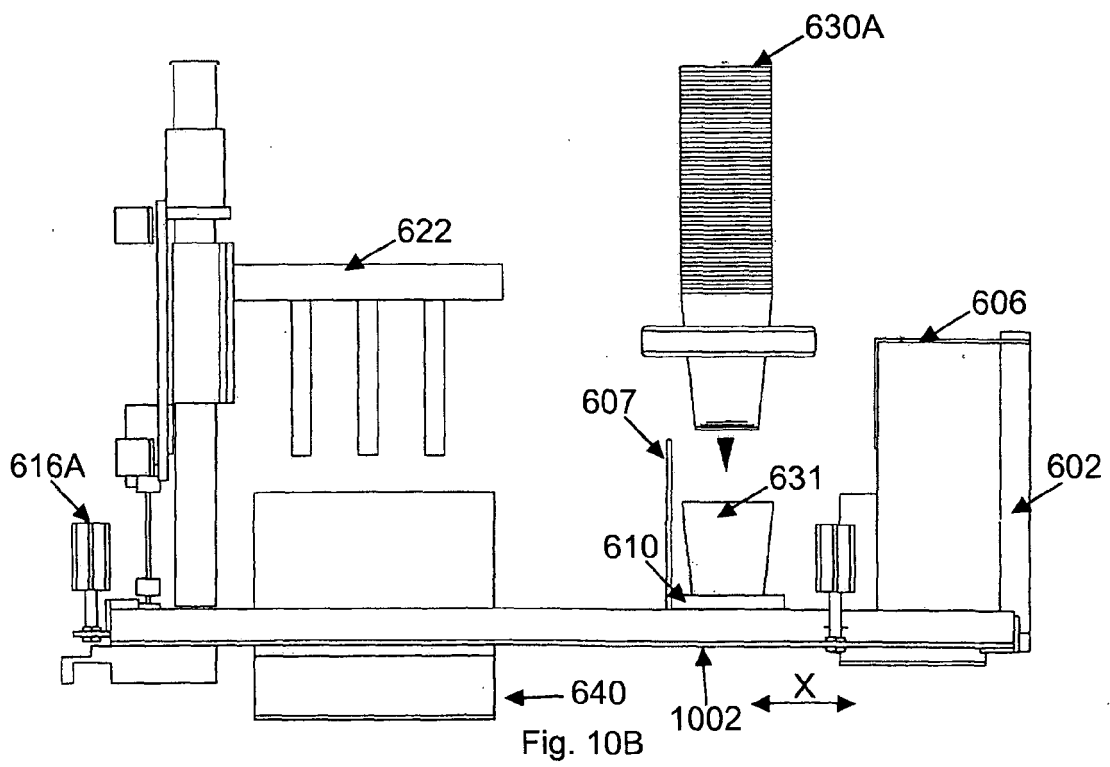
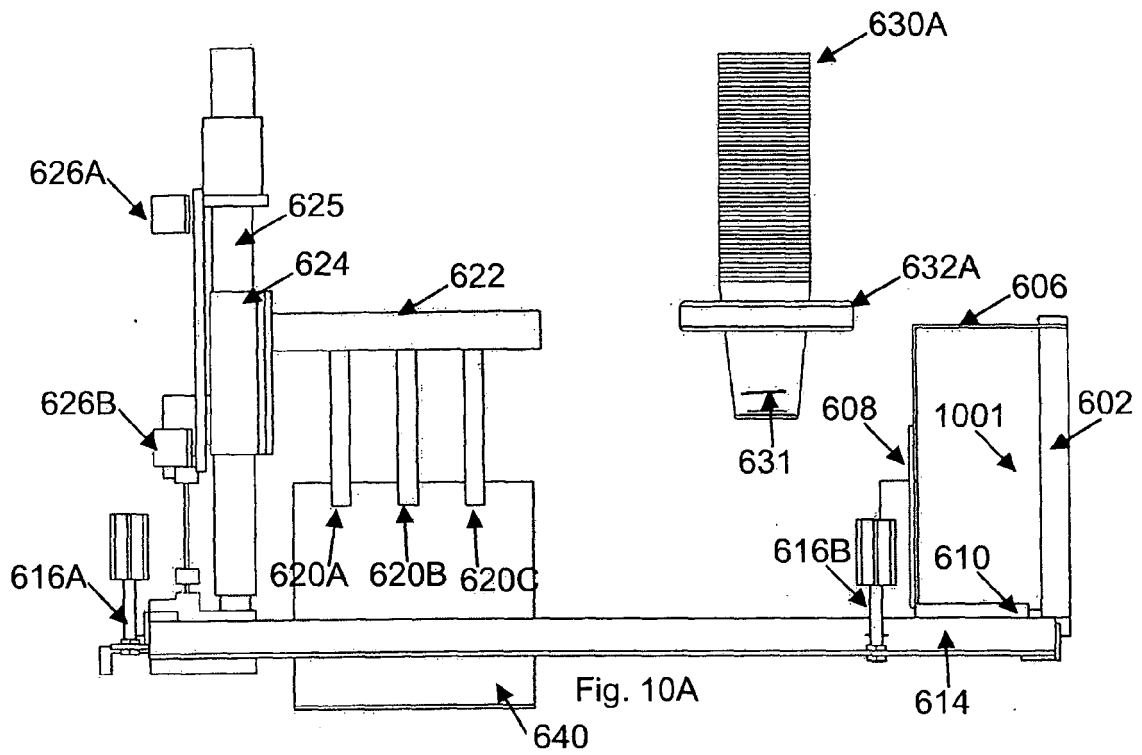
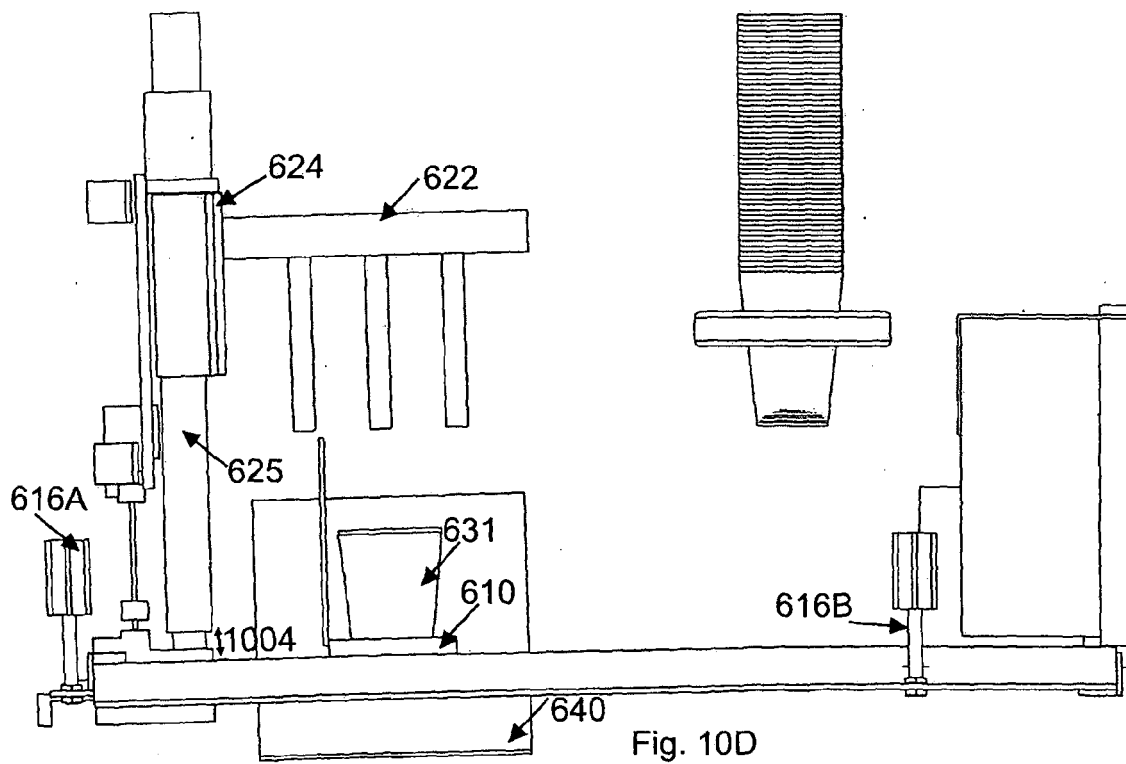
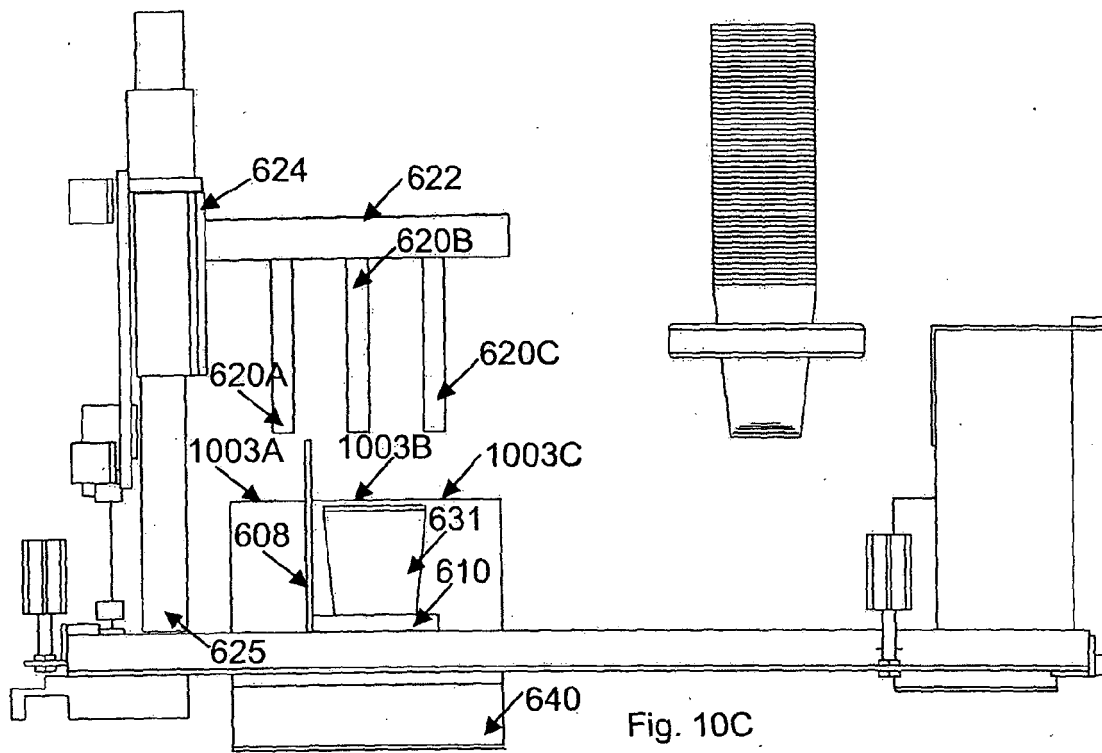


Fig. 9





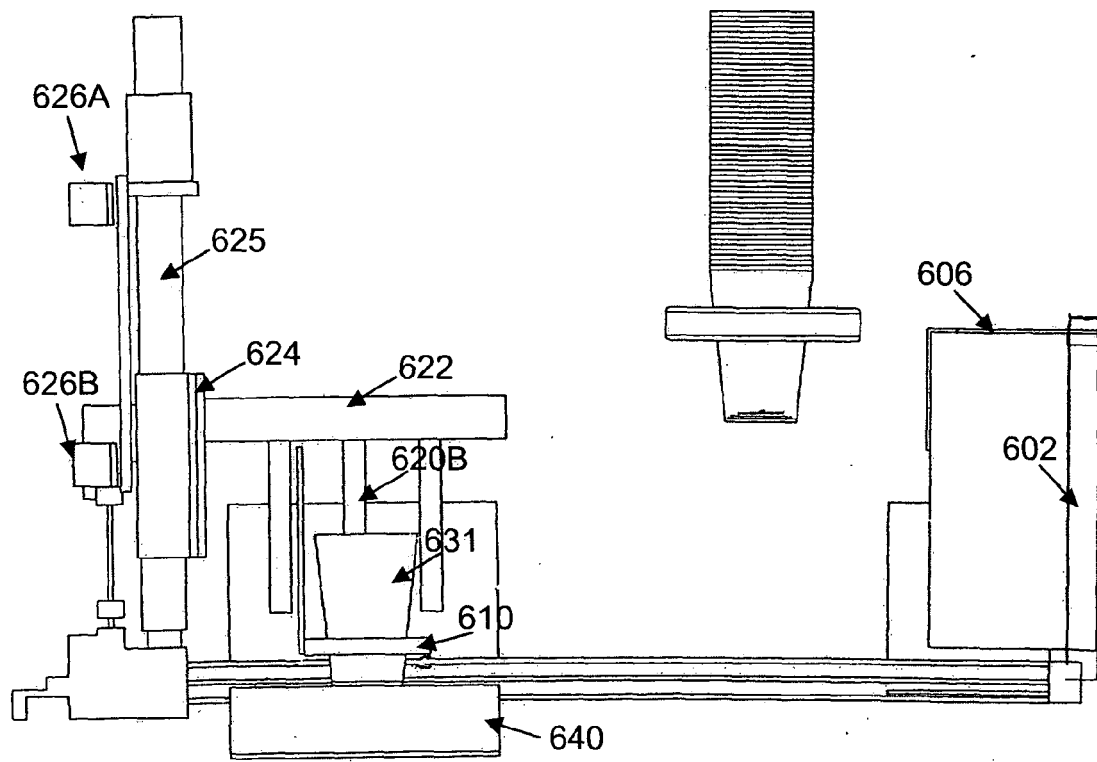


Fig. 10E

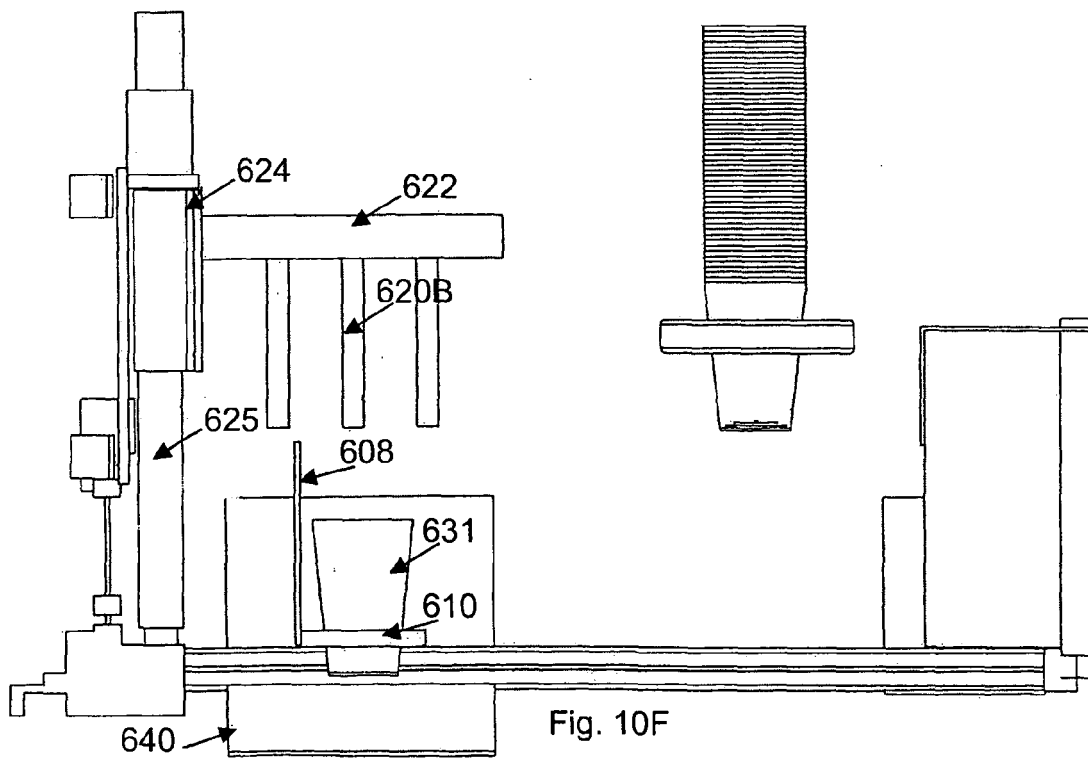
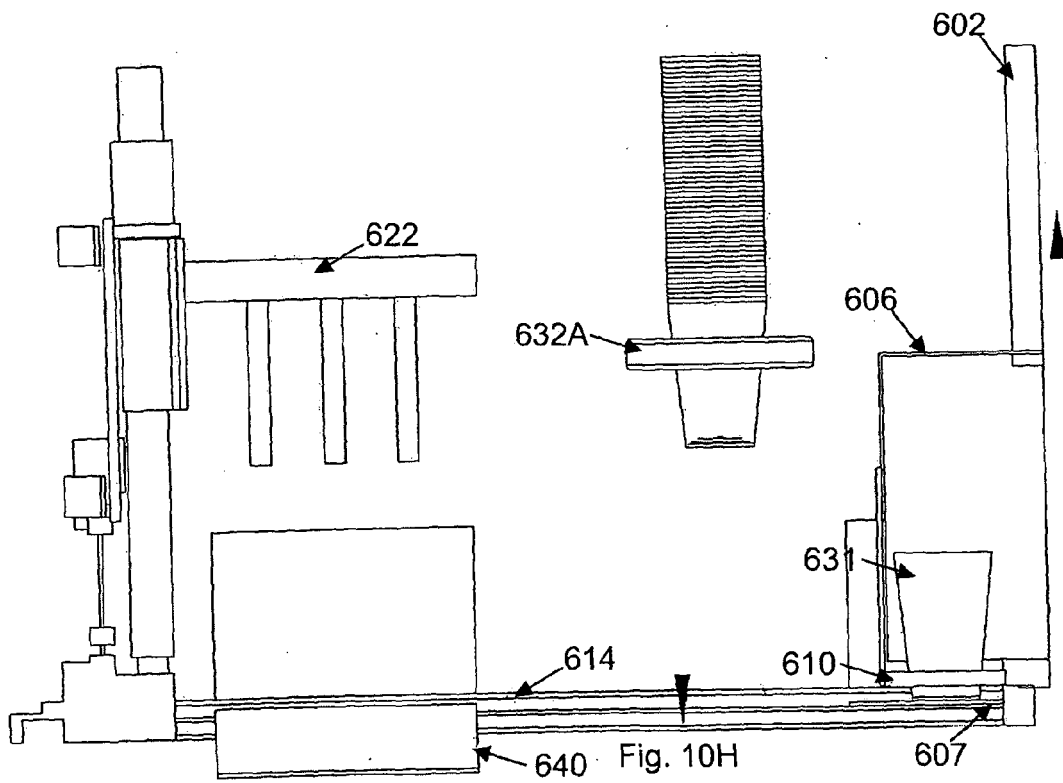
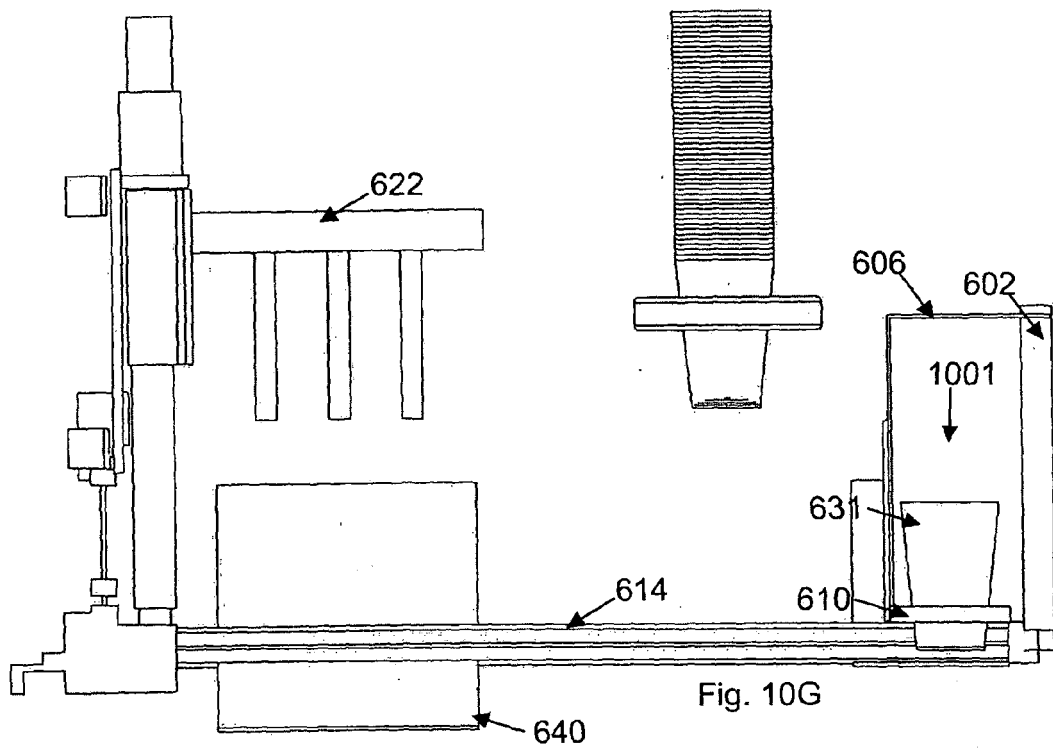


Fig. 10F



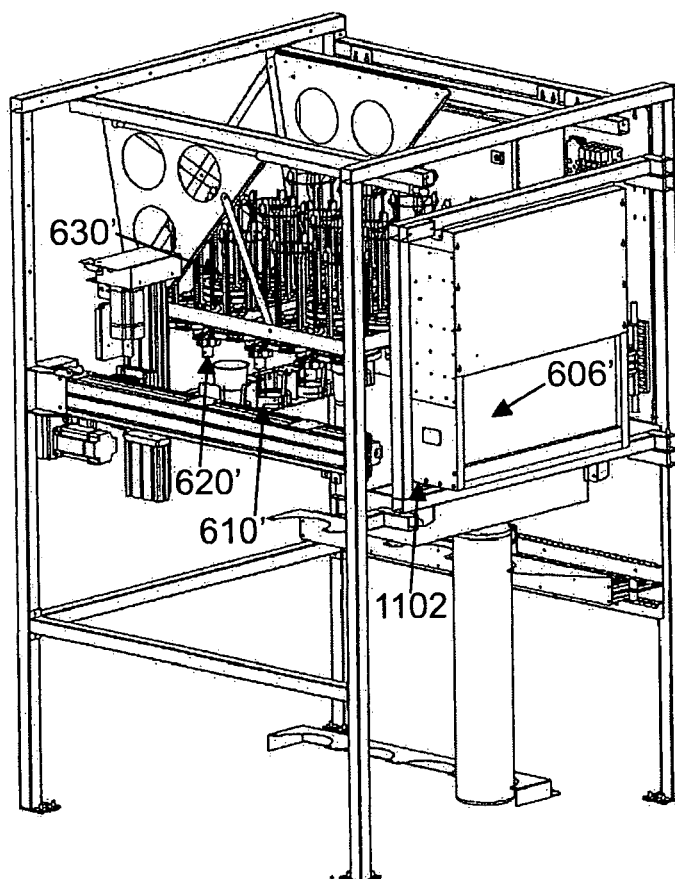


Fig. 11

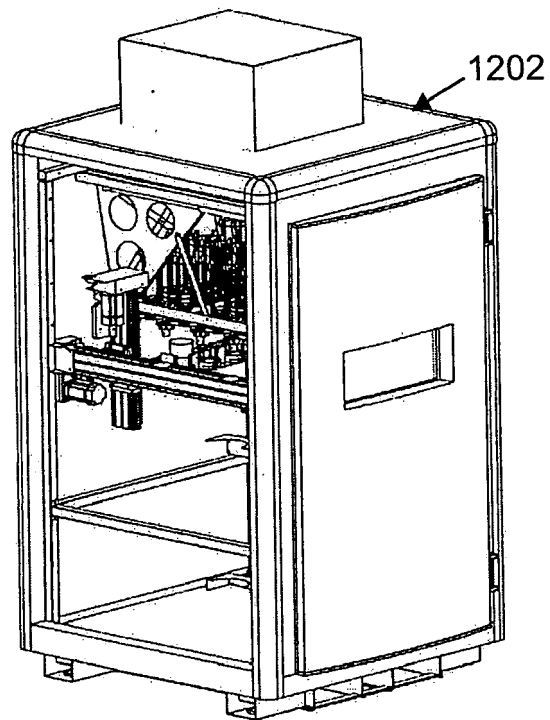


Fig. 12

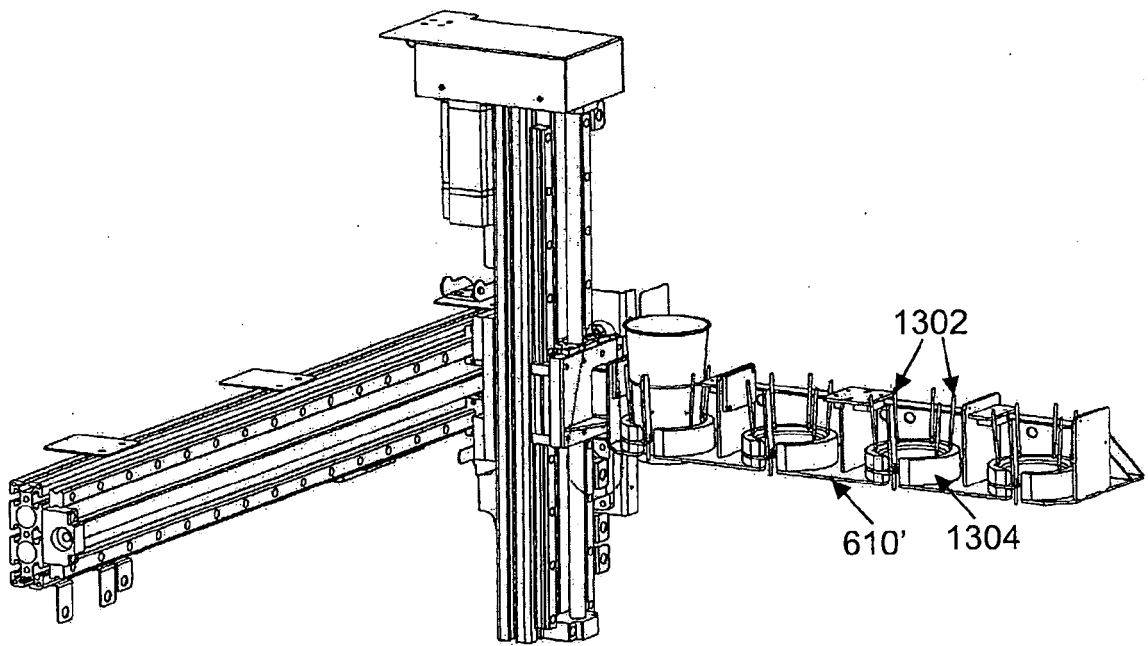


Fig. 13