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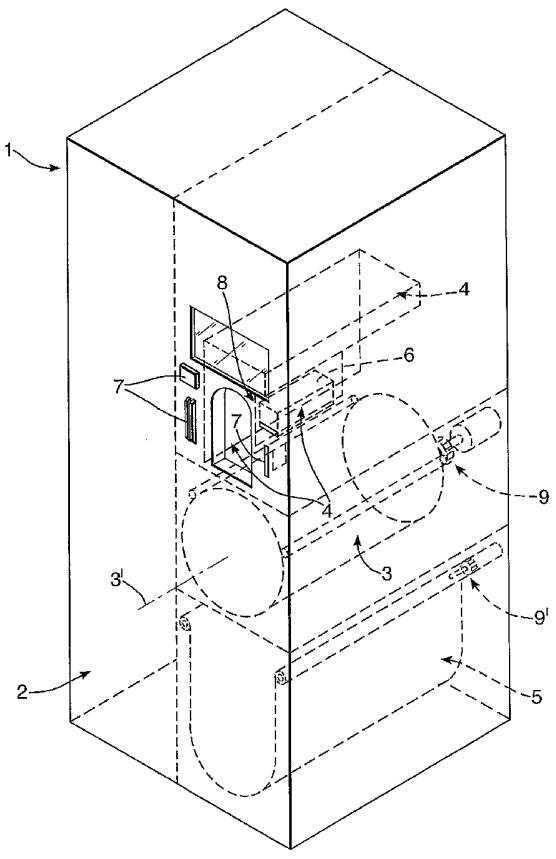
(54) Title: MEANS IN A REVERSE VENDING MACHINE (RVM) FOR RECEIVING, HANDLING, SORTING AND STORING RETURNABLE ITEMS OR OBJECTS



(57) Abstract: The invention relates to means in a reverse vending machine (RVM) for receiving, handling, sorting and storing returnable items or objects. The RVM includes an item supporting, rotating, sorting and conveyor unit, an upright storage chamber for such items, a safety apparatus to avoid operational hazards, a camera aided detection device for detecting at least one of a bar code on and other characteristics, e.g. contour, of an item, a simplified token system , and a drive system with a releasable power coupling for operating the sorting device and a further storage device.

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Means in a reverse vending machine (RVM) for receiving, handling, sorting and storing returnable items or objects.

FIELD OF THE INVENTION

[0001] The present invention is related in general to apparatus for handling items or objects, e.g. for receiving, sorting and storing returnable items or objects, such as empty beverage containers like bottles, cans or the like. The invention is particularly useful in connection with reverse vending machines, although certain aspects of the present invention may also find other fields of use.

BACKGROUND OF THE INVENTION

[0002] The present invention came about following the recognition of the need to provide a more cost efficient reverse vending machine, yet simple, reliable and space saving. In particular, it was recognized the need to reduce overall cost of manufacturing such new machines by addressing such important issues to as minimizing the number of expensive components, such as e.g. camera, barcode reader, object sorter, object conveyor, object rotator, and token printer, as well as minimizing required space, especially as regards floor area.

[0003] However, in such recognition, it was revealed that the invention would become related to a plurality of aspects which all in their own respective manner would contribute to a desirable end result.

[0004] In a decade or so, environmental and economical concerns have spurred significant developments in the field of facilities for collecting cans, bottles, jars and other containers, preferably for recovering the material for recycling purposes. These days, fully automatic systems are available that are capable of receiving and storing many different types of used containers, or even parts of used containers.

[0005] Arrangements for handling recyclable items like returnable empty beverage containers are *inter alia* known from the European publications EP 0 384 885 (SIG Schweizerische Industrie-Gesellschaft), EP 1311448, and the International Patent Application publication WO02/12096 (EP 1313656) (TOMRA SYSTEMS ASA) and EP 14677328 (TOMRA SYSTEMS ASA).

[0006] Till now, available fully automated systems, so-called reverse vending machines (RVMs) and back-room systems, that are capable of receiving and storing used containers

have been quite complex and expensive. They have, therefore, mostly been found in larger stores, shopping centers or supermarkets, or in special facilities put up for collecting recyclable items or objects.

[0007] Accordingly, for the customer who has recyclable items or objects in smaller quantities, and who may not have at disposal a proper vehicle to facilitate easy transportation of recyclable material to a larger store, shopping center or supermarket that may be located at a distance from the person's home, it is often easier to throw the recyclable items out with the garbage.

[0008] The currently available reverse vending machines normally deliver the received objects to a back-room receiving facility or a downstairs facility. The total installation is expensive, requires substantial space, is often complex to install and service, and has operational drawbacks, in particular from a cleaning point of view. Frequent cleaning of soiled operational parts, suitably with water or special cleaning agent, is very important to secure failsafe operation. Returnable beverage containers frequently contain beverage leftovers, which often happen to come into contact with operational parts, thus making such parts sticky and causing operational failure if not properly cleaned. Cleaning is more than often a messy operation, and care has to be made not to harm electrical components.

[0009] Most RVMs need to have the ability to inspect identifying features on the object, such as e.g. a bar code. If such features are not immediately seen by a dedicated detector, the object will need to be rotated to find if such features are indeed present. An object rotating mechanism is expensive and requires substantial space in the longitudinal or depth direction of the RVM. Further, if such RVMs are also to provide object sorting, an additional sorter has to be provided, adding further to the cost of the installation, and the dimension of the RVM as regards depth dimension is in some cases prohibitive when both a rotator and a sorter are to be included. Also, most owners of stores, shopping centers or supermarkets are concerned over RVMs requiring substantial and expensive space for collecting the containers received by the RVM, such space frequently being occupied by container collection tables.

OBJECTS OF THE INVENTION

[0010] The present invention therefore has as a principal object to meet a long felt need to provide an improved automated facility for collecting returnable objects or items, such as recyclable items of plastic, metal or glass, and for overcoming the well-known mentioned drawbacks, thus yielding a low cost facility which exhibits optimal use of limited space, in

particular floor space, that may be available almost everywhere, enabling their placement even in smaller stores, convenience stores, local gas stations and public areas. Thereby, such facilities may be more conveniently available to customers. These features and other features to appear through reading of the specification are some of the objectives of the present invention.

SUMMARY OF INVENTION

[0011] A first aspect of the invention relates particularly to a facility which allows storage of a large number of returnable items or objects in a mostly vertically oriented storage space without employing a vertical conveyor for filling the storage space.

[0012] In the first aspect of the present invention, the invention provides a vertically oriented storage having an interior space for storing height-wise returnable items as stated in the preamble of attached claim 1.

[0013] According to the first aspect , the invention also provides for an essentially vertically oriented storage for storing in a substantially upwards filling direction returnable objects or items, particularly returnable containers like bottles, cans and the like, preferably such that are made from plastic, glass or metallic material, and the characterizing features of the first aspect of the invention appear from the characterizing clause of attached claim 1.

[0014] Further advantageous embodiments of the storage space part of the storage facility of the present invention are recited in the attached dependent patent claims 2 – 47.

[0015] In second and third aspects of the invention, and as recited in the preamble of attached independent claims 48 and 73, respectively, the present invention relates to a conveyor means for a facility for receiving returnable items.

[0016] Such conveyor means are useful for receiving and sorting returnable items, and in the context of the present invention preferably for delivering returnable items for storing in the storage facility as defined in claims 2 – 47, and it has been the purpose of the present invention to provide for a very compact conveyor means for such use.

[0017] The characteristic features of the conveyor means appear from the independent claims 48 and 73, respectively.

[0018] Further advantageous embodiments of a drum type conveyor means according to claim 48 are recited in the attached dependent patent claims 49 – 72.

[0019] Further advantageous features of a conveyor means having a movable plunger in a stationary elongate housing part , as defined in claim 73 are recited in the accompanying dependent patent claims 74 - 94.

[0020] The conveyor means as defined are particularly suitable for feeding returnable objects or items, particularly returnable containers like bottles, cans and the like, preferably made from plastic, glass or metallic material to a vertically oriented storage for storing returnable objects or items in a substantially upwards filling direction.

[0021] More specifically, the conveyor means is adapted to handle, sort and convey returnable items or objects, and for feeding such items or objects into the substantially vertically oriented storage space, without employing a vertical conveyor for filling the storage space.

[0022] In recognition of the necessity to be able to view and recognize characteristic features of an object, a fourth aspect of the present invention relates to a device for enabling camera viewing of characteristic features of an object in order to subsequently enable processing of signals related to viewed features, as defined in the preamble of attached claim 95.

[0023] Further, a fifth aspect of the invention is related to a device for enabling camera viewing of two regions of an object, in order to subsequently enable processing of signals related to viewed features, as defined in the preamble of claim 148.

[0024] In addition, a sixth aspect of the invention is related to a device for enabling camera viewing of characteristic features of an object, in order to subsequently enable processing of signals related to viewed features, a single camera being configured to view a location where the object can be placed and thereby cause subsequent recognition of the contour of the object, a lens being arranged between the camera and said location, as defined in the preamble of claim 149.

[0025] Further, a seventh aspect of the invention is related to a device for enabling camera viewing of characteristic features of an object against light providing or bright background area, in order to subsequently enable processing of signals related to viewed features, a single camera being provided and configured to view a location where the object can be placed and thereby cause detection of its contour, as defined in the preamble of claim 154.

[0026] Still further, an eight aspect of the invention is related to a device using a camera to view characteristic features of an object against a light providing or bright background area, in order to subsequently enable processing related to viewed features, as defined in the preamble of claim 159.

[0027] It is important to note that the fourth, fifth, sixth, seventh and eight features of the invention are closely interrelated.

[0028] From prior art it is conventional to view an object or article, e.g. empty beverage packaging, such as a can or bottle, against a light reflective background , the viewing being made via a lens in order that light rays which are sent towards the object are parallel rays. DE 19512133 A1 discloses such technique. On the basis of such viewing, analysis for object contour is made.

[0029] However, simultaneously with viewing of shape of a bottle or can, as disclosed in said DE 195 12 133 A1, there has also been the need to view and recognize or read other characteristic features, such as a bar code on the can or bottle.

[0030] In a reverse vending machine (RVM), it is conventional to view and recognize shape of the object at one location in the RVM and to recognize other identifiable characteristic features such as indicia, barcode etc. at another location. If e.g. a barcode is not directly visible to a barcode reader, the object must be rotated until the barcode becomes visible and can be read by the reader.

[0031] It is a well known fact that in order to be able to detect both contour of the object and read indicia or identifying features located on the object, including object rotation to find and read identifying features, multiple and separate operating units need to be provided, thus requiring extra space within the RVM to carry out the operations. If there is in addition the requirement of a sorting function, additional challenges arise as regards available space. Said EP publications EP1311448 and 1313656 disclose, with reference to an RVM for beverage container such as bottles and cans, the provisions of contour detection, barcode reading and beverage container sorting. Contour detection and sorting is made by one operating unit (see EP 1313656), and a further operating unit (EP1311448) provides for beverage container rotation to find a barcode and barcode reading.

[0032] US 5 934 440 discloses a device with a detection station for reading barcode, rotation of the object such as e.g. a bottle to locate a barcode not immediately visible, as well as a sorting function. However, the possibility of detecting an object contour at such station is not available and needs to be performed by a separate station suitably located upstream, as disclosed in said patent.

[0033] It has therefore been a long felt need to provide for a technical solution which yields a more compact, yet simple and cost-effective arrangement and with the possibility of both

detection of contour and identifying features located on the object, as well as a sorting function and other optional functions.

[0034] Accordingly the present invention provides for a device which makes use of camera aid to provide for major detection functions, and with other benefits resulting from the overall structure. The characteristic features of the inventive device appear from the attached independent claims 95, 148, 149, 154 and 159. Further embodiments thereof appear from related sub-claims 96 – 147, 150 – 153, 155 – 158 and 160.

[0035] In recognition of the need to avoid operational hazards as far as possible, and above all avoid any accidental injury to a user of the facility, a ninth aspect of the present invention relates to a safety apparatus for controlling operation of functional equipment having movable parts, as defined in the preamble of attached claim 161.

[0036] It is a well known technique in a reverse vending machine (RVM) to provide movement detectors or light curtains in the form of transmitter/ receiver pairs to detect when an object has reached a particular position in the RVM , to alert if someone tries to move a hand into the RVM, or to view a video image to detect entry into or direction of movement into a detection region as seen by a camera. Upon such detection, action can be taken to inhibit further operation of moving parts and/ or trigger an alarm. Further, in the case of transmitter/ receiver pairs, expensive hardware has to be installed, aligned and serviced.

[0037] European Patent EP-0910485 (TOMRA SYSTEMS ASA) discloses a camera functionality in order to control movements in a camera field of view in connection with a reverse vending machine. Such movement control is software related.

[0038] If a particular part of a camera provided image of e.g. an entry region of a device such as a reverse vending machine for empty beverage containers is to be used for monitoring safety hazard, any software update related to camera function must also be documented and certified to ensure that said monitoring capability is still operative. Such process is time consuming and expensive. In case of e.g. camera failure, the image may appear blank as if no activity or events in the camera field of view would be present. In such a situation, an inherent safety hazard may be present.

[0039] Safety hazards e.g. include the risk of a person getting a hand injured if put into the RVM, or operational failures due to incorrect handling of the RVM by a person.

[0040] The ninth aspect of the invention has therefore as an object to avoid the inherent drawbacks of the prior art solutions, and the detection device is characterised by the features appearing from the attached claim 161.

[0041] Further embodiments of the ninth aspect of the invention will appear from the attached sub-claims 162 - 174.

[0042] The ninth aspect of the invention is explained in more detail with reference in particular to drawing figs. 37a, 37b, 37c, 40a and 40b.

[0043] Reverse vending machines conventionally issue a specially printed token related to the return or redemption value of empty beverage containers received by the reverse vending machine (RVM), and the token is then taken to a rewarding unit or so-called checkout and payment station to get a cash reward or a cash deduction from a bill to be paid for other sales items or objects, e.g. groceries. However, it has also been a long felt desire to simplify dispensing of tokens in a RVM to avoid occasional and inherent printer failures well known to the expert in the art when tokens are to be printed with individual return value related data.

[0044] A tenth aspect of the present invention therefore relates to a token system for use with a reverse vending machine suitable for receiving empty packaging in the form of empty beverage containers, as defined in the preamble of claims 175, 176 and 177.

[0045] An eleventh aspect of the present invention, closely linked to the tenth aspect of the invention, is a token system related to a reverse vending machine which is configured to detect and identify features of an object, tokens being dispensable one-by-one from a token dispenser and configured to be related to an object being observable and detectable for object identification, as defined in the preamble of claim 178.

[0046] Security measures have over the past years been implemented in order to avoid recurring swindle attempt through presentation at the rewarding unit of home-made tokens with a redemption value printed thereon. Thus, the new tokens issued have also included a particular serial number, and both the redemption value and the serial number have been communicated from the RVM to a central computer, suitably located in the store or supermarket, in order to validate the token, and when the token has been presented at the rewarding unit, payment is made to the customer and the central computer then invalidates the token by removing the data from availability at the rewarding unit.

[0047] The tokens are usually made from thin paper from a roll of paper passing through a printer, suitably a thermal printer, before it is issued to the customer. Experience has,

however, shown that use of such printed paper tokens has the drawback that the printer occasionally fails, the printer is expensive and needs maintenance service at regular intervals, and the paper from the paper roll is expensive and needs to be of a particular quality to yield as low failure rate as possible.

[0048] Given some of the disadvantages of the prior art tokens, the tenth and eleventh aspects of the present invention have as an object to provide for a token system that avoids printing of tokens in an RVM, yet provides the required security against swindle attempts and avoids the use of any printer and related printer maintenance.

[0049] According to the invention, the characterising features of the token system according to the tenth and eleventh aspects of the invention appear from the attached independent patent claims 175, 176, 177 and 178. Further embodiments appear from the related sub-claims 179 - 188.

[0050] A twelfth aspect of the present invention is concerned with the inherent problems in a reverse vending machine of disconnecting operational units for cleaning purposes, services etc., and the twelfth aspect of the present invention is accordingly related to a drive device in a reverse vending machine to forcibly drive at least one handling unit suited to handle empty packaging in the form of empty beverage containers, as stated in the preamble of claim 189.

[0051] It is well known in the art that equipment used for handling empty beverage containers in a reverse vending machine (RVM) is frequently soiled by beverage leftovers coming from the interior of such containers, and causing malfunction of the equipment or drive motor overload if not properly washed and cleaned at regular intervals, in many cases with a necessity for cleaning once every day.

[0052] Such equipment is conventionally made with drive motors firmly attached to the equipment either on the outside or internally, and with sophisticated or expensive plug /socket connection to power supply in the reverse vending machine.

[0053] When cleaning such equipment, often with hot water and/or pressurized water or other cleaning agent, motors and connectors may be damaged or get moist through intrusion of water, with the inherent risk of malfunction through leakage currents or even short-circuit. Therefore, expensive and sophisticated technical solutions have to be designed to avoid such damages or other operational problems or hazards. Such solutions may therefore include special purpose motors, plug and socket units, wiring etc.

[0054] The present invention therefore intends to overcome the present every-day problem linked with the operation of reverse vending machines which are in need of frequent cleaning to remove spillage of beverage leftovers which are more than often with a very high sugar content, resulting in sticky functional components and adherence between components, causing unnecessary wear and tear on functional components and drive units, causing reduced life of many components, as well as substantial risk of malfunction.

[0055] The drive device has characteristic features as stated in the characterizing clause of attached claim 189. Additional features of the invention are found in related sub-claims 190 – 196.

[0056] In the following, each of the twelve aspects of the present invention will be explained in their respective order by way of examples and by reference to the accompanying drawings, wherein the same reference numerals indicate the same elements, although as regards some elements, different reference numerals have been used for elements having same properties of functioning and for practical reasons.

BRIEF DESCRIPTION OF THE DRAWINGS

[0057] In the drawings:

[0058] fig. **1a** shows in a perspective view , an exemplary mode of a reverse vending machine with object storage chamber; object supporting, rotating, sorting and conveyor means; camera-aided detector device; supplementary item/ object collector means; token dispenser; token reader; safety apparatus; and drive means,

[0059] figs. **1b** and **1c** show the object rotating, sorting and conveyor means with its longitudinal axis tilted relative to the horizontal,

[0060] fig. **2a** shows an exemplary embodiment of an essentially upwardly oriented storage or storage chamber according to the invention,

[0061] figs. **2b** and **2c** show the embodiments of fig. **2a** in association with a compactor.

[0062] fig. **3** is a further a principle drawing of a storage space or chamber for a storage facility according to the present invention,

[0063] fig. **4** is a principle drawing showing a first embodiment of an expandable storage chamber for a storage facility according to the present invention,

[0064] fig. **5** is a principle drawing showing a second embodiment of an expandable storage chamber for a storage facility according to the present invention,

[0065] fig. **6** is a principle drawing showing an exemplary layout of a storage facility according to the present invention having multiple storage chambers,

[0066] fig. **7** is a principle drawing showing an exemplary possible layout of a storage facility according to the present invention having multiple storage chambers and a drum type conveyor unit,

[0067] fig. **8** is a principle drawing showing a possible layout of a storage facility according to the present invention having multiple storage chambers, a conveying and sorting means, and means for reading information from, or detecting the type of, returnable item or object being positioned in an input receiving area,

[0068] fig. **9** is a partial sectional view of a drum type conveyor for a storage facility according to the present invention, being positioned in a first rotational position,

[0069] fig. **10** is a perspective view of the drum type conveyor shown in fig. 9,

[0070] fig. **11** is a partial sectional view of an embodiment of a drum type conveyor for incorporation in the present invention, the drum being in a second rotational position with a piston like plunger element in a retracted position,

[0071] fig. **12** is a perspective view of the conveyor of fig. 11,

[0072] fig. **13** is a partial sectional view of an embodiment of a drum type conveyor for incorporation in the storage facility of the present invention, the drum being rotated in a first direction from the second position to assume a third rotational position in which with the piston-like plunger element is in an advanced position,

[0073] fig. **14** is a perspective view of the positional state of the drum type conveyor of fig.13,

[0074] fig. **15** is a partial sectional view of an embodiment of a drum type conveyor for incorporation in a storage facility according to the invention, with the drum rotated in a direction opposite to that starting at figs.11, 12 and ending at figs. 13, 14, i.e. a rotation in clockwise direction - as viewed on fig. 15 - from the second position to the first position to assume a further rotational position with the piston-like plunger in an advanced, downwardly facing position,

[0075] fig. **16** is a perspective view of positional state of the drum type conveyor of figure 15, as seen partly from below,

[0076] fig. **17** is a perspective view of an embodiment of a drum type conveyor for incorporation in a storage facility of the present invention, having a roller and a load cell applied to the roller,

[0077] fig. **18** is an illustration of a drum type conveyor embodiment positioned in a cabinet with a bearing for the roller and load cell on a movable arm,

[0078] fig. **19** shows the bearing and load cell arrangement of figure 18 with the movable arm positioned for bearing and load cell engagement with a roller,

[0079] fig. **20** is a principle drawing of a first embodiment of a conveyor having a moveable plunger in a stationary housing and useful for a storage facility according to the invention,

[0080] fig. **21** is a principle drawing of the conveyor of fig. 20 in a different operational state,

[0081] fig. **22** is a principle drawing of a second and modified embodiment of the conveyor of figs. 20 and 21,

[0082] fig. **23** is a schematic side view of the conveyor of figure 22,

[0083] fig. **24** is a principle drawing of the conveyor of figs. 20 - 23 to illustrate rotation of a returnable item received in the input receiving area of the conveyor,

[0084] fig. **25** is a principle sketch of a first embodiment of a camera-aided viewing device for viewing an object with regard to contour of the object and identifying features or indicia on the object,

[0085] fig. **26** is a principle, though slightly more detailed sketch of the first embodiment of the camera-aided viewing device showing in more detail a first object supporting, rotation, sorting and conveying means,

[0086] fig. **27** is a principle sketch of a second embodiment of the camera-aided viewing device,

[0087] fig. **28** is a principle sketch of a third embodiment of the camera-aided viewing device,

[0088] fig. **29** is a principle sketch of a fourth embodiment of the camera-aided viewing device,

[0089] fig. **30** is a principle sketch of a fifth embodiment of the camera-aided viewing device,

[0090] fig. **31** is a principle sketch of a sixth embodiment of the camera-aided viewing device,

[0091] fig. **32** is a principle sketch of a second object supporting, rotation, sorting and conveying means,

[0092] fig. **33** is a principle sketch of a seventh embodiment of the camera-aided viewing device,

[0093] fig. **34** is a principle sketch of an eight embodiment of the camera-aided viewing device,

[0094] fig. **35** is a principle sketch of a ninth embodiment of the camera-aided viewing device,

[0095] fig. **36** is a principle sketch of a tenth embodiment of the camera-aided viewing device,

[0096] fig. **37a** shows a camera image with two image parts, and fig. **37b** shows a camera surveillance image with a set of dedicated camera image sensor matrix pixels indicated,

[0097] fig. **37c** shows a simplified circuit diagram forming part of the block schematic diagram in fig. 46,

[0098] fig. **38** is a principle sketch to illustrate camera reading of bar-code on a token in a token storage device,

[0099] fig. **39** is an exemplifying token,

[0100] fig. **40a** is a partial view of a supporting device and a background area or panel,

[0101] fig. **40b** is a variant of the background area or panel shown on fig. 40a,

[0102] fig. **41a** is a sketch of a first embodiment of a token reading means,

[0103] fig. **41b** is a sketch of a second embodiment of a token reading means,

[0104] fig. **42** is a perspective view of a part of the view of fig. 38,

[0105] figs. **43 – 45** are perspective views of a token dispenser seen from below, from the side and above, and substantially from above, respectively,

[0106] fig. **46** is a block schematic diagram of electrically or electronically operative elements in a system incorporating the invention,

[0107] fig. **47** is a principle sketch to illustrate drive means for rotatably driving a drum in said object supporting, rotating, sorting and conveyor means,

[0108] fig. **48a** and **48b** are principle sketches to illustrate a mechanical drive coupling between drive means (fig. 48a) and a handling device, e.g. a "soft-drop" storage container (fig. 48b),

[0109] fig. **49a** shows in principle an alternative mechanical drive coupling, and fig. **49b** is a modification thereof,

[0110] fig. **50a** shows the sketch of fig. 47 with a first type of drum rotational position sensors indicated,

[0111] fig. **50b** shows the sketch of fig. 47 with a second type of drum rotational position sensors indicated, and

[0112] fig. **51** shows in a perspective view a reverse vending machine with object storage chamber; object supporting, rotating, sorting and conveyor means; item collector means; token dispenser; token reader; and drive means,

SPECIFIC DESCRIPTION

[0113] **RVM overview**

[0114] Fig. **1a** illustrates in an exemplary embodiment a reverse vending machine (RVM) **1** embodying main inventive aspects of the present invention, .i.e. object storage chamber **2**; object supporting, rotating, sorting and conveyor unit **3**; camera-aided detector device **4**; supplementary item/ object collector means **5**; token dispenser **6**; token reader **7** , safety apparatus **8**, and drive means **9; 9'**. The unit **3** (later denoted as **200**) could have to have its longitudinal axis **3'** horizontal or forming an angle α with the horizontal, yielding angle β in the range $\pm$ 0° - 30°, as indicated on figs. **1b** and **1c**. In the more detailed disclosure to follow, the operational means **2 – 9** just mentioned will for practical reasons be denoted by other reference numerals. Direction is also made to fig. **51** showing the figure of fig. **1a**, however with more reference numerals inserted to identify location of some of the various operational means which are extensively disclosed in the disclosure to follow in connection with figs. **2 - 50.**

[0115] **Upwardly Oriented Storage**

[0116] With reference to fig. **2a** showing a principle drawing of a storage chamber according to the present invention, certain features relating to the storage chamber and the principles of the invention will now be explained. In an advantageous embodiment of the invention, the storage chamber has an elongated and vertically oriented shape, with bottom and side walls, wherein the side walls are spaced apart, preferably sufficiently to allow for a side-by-side storage of a plurality of returnable items. The storage chamber has an in-feed opening in the lower part of the chamber, preferably arranged in one of the side walls, and feeding of the storage is obtained by driving returnable objects or items to be stored in the chamber into the storage chamber through the in-feed opening. By properly selecting the force by which the objects or items are driven into the storage chamber, and preferably by applying a forced pushing or thrust mode drive, objects/ items already positioned in the storage chamber will be driven away from the in-feed opening and into the interior or back of the chamber until the chamber has been filled to the level at which the in-feed opening is located, and thereafter driven upwards by further objects/items being driven into the chamber.

[0117] In the illustration of fig. **2a**, the storage chamber **100** illustrating the invention is provided with a bottom part **120** and a side wall **130, 131 or 132**, respectively, and an upper part **150**. An in-feed opening **140** is located in the lower part of one of the side walls. To allow the storage space **110** to be safely emptied into removable transport container (not shown), e.g. a large box, for removal of returnable items **10** collected in the storage space or chamber **110**, the bottom **120** can be made movable or removable, or one of the side walls **130** can be made movable such that items stored in the chamber or space **110** can be removed therefrom. As the chamber is being filled by returnable objects/ items **10**, it can be expected that the force applied to drive additional objects/ items **10** into the storage through the in-feed opening **140** may give rise to some tension in the items already in the storage, due to other forces such as from friction or the weight of the stored items **10.** Tension or friction may typically result in problems when trying to empty a filled storage space, for which reason a movable interior wall **132** is proposed, such that, in the case where the bottom part **120** is adapted to be opened to empty the storage space, the interior wall **132** may be moved in a direction away from the items **10** already located in the storage room. Thus, the tension is relieved and friction is reduced. This will allow for easy emptying of the storage. As the storage room becomes filled above the input opening, there is a risk that objects/items already positioned in the storage space may flow back through the in-feed or inlet opening. To stop

such possible back-flow, a back-flow blocking arrangement **170** is preferably provided in the area of the in-feed opening.

[0118] The storage space exhibits a width dimension **111** being a multiple of the width dimension **11** of a returnable item for storage in said upwardly oriented storage, whereby a plurality of returnable items can be accommodated substantially or at least in part side by side in the interior space.

[0119] On fig. **2a**, a conveyor **200** for feeding items into the storage **100** is shown. Exemplary embodiments of such conveyor will be described with particular reference to figs. **8 – 24**.

[0120] Although fig. **2a** illustrates a theoretical side-by-side stacking of returned items 10 lowermost inside the storage, practical tests have proved that the items in fact may be lying at least partly in a "criss-cross" manner, as indicated higher in the storage chamber. Thus, in general at least a partly "criss-cross" stacking will be present throughout the stacking in the chamber.

[0121] Fig. 2b illustrates the use of an item or object compactor device **290** between the conveyor **200** and the storage **100.** The compactor device **290** could be of any suitable type. In a particular exemplary embodiment it could be in the form of a set of spike-provided chains in a wedge-like arrangement in order to provide gradually flattened and punctured returnable items. The use of a set of flattening rollers acting as a compactor device could also be envisaged, as well as other types of well-known compactors.

[0122] Although the conveyor **200** is included upstream of the compactor **290** on fig. **2b**, it will be appreciated that in a particular embodiment the storage **100** and the compactor **290** could be able to work without the use of the conveyor **200**. In an alternative, as generally indicated on fig. **2c**, a conveyor could be included, as indicated on fig. **2b**, or the conveyor needs not to be provided, or it could be operationally integrated with the compactor unit, the integrated unit being labeled **291**.

[0123] The compactor device **290** of fig.**2b** indicates that it receives returnable items with the longitudinal axis of the item **10** in question transverse to the in-feed direction. The compactor device **291** shown on fig. **2c** , is suitably of a type capable of receiving the returnable item **10** with its longitudinal axis in the in-feed direction. This implies however that the transverse dimension **111** of the storage should preferably be a dimension **11'** related to the compacted

item **10'** which exceeds at least a maximum longitudinal extent **11"** of an item **10** to be compacted.

[0124] It will be noted that when items are fed into the storage **100**, after compaction, the orientation of the compacted items will be rather arbitrary or highly in a "criss-cross" fashion, irrespective of whether the items where fed into the compactor in a transverse or longitudinal direction.

[0125] Now, with reference to fig. **3**, an alternative storage chamber in-feed arrangement is explained. In the principle shown in fig. **3**, when compared with the principle shown in fig. **2a –2c**, the in-feed opening **140** is no longer positioned in a side wall, but rather in a bottom part **122** of the storage chamber **100**. By this arrangement, items **10** to be stored will be provided with an upwardly directed movement or drive force component as a result of the in part upwardly directed drive component applied to drive items into the storage space. Similarly to what is shown in figs. **2a – 2c**, there may be provided several options for removing items stored in the storage space, such as by a movable or removable bottom part **121**, or by a side wall arrangement as shown by **130, 131** or **132** in figs. **2a –2c.** The storage chamber illustrated is adaptable to handle an overflow of stored items **10** by being provided with an overflow opening **160** through which excess object/ items due to an overfilling of the storage space may exit from the storage chamber **110** and thereby relieve the storage chamber **110** from possible additional stress, as may result from further filling of the chamber by additional items **10** when the chamber has reached a point of maximum filling.

[0126] Fig. **4** illustrates in principle an expandable storage chamber for a storage facility according to the invention. The storage chamber may have any type of in-feed opening in its lower part as illustrated by figs. **2a – 2c** or **3** and is made expandable by a movable top section **151**. Advantageously, by making the movable top section **151** from a light weight material, the driving force applied to a returnable object/ item that enters the storage space through the in-feed opening will be sufficient to move the top section in an upward direction to allow an expansion of the storage chamber. The upward movement of the top section **151** can also be facilitated by mechanical, electrical, hydraulic or pneumatic means, to mention a few, such that the driving force applied to an object or item **10** that enters the storage space can be kept at a level that is independent of the design of or materials selected for the top section.

[0127] Fig. **5** illustrates the principle of another alternative for providing an expandable storage chamber, wherein the upper part **150** comprises flexible members that by an upwards

movement of the upper part and the connected flexible members **152** will provide an increase of the storage space as the storage fills with returned items. Advantageously, as explained above with reference to fig. **4**, the top section and flexible members preferably are made from light weight material, such that the upward movement required for expanding the storage chamber may be facilitated by the force applied when driving an element into the storage space through the input in-feed opening. A vertical movement of the upper section and the flexible members **152** can be provided by other means, such as electrical, mechanical, hydraulic or pneumatic, to mention a few.

[0128] Reference is now made to fig. **6**, which provides an illustration of the principles of the present invention in a possible layout having multiple storage chambers. The exemplary storage facility illustrated in fig. **6**, comprises as many as three storage chambers **110, 112** and **114**, respectively, each having a respective in-feed opening positioned for being in communication with a conveyor **200** being capable of receiving an item in an input receiving area **110** and conveying the received item **10** to a selected one of in-feed openings **141, 142** and **143** (see also reference numerals **263, 264** and **265** with respect to the embodiments of figs. **20 – 24** and **32**) of the storage chambers **110, 112** and 114, respectively. The storage chamber **110** is provided with a cooperating supplementary storage space **161** in communication with the first storage chamber **110** by overflow openings **160** in the upper part of adjacent side walls. Storage chambers **110** and **112** have respective in-feed openings **141** and **142** located in respective side walls in their lowermost parts, and are dimensioned appropriately to provide a filling of the respective chamber in an upwardly direction when the appropriate item is driven into the chamber through the respective in-feed opening. In the example of fig. **6**, storage chamber **110** has been provided with a deflector **180** located inside the chamber and at an appropriate distance from the in-feed opening **141** to provide an upwardly directed force component to objects/ items being driven or forced into the storage space in a specific direction, although the driving force may already have an upwardly directed drive component. Thus, the upwardly directed drive forces exerted on the item **10** as it enters the chamber may become more consistent, and also less dependent on the shape and nature of other items **10** already located in the storage. Advantageously, the deflector can be moveable, such as by being tiltable or even removable, to allow easy and complete removal of all items held in the storage chamber when the storage chamber is to be emptied.

[0129] Fig. **7** shows a simplified variant of the layout depicted in fig. **6**, and with a conveyor of a drum type that provides a highly compact facility for receiving, transporting, sorting and

storage of returnable items. The arrangement shown in fig. **7** is capable of sorting, conveying and storing large quantities of returnable items while requiring a very small floor space, by employing the compact conveyor and sorter **200** and the vertically oriented storage system of the present invention. Thus, the need for use of a separate lifting arrangement to fill from a low level a tall storage space is being eliminated, such that in a practical implementation and embodiment the storage chamber may extend from any level and up to a ceiling above as desired, which is highly beneficial in a small business environment, like in a convenience store or a gas station, where available floor space typically is quite limited. The fig. **7** embodiment provides for the additional storage or item collector **114** below the conveyor and sorter **200**. In the case of receiving returnable items like bottles and cans, glass bottles could e.g. be dropped by gravity into the collector **114** when the conveyor and sorter **200** has brought such a type of item to be just above a receiving opening of the collector **114**.

[0130] Fig. **8** illustrates a further exemplary embodiment layout of the present invention that utilizes a highly compact drum based conveyor with as many as three different storage chambers, denoted by **110, 112** and **114,** for storing different types of returnable items **10**. The conveyor **200** is adapted to receive items **10** in an input receiving area **210**, and to move and output the item, based on certain criteria and a decision made by a controller that operates a drum drive unit, at either a first output **224** for driving the item into a storage space **110**, or to a second output , which is either the second output **226** for driving a received item **10** into the related storage chamber **112**, or the second output **226'** for, in this particular embodiment, allowing also gravity to assist in moving the item **10** from the conveyor to the related storage space **114.** The storage space **114** is particularly useful for items to which a relatively high driving force should not be applied, such as for example fragile glass items or heavy items, such as bottles that carry significant amounts of liquid contents, or for other reasons are found unsuitable for being driven into one of the upright storage spaces **110** or **112** for elevated storing above the level of the input receiving area.

[0131] Although three storage chambers **110, 112** and **114** are shown on fig. **8**, in a practical embodiment with a rotary conveyor and sorter as depicted, only two storage chambers will be used e.g. **110, 112; 110, 114;** or **112, 114** with the related outputs **224, 226; 224, 226';** or **226; 226'.**

[0132] In the layout of fig. **8**, the storage chamber **110** is provided with an overflow opening that provides communication to a supplementary storage chamber **161**. The facility layout shown provides a highly compact design, augmented by the use of the compact drum type

conveyor means. For a person who is to deposit a returnable object/ item at the facility, there is conveniently an input receiving area **210** located as shown in the lower half of the facility. The facility includes a returnable object/ item recognition unit **20**, which can include, or be connected with a controller for controlling the operation of the conveyor **200**. The recognition unit **20** can be of an optical or acoustic type, or employ other or supplementary technology, such as magnetic, mechanical or electrical sensing to determine the type of returnable object/ item **10** that has been placed in the input receiving area **210**, or to read information or identifying features (e.g. bar-code) carried by, or located on, the item **10**. A preferred embodiment of a recognition unit is further disclosed in connection with figs. **25 – 42**, and **46**. In particular, with regard to the storage chambers **110; 112**, by employing a movable side wall **130; 132** or a removable storage chamber **114**, the storage chamber **114** can be extended to fill the unused space shown to appear below the first storage chamber **110.** To facilitate easier filling of the upright oriented storage chambers **110** and **112**, a deflector **180**, such as is shown in fig. **6**, can also be included.

[0133] **Rotary Drum Type Conveyor Means**

[0134] Reference is made to fig. **9**, to explain the drum type conveyor of the present invention. The drum type conveyor includes a drum shaped element that is rotary about a central, longitudinal axis of rotation **221**. A substantially rectangular and elongate recess-like space or cavity, being open at the peripheral area of the drum, is provided in the drum, for holding an elongate movable element which can be retracted and advanced, the movable element having an outer surface that in the advanced position preferably becomes substantially aligned with an outer surface of the drum. In the accompanying drawings, the movable element is denoted by the numeral **223**, and the space or cavity in the drum is denoted by reference numeral **222**. The rotational capability of the drum **220** is obtained through use of bearings positioned in a region at each end of the drum, and positioned on the axis of rotation **221**. A part of the structure as shown in principle for example in fig. **8**, such as a cabinet, can be adapted to hold the bearings in place, thereby allowing the drum to rotate with its outer surface **228** in proximity to the input receiving area **210** which is made to coincide with an inlet opening **425** (see fig. **51**) in the cabinet **250** (see fig. **18**), **428** (see fig. **51**). As an alternative, as shown in fig. **10** and in other drawing figures, the drum **220** may be positioned in a frame **240** to form a conveyor assembly for easy conveyor assembly removal for convenient conveyor cleaning, test, maintenance and replacement.

[0135] To ensure proper alignment and good fixation of the conveyor unit when located in a storage facility according to the invention, the frame **240** is suitably adapted to match a receiving frame **251** (fig. **18**) that preferably is part of a cabinet **250** (fig. **18**), **428** (fig. **51**), and which facilitates any of the possible layouts of a storage facility, as exemplified by several of the previous figures.

[0136] Preferably, as shown in figs. **10, 14** or **16**, the moveable element **223** is driven by way of a moveable element drive means comprising a tappet or a roller **232,** being attached to the moveable element **223**, that follows a track **231** located proximal to an end of the drum and being stationary in respect of the drum. By providing a tappet or roller **232** on each side of the moveable element, made to engage with respective stationary tracks **231** located proximal to respective ends of the drum, a balanced driving force can be applied to the moveable element by the rotation of the drum. Thus, only the drum will require a drive for the assembly to operate as described here, as the moveable element will be driven by the movement of the drum relative to the stationary track. The shape of the track, i.e. the distance of the track from the axis of rotation of the drum, controls the position of the tappet or roller **232**, and, hence, the position of the moveable element, in a radial direction with respect to the drum center axis. The track is a single, continuous track **231** followed by the tappet or roller means **232.**

[0137] In fig. **9,** the drum **220** is shown in a first rotational position with the movable element in an advanced position and pointing downwards, and with a returnable object/ item **10** entered into the input receiving space or area **210** to be placed on an upward facing region of the outer circumferential surface **228** of the drum **220**. In a preferable embodiment, the drum type conveyor includes an elongate roller **243**, or other means to allow rotation of the item while keeping the item in the input receiving area, to facilitate a rotation of a returnable object/ item **10** resting on the drum surface **228** as the drum **220** is put into rotation about its axis of rotation **221**. In particular, when the returnable item is provided with a readable code for identification of the item or for providing specific information about the container, rotation of the object/ item **10** will often be required to position the part of the object/ item **10** carrying the code such that it becomes readable, for example by use of a reader or recognizing device **20** located to observe the input receiving area, as shown in fig. **8**. The drum type conveyor has also a guide **241**, e.g. a curved plate member, that extends from the area **210** to the output **224**, as will be further explained in connection with fig. **15**. Further guides **241,** e.g. as also shown on fig. **15**, could extend from the area 210 down to the output **226'**.

[0138] Fig. **10** depicts in a perspective view the drum **220** in the first rotational position as shown in fig. **9** and with the returnable item **10** resting on an upwardly facing part of the drum circumference. In the embodiment of fig. **10**, the conveyor is provided with a roller driving **244** means for driving the roller **243** in conjunction with driving of the drum, such that the surface velocity of the roller **243** is in a range of a velocity of a rolling surface **228** of the drum when rotated. Preferably, the roller driving means **244** comprises a gear drive arrangement that mechanically provides a rotation of the roller **243** by the rotation of the drum **220**. Movement in an axial direction of a returnable object/ item **10** being positioned in the input receiving area and resting on the drum **220** and roller **243** is in part restricted by end walls **229** associated with and located at each end of the drum **220**, and in part by elements **242** that constitute the frame **240**. Depending on the design of the means for driving the movable piston-like element **221** between its retracted position and its advanced position, the conveyor shown in fig. **10** can be provided with a single output **224**, corresponding to only one particular angular drum rotary position, or with a second output at a different angular rotary position of the drum.

[0139] In fig. **11**, the drum **220** is shown in a second rotational position with the space or cavity opening in the drum facing the input receiving area, and with the movable element **223** moved to the retracted position. This has thereby allowed the returnable object/ item **10,** shown in fig. **9** as resting on the circumferential drum surface **228**, to fall into the recess-like space or cavity **222,** as the drum is rotated to arrive at the second position after rotation from the first position, and be contained by the drum **220**. The same situation is also shown in the perspective view of fig. **12**, which shows parts of interior side walls of the space **222** and the drum end walls **229**, which contribute to restrict a movement of the returnable object/ item **10** such that it may not go beyond the space provided by the cavity **222**.

[0140] In fig. **13**, a partial sectional view of the drum type conveyor shows the drum in a third angular position, where the movable element has been moved in a first and counter-clockwise direction from the retracted position shown in figs. **11** and **12** to an advanced position to drive the returnable item to the first output **224**, preferably for the purpose of driving the object/ item **10** towards the in-feed opening of a storage chamber **110**. If driven in a second and clockwise direction to a second output, which is either output **226** or output **226'**, but not both, in-feed to a respective storage chamber **112** or **114** could be envisaged. The drum type conveyor is provided with said guide **241** to restrict the item **10** to its location in the cavity **222** while the drum is being rotated from the second position with the space **222**

facing the input receiving area **210** to the third angular position where the opening of the cavity **222** is facing the first output **224**. The same situation is also shown in perspective view fig. **14**, with the opening of the cavity **222** aligned with the first output **224** and with the movable element **223** in an advanced position.

[0141] In fig. **15**, a partial cross sectional view of the drum type conveyor shows the situation based on the situation shown in fig. **11**, now with the drum rotated in a second and opposite rotational direction (clockwise direction in the example), whereby the returnable object/ item **10** that was received in the space or cavity **222** when the drum was in its second rotational position has been carried by the drum through a rotation of the drum through approximately 180° so that the drum assumes its first position as shown on figs. **9** and **10**. The object/ item is driven out from the space **222** by the movable element **223** moving from a retracted position to an advanced position, but also by the effect of gravity. A guide **241** is provided to restrict the movement of the object/ item 10 when held in the space **222** while the drum is being rotated from the second rotational position with the space facing the input receiving area **210** to the first rotational position with the opening of the space **222** and the curved face **223'** of the element **223** being in register with the output **226'**. The situation of fig. **15** is also shown in the perspective view from below of fig. **16**, with the item **10** exiting from the conveyor at the alternative output **226'**.

[0142] For conveying an item **10** that has entered the recess-like space or cavity to one out of two possible outputs in a specific embodiment of the combined drum conveyor and sorter, different directions of rotation can be used. For example, in the embodiments shown in figs. **9 - 16** of the accompanying drawings, the drum would be rotated in a first direction (e.g. counter-clockwise, as shown) to deliver the item at the first output **224**, while a rotation in a second direction (e.g. clockwise, as shown) would be applied to the drum for delivering the item **10** at a second output **226** or **226'**.

[0143] Thus, in the present context, there are in effect four main rotary positions of the drum **220:**

a) the first rotary position with the recess **222** and the element **223** facing downwards;

b) the second rotary position with the recess **222** and the element **223** facing upwards, thus facing the input receiving area,

c) the third rotary position with the recess **222** and the element **223** facing the first output **224**, and

d) the fourth rotary position with the recess **222** and the element **223** facing the second output **226** or facing the alternative second output **226'**. If facing output **226'**, the fourth rotary position will in effect be the same as the first rotary position.

[0144] Now, with reference to figs. **17, 18** and **19**, a load cell arrangement for determining a mass of a returnable item positioned on the drum type conveyor of the invention will be explained. When positioned to rest on the drum **220** or when rotating the drum **220** to spin the item **10**, the item **10** will also in part be resting on or rotating with the roller **243**, if such roller **243** is provided. Reference is also made to fig. **9** to see how the object/ item **10** will be resting against the roller **243**. For making a decision as to whether or not to accept the object/ item **10** for storage in the facility according to the invention or to determine an appropriate storage chamber in an embodiment having multiple storage chambers, the mass of the object/ item **10** should be determined. To facilitate a mass determination, the roller **243** is provided with at least one bearing **245** support the roller shaft **247** at one end of the roller, which bearing **245** is connected to and supported by a load cell **246**. In the exemplary embodiment shown in fig. **17,** the load cell **246** is attached to a frame **240** for the conveyor, while a further bearing **248** is provided at an opposite end of the roller.

[0145] A second and alternative embodiment of a load cell arrangement of fig. **17** for determining a mass of a returnable object/ item **10** resting on the roller **243** is depicted on fig. **18.** The arrangement includes a bearing **252** to be applied to one end of the roller shaft **247** when the conveyor is positioned in a cabinet **250**. In this particular embodiment, the shaft **247** is partly free to move about in a plane perpendicular, suitably vertically, relative to the roller's **243** axis of rotation, and with the bearing **252** applied to the end part of the shaft **247** of the roller **243** after positioning the drum type conveyor in the cabinet **250. 251** denotes an electrical connection to the load cell **253**. Thus, in fig. **18**, the removable bearing **252** and its associated load cell **253** is shown in a detached position, while, in fig. **19**, the cabinet arm **250'** holding the bearing **252** has been relocated to a position where the bearing **252** engages the bearing receiving end of the roller shaft **247** to provide a bearing with a load cell **253** referenced to the cabinet **250** or to the frame **240.** The embodiments of fig. **17 – 19** are particularly advantageous to avoid as far as possible the risk that remaining liquid contents in returnable objects/ items **10** that are positioned on top of the conveyor typically can be spilled, as such spillage will likely require more frequent removal of the conveyor assembly from the cabinet than normally for cleaning away spilling of such unwanted liquid. Also, the use of the load cell prevents an RVM user from being successful with a swindle attempt by entering a

full, unopened beverage container into the receiving area and place on top of the drum. The detection system **20** (see fig. **8**) will – as to be explained later – according to predetermined data determine that a specific observed and recognized item should have a specific weight or weight range. If the item is a full beverage can or bottle, the RVM will determine that there is a potential swindle situation and may trigger an alarm. Furthermore, in the embodiment shown, the drive means for operating the conveyor is separable from the drum type conveyor itself (as will be explained later) , such that, by removing the conveyor from the storage facility assembly, the load cell will remain at the facility (i.e. located on the cabinet arm **250'**) and thus be protected from being subject to possibly harmful cleaning agents and water that typically would be used for cleaning the conveyor. If the load cell is located on the frame **240** of the conveyor, as depicted on fig. **17**, special measures must be taken to ensure that the load cell is not damaged in any washing or cleaning operation of the conveyor **200**. Thus the embodiment of figs. **18** and **19** would be the preferred embodiment.

[0146] **Plunger-type conveyor means**

[0147] In the following, a piston-like moveable plunger in a stationary housing-type of conveyor part of the present invention will be explained.

[0148] Reference is first made to fig. **20,** which in principle shows a first embodiment of a substantially linearly moveable plunger in a stationary housing type conveyor, as comprising an elongated housing **260** with an input opening **262** on one side adapted to face the input receiving area **210** of the storage facility, an interior space **261**, a substantially linearly movable plunger or slide member **270**, a first output **263** and a second output **264**. Although exemplified here with a housing based on a straightforward design for a rectilinear movement of the plunger, the housing may be designed to be curved in any direction to allow an output in an arbitrarily chosen angle. With a housing having a curved shape, naturally, the plunger would follow a curved path corresponding to the shape of the housing. Also shown in fig. **20**, is an elongated slot **272** in one side of the housing, which is provided as an access means for allowing a plunger drive means (not shown) to be attached to the plunger **270** for positioning of the plunger in different parts of the interior space **261**. Such a slot can be provided at any longitudinally extending side of the housing, and also at more than one side to provide a balanced drive force to the plunger. In fig. **20** is also shown a returnable object/ item **10** which has been positioned in the input receiving area, and which by the aid of gravity and the provision of the input opening **262** will fall into the interior space **261** of the housing, and

thereby become located adjacent to the plunger **270** when the plunger initially has been positioned in a first position which is below the opening **262**.

[0149] In a preferred embodiment of the conveyor and sorter of the present invention, as shown on figs. **20** and **21,** embodying the moveable plunger in a stationary housing type conveyor, the conveyor suitably includes an item turning device, preferably using at least one roller **273** or preferably two rollers **273, 273'** if two outputs **263, 264** are two be used. The device is located adjacent the input opening **262**. The upper side face **271** of the plunger, i.e. the side of the plunger that will be facing the input opening **262**, has a surface structure that is specially prepared to provide good friction against a returnable object/ item **10** that has been deposited in the input receiving area and brought to rest on the upper side face **271** of the plunger. A rotation of the object/ item **10** that rests on the upper side face **271** of the plunger **270** is then obtainable by movement of the plunger **270** while the object/ item **10** is resting on top of the plunger **270**, which rotation is further augmented by the rollers **273, 273'**. The rollers **273, 273'** also cause the object/ item **10** to not move away from the opening **262** while rotated or if the longitudinal axis **260'**(see figs. **21** and **23**) of the housing forms an angle with the horizontal. The upper side face **271** of the plunger **270** can be extended in any direction of movement of the plunger **270**, to obtain a desired range of turning of the item 10 that rests on the upper side face **271** of the plunger **270**. Although just one roller **273** may suffice, a preferred embodiment of the plunger type conveyor and sorter has two rollers **273, 273'**, one at each side of the input opening **262,** to facilitate rotation of the item **10** in any direction in connection with a movement of the plunger **270** in the longitudinal direction of the housing **260.** The rollers are rotatably supported at each end by mountings **275**. The rollers **273; 273'** can be freely rotatable, or they can be driven by a driver arrangement **274** by way of a separate drive means or by a linkage to the plunger **270** or the driver for the plunger. Preferably, but not necessarily, the drive means **274; 274'**, e.g. a motor inside the roller, is arranged such that a surface velocity of the roller **273** during its rotation is about the same as the surface velocity of the upper face **271** of the plunger **270**, relative to the housing **260** as the plunger **270** is moved in the housing **260.** In order to obtain a measure for the mass of a returnable object/ item **10** resting on the plunger **270**, any roller arrangement **273** can include a load cell **276** suitably supporting the roller at one end thereof in order to measure a reaction force exerted on the roller as a function of an acceleration or turning of the object/ item **10** due to movement of the plunger **270**, or a reaction force due to the weight of the item **10**, in

particular if longitudinal axis of the housing **260** is made to tilt, e,g. in the range of ± 0° - 30° relative to the horizontal. .

[0150] In a next step of operation of the linear movement type conveyor, when the upper face **271** of the plunger has moved away from the opening **262** either towards output **263** or **264**, the returnable object/ item **10** will enter into the interior space **261**, the plunger **270** will then upon movement in an opposite direction apply a driving force to the object/ item **10** to drive it towards and through e.g. the first output **263** if the plunger at first had moved away from the opening **262** towards output **264**, or towards and through e.g. the second output **264** if the plunger had at first moved away from the opening **262** towards output **263**. In either case the plunger **270** would preferably force the item , towards an in-feed opening **140** (see fig. **2a**) or an in-feed opening **141** or **142** (see fig. **6**) of a storage chamber of a storage facility as disclosed herein.

[0151] Now, with reference to figs. **22**, a further variant of the conveyor and sorter of the type having the moveable plunger in a stationary housing will be explained, this embodiment exhibiting three outputs. In this variant, at least three positions for the plunger element in the housing are defined, namely with the plunger positioned immediately under the input opening **262,** with the plunger positioned toward a first output **263** in the first movement direction of the plunger **270**, and a further position where the plunger has been moved near a second output **264.** For the sake of clarity, the rollers **273, 273'** have not been shown on fig. **22**, but the rollers will preferably be present in a practical embodiments. The variant shown in fig. **22** includes a third output **265** of the housing, the third output being located opposite to and below the input opening **262** in the bottom of the housing **260**. Preferably, the third output **265** includes a closing means **265'** which is shown on fig. **23,** but not on fig. **22**. The closing means **265** is capable of controllably blocking the output **265** such that an object/ item 10 that has entered the interior space **261** of the housing **260** selectively can be kept from exiting the housing through the output **265** if the object/ item **10** is instead to be directed towards a different output, e.g. output **263** or **264**. The means **265'** for selectively closing the third output **265** can be made operational by way of a separate driver or actuator **265"**, e.g. a solenoid, or by a linkage to the plunger **270**, for example by placing the output in an open state when the plunger is placed in an extreme position within the housing, such as for example in connection with a movement of the plunger beyond the position of the plunger **270** as shown in e.g. on fig. **22**. By the depositing of an object/ item **10** in the input receiving area **210** immediately above the input opening **262**, and with the third output **265** in an open

state, and by locating the plunger **270** in a position where it does not block a passage provided between the input **262** and the third output **265** by the interior space **261** of the housing, the object/ item **10** is allowed to pass through the opening **262**, the interior of the housing **260** and then exit through the opening **265**. The exit of the item **10** after having traveled straight through the housing from the input **262** to the output **265** is shown in fig. **22**.

[0152] Fig. **24** illustrates how the plunger **270** may be used to rotate the object / item **10.**, e.g. a bottle, by moving the plunger either way, the rollers **273, 273'** assisting a safe and efficient rotation of the item **10**. The understanding of fig. **24** as regards rotation of the item 10 before it enters into the interior **261** of the housing **260** will be the same, irrespective of the presence of the output **265**. In effect, the three-outputs embodiment could be made instead as a two-outputs embodiment, having e.g. outputs **263** and **264**, outputs **263** and **265** or outputs **264** and **265**.

[0153] **Single Camera Viewing Device**

[0154] Fig. **25** depicts a first light source **300** and a second light source **301**, the light source **301** suitably consisting of a plurality of light sub-sources **302, 303, 304, 305** . The light sources **300** and **301** are separately configured to illuminate a first region **306** and a second region **307** of an object, e.g. a returnable item **10;10';10",10"'**. A single camera **308** is provided to view at least part of the regions **306** and **307**. The first light source **300** is configured to assist the camera **308** in viewing of contour of objects, items or articles **10, 10', 10", 10"'** of different cross section , e.g. empty beverage packaging such as cans and bottles against a light reflective area or background **313** forming a bright, light emitting background. The light from the first light source **300** is directed towards the object (e,g. one of those labeled **10** through **10"'**) as parallel light using a lens **314**. The second light source **301** is configured to assist camera viewing by the camera **308** for detection and recognition of any identity features located on the object in viewing sector labeled **315**.

[0155] Said identity features are suitably at least one of: bar code, graphic symbol and alphanumeric characters.

[0156] Although it would be feasible to use two cameras instead of a single camera, the use of a single camera yields less technical complexity, a simpler and more maintenance friendly structure, in addition to requiring less space in order to carry out the required functions. Further, from a components cost aspect and installation cost, the invention also offers a substantial advantage over a two-camera solution.

[0157] When a camera views e.g. an object contour or identifying features thereon, the camera sensor matrix provides a string of matrix pixel signals to be processed in order to identify or recognize such contour or features, including the possibility of letting the camera read and causing identification of e.g. a bar code.

[0158] As seen from figs. **25 –28**, the first light source **300** illuminates the first region **306** via a light path which includes an optical beam splitter (or view splitter) **316** (figs. **25** and **26**), **318** (fig. **27**) or **319** (fig. **28**), at least one inclined mirror **320** and the lens **314**. However, it is noted that in the most preferred versions, there is suitably used two mirrors **320** and **321**, as shown on figs. **25 – 27**, in the light path.

[0159] Figs. **25, 26** and **28** depict a light beam splitter **316; 319** located in an inclined posture in the camera field of view **322** and covers at least part of said field of view , suitably approximately half of the camera field of view. Fig. **27** depicts an optical beam splitter **318** which covers the complete camera field of view.

[0160] It is seen from figs. **25 – 28** that camera viewing of the first region **306** via one mirror **320** or two mirrors **320, 321** is suitably made with line of sight towards the object shifted by an angle α of 90°± 30° relative to camera line of sight towards the object when viewing the second region **307.** In the drawing figs. **25 – 28** the angle α is shown as 90°. However, by arranging the mirrors **320, 321** differently, it is evident that the angle range of 90°± 30° is possible.

[0161] In the case that there is used an optical beam splitter **316** or **319** which is within only half or less of the camera field of view, there is the possibility that when the camera is set to view the second region or part thereof, the splitter is suitably assisted by a vision blocker **323; 324** to prevent the camera from viewing both directly in the sector **315** and through the splitter, the splitter providing a less clear viewing. If the vision blocker **323; 324** is omitted, then the camera will be able to view the entire region **307**.

[0162] Fig. **27** shows the camera in a configuration set to view the second region **307** completely via the beam splitter **318**. This implies that the camera **308** views either the first region **306** via the splitter, the mirrors **321, 320** and the lens **314**, and secondly the second region **307** through the splitter. In this latter situation, the light source **301** is fully or partly activated, and the light source **300** is deactivated.

[0163] The light source **301**, suitably comprising a plurality of light sub-sources **302 – 305**, is notably located in a region between the beam splitter **316; 318; 319** and an object

supporting means in the form of said compact conveyor and sorter **200**. In the embodiments shown on fig. **25, 28 -30**, the object supporting means **200** is shown only schematically, but in more detail on fig. **26.** A more detailed operation of the object supporting means **200** and a possible, schematically shown alternative on fig. **32**, is disclosed in the preceding disclosure of figs. **1 – 24**.

[0164] It will now be briefly highlighted some of the earlier disclosed features of the object supporting means **200** in a specific context of camera aided viewing of an object, e.g. the object **10**, located on the object supporting means **200**, said supporting means is in the form of the rotary drum **220** (see fig. **26**) with the auxiliary roller **243**. The drum **220** and the roller 243 will controllably, but forcibly rotate the object **10** on a portion **220'** or **220"** of the circumference of the drum. The drum **220** has at least one radial inwardly directed, adjustable space or cavity **222** for receiving the object **10** after its rotation on said circumference portion and for transporting the object **10** through rotation of the drum to an output location, e.g. at generally indicated by arrows **224, 226** and **226'** . The camera **308** will be able to view and cause detection of the presence of the object **10** when it has dropped into the adjustable space **222**. This has a safety function aspect and also a security function aspect., i.e. to prevent any swindle attempt. This means that the drum **220** will not start turning until the camera **308** actually observes and causes detection of the object being present in the space **222** and with the movable element **223** operating as a movable bottom in its fully retracted state.

[0165] The direction which the drum will then turn is determined by set criteria which are compared to recognize characteristic features of the object. This will be more fully explained and considered in connection with the disclosure of fig. **38**. Further, in case the contour of the object is to be viewable from above, rather than sideways, it would be advantageous to let at least a part of the rotary drum **220** be provided with a coating which is retro-reflective to light, in particular at the portions labeled **220'** and **220"** of the drum **220**. Such a situation is in particular suitable in connection with the embodiment shown on fig. **29** and will be further explained later.

[0166] A brief repeated disclosure is now made of the alternative supporting means as shown on figs. **20 - 24** in the context of camera aided viewing of an object **10**. The single camera is generally denoted by **308, 308'**, the reference **308'** symbolizing viewing by the camera **308** via e.g. a beam splitter **318** and mirrors **321, 320** (see fig. **27**). Said supporting means is suitably in the form of the housing **260** forming a guide with an object receiving input opening **262** and a reciprocating plunger or **270** therein. There is suitably at one or both of

two longitudinal sides of the opening **262** an auxiliary roller **273; 273'** for roller support upon rotation of the object or item **10; 10'; 10"; 10"'** on the plunger **270** when it is set to move with its upper surface **271** past said opening, thus enabling the camera **308** to read an identifying feature on the object or item **10** if not immediately viewable by the camera. The plunger **270** is controllable to move beyond said opening **262**, e.g. to the position shown by dotted lines **270"** to allow the object to drop into the interior of the housing **260** through said opening **262** and by return movement of the plunger **270** (towards left as shown on fig. **32**) causing the object to be pushed out of the housing to an output location **263**. From the understanding and concept depicted in connection with the supporting means **200** on fig. **26**, it is readily appreciated that the object **10** is camera observable while at a location inside said housing **260** below said opening **262**, provided that such location is in at least part of a field of view of the camera **308**. In a particular embodiment, at least at the upper part **271** of the plunger **270** can be provided with a coating retro-reflective to light , thus enabling the contour of the object, e.g. **10**, to be viewed from above.

[0167] Fig. **29** shows the use of a single camera **340** and with an optical beam splitter **341** inclined relative to a lens **343**. A light source **342** provides for illumination of the object, e.g. **10**, through lens **343** to provide parallel light rays towards the supporting means **200**, which has its drum parts **220'** and **220"** (see fig. **26**) provided with retro-reflective material or property enabling light not hit by the object to be retro-reflected back to camera **340** via the lens **343** and the splitter **341** to provide an image of the contour of the object. When it is desirable to view and read identifying features on the object, such as e.g. bar-code, a light source **344** is activated, the light source suitably being of the same type as the light source **301**. At the same time, light source **342** may be deactivated, if required.

[0168] Fig. **30** shows an embodiment which in operation is similar to that of fig. **29.** A single camera **345** is used with an optical beam splitter **346** inclined relative to a lens **347**. A light source **348** provides for illumination of the object, e.g. **10**, through lens **347** to provide parallel light rays towards a light reflective background or area **313** enabling light not hit by the object to be retro-reflected back to camera **345** via the lens **347** and the splitter **346** to provide an image of the contour of the object. When it is desirable to view and read (or detect) identifying features on the object, such as e.g. bar code, a light source **349** is activated, the light source suitably being of the same type as the light source **344**, i.e. comprising a plurality of light sub-sources. At the same time the light source **349** is activated, light source **348** may be deactivated, if required. Fig. **31** is a modification of the embodiment of fig. **30**,

the major difference being the non-existence of the lens **347**, thus yielding that the object contour is not viewed by means parallel light rays.

[0169] Figs. **25 –28** clearly demonstrate that the first and second regions **306, 307** are partly overlapping, and figs. **29 - 31** indicate full overlapping.

[0170] Fig. **33** is identical to the embodiment shown on fig. **25**, apart from the light source **300** and the retro-reflective background **313** having been deleted and replaced by a light emitting, illuminated or backlit panel **350**, the panel **350** thus forming a bright background. Ambient light may in some applications be sufficient in order that the camera views a bright background.

[0171] The panel **350** will provide the bright background against which e.g. the object 10 is to be viewed by the single camera **308**.

[0172] A similar situation is present with the embodiment of fig. **34**, which is identical to the embodiment shown on fig. **27**, apart from the light source **300** and the retro-reflective background area **313** having been deleted and replaced by a light emitting area, suitably in the form of the panel **350** to form a bright background against which e.g. the object **10** is to be viewed by the single camera **308** to provide for e.g. detection of object contour.

[0173] The further embodiments depicted on fig. **35** and **36** are also related to the use of a light emitting panel **350** to form said bright background and against which camera viewing of an object can be made, as will be further explained.

[0174] Fig. **35** is a modification of the embodiments of fig.**30**. It is noted that the lens **353**, which is suitably of same type as lens **347** in fig. **30** or lens **314** in other drawing figures, is present in order to let a single camera **356** view and detect object contour, e.g. contour of object **309** against the panel **350** which in this embodiment constitutes the first light source. The second light source is that labeled **349**, which could be constituted by two or more light sub-sources. The camera **356** uses the lens **347** to enable viewing through use of parallel rays, in order to get as accurate contour image of the object as possible. The light source **349** is activated when the camera is to view and read identity features, like e.g. bar code **309'**, located on the object. Suitably, panel **350** is then not exhibiting a light emitting surface or background area, or its light emitting intensity could suitably be reduced. Other structural details shown on fig. **35** will be further explained later with reference to fig. **39.**

[0175] Fig. **36** is an embodiment with a single camera **358** which is capable of viewing an object, e.g. an empty beverage bottle or can **10;10'; 10"** or **10"'** against a light emitting

background area, such as the panel **350** as described earlier. In order for the camera **358** to view and read identifying features located on the object, e.g. a bar-code **10''''** on object **10**, it is preferable to use a second light source **359**. When the light source **359** is activated, it would be preferable, though not essential, to reduce light intensity from the panel **350** or even turn off emission of light from the panel **350**. The light source **359**, which is similar or identical to the light source **349**, could be constituted by two or more sub-sources.

[0176] From a viewing of figs. **33 - 36** it will be appreciated that turning of the object to be inspected, e.g.. to suitably find an identifying feature to be detected, is made by means of the object supporting means **220, 220, 243** or **260, 262, 270, 271, 273, 273'** as shown on in more detail on figs. **26** and **32**, respectively.

[0177] Further, it could be of advantage to let the first and second light sources, e.g. **300, 301; 300', 301; 342, 344; 348, 349; 350, 301; 350, 354; 350, 349; 350, 359** have different spectral range or composition. Also, it would be possible to have the second light sources **301; 344; 349; 359** composed of two or more sub-sources. Further, the sub-sources could have different spectra range or composition, either all different, different in pairs or in groups. Such features of the light sources and possible sub-sources are of importance to be able to detect e.g. identifying features on the objects appearing e.g. with different colours, different reflective properties etc.

[0178] Further aspects of the invention are now to be explained with reference to fig. **37**. In the particular case of the embodiments of figs. **25, 26** and **28**, as well as fig. **33** , it would be suitable to split the camera video image in two with a part **360** related to the first region **306** and another part **361** related to the second region **307**. In the embodiments of figs. **27** and **34** it may be visualized the possibility of dedicating half of the camera video image to region **306** and the other half to region **307**, or alternatively have alternating full video images of regions **306** and **307**. For the embodiments of figs. **29, 30** and **36** the choice is alternating full video images only.

[0179] Camera viewing of the first region of the object **362** related to its contour **363** can in addition include observation or rather recognition of mere presence or absence of said identifying features **364**, e.g. bar code located on the object.

[0180] The focus of the camera will not be exactly on the features **364**, but the camera will at least sense or detect with relation to the partial image **360** whether the features **364**, here labeled **364'** are indeed present or not, although on the partial image **360** appearing "blurred"

or a bit out of focus. If the features **364** are not visible on the image part **361**, but visible on part **360**, this will indicate necessity to rotate the object one way or the other through a maximum angle of 180°. The comparison between the two images **360** and **361** in this respect has some impact on the required amount of rotation of the object in order to be able to view and read the feature **364** properly in region **307**, and consequently has also importance with regard to processing time in order to find the feature **364**, read and record it.

[0181] When using in this manner a single camera for camera viewing of both said first and second regions, the camera has preferably, but not necessarily its image field subdivided into said at least two partial images **360, 361**, the first partial image **360** being dedicated to object contour detection and/ or detection of presence or absence of said identifying features, and the second partial image **361** being dedicated to observation and reading of said identifying features.

[0182] It is readily understood that the principle of detecting presence or absence of identifying features in region **306** and the need for rotation of the object is equally well useful when the camera switches between viewing regions **306** and **307**.

[0183] **Operational Safety Means**

[0184] As indicated in the introductory part of the specification it is important also to focus on safety aspects when using an apparatus as extensively disclosed in the present specification and on the drawings, in particular to avoid injury to persons operating the apparatus or to avoid functional breakdown or jamming of the apparatus.

[0185] Therefore, the invention is in this aspect focused on implementation of safety measures which are provided from actions obtained by operating a hardware circuit which is adapted to read predefined or dedicated pixels on the sensor matrix of the camera, i.e. reading hardware assigned physical pixels of the camera sensor matrix when a camera image is made.

[0186] This will yield a reliable safety measure related to possible operational hazards, thus e.g. preventing a motor from operating through halting its rotation or removing current supply thereto to thereby remove its torque.

[0187] This aspect of the invention is therefore through use of camera functionality able to provide an efficient hardware implemented light curtain functionality, as will be more closely explained in the following description with reference to figs. **37a, 37b , 37c, 40a, 40b** and **46.**

[0188] In the present embodiment there is used a camera image , such as e.g. image **360** or **385** for detection of so-called "border crossing", i.e. an event in a field of view of the camera.

[0189] As indicated above, it is important to provide for personnel or an operator (e.g. a supermarket customer) operational safety of an apparatus , e.g. a reverse vending machine, and also protect in such apparatus machinery, having movable parts, against externally created interference that could cause operational damages or personal injuries, or operational or personal hazard. With a light curtain functionality it is possible to disable operation or stop the machinery altogether immediately and inhibit further operation until the cause of such operational disruption has been attended to.

[0190] With reference to figs. **40a** and **40b**, as well as figs. **37a** and **37b** there is on the bright or light emitting background **313; 350** located at least one array or column **385** of repeatedly occurring dark markings **385'**, e.g. black squares at an in-feed region receiving objects in direction **388** at which objects are fed into the apparatus for viewing, detection, turning and sorting, as previously disclosed. Further, there may on the background **313; 350** be located at least one array or row **385"** of repeatedly occurring dark markings **385"'**. At least one such row may be useful if the entry or in-feed region causes objects to be fed in a direction **388'**. However, if the insertion opening **425** is so configured that it may be possible for a human hand to be inserted there-through and into the viewing chamber, so as to move into the viewing chamber essentially from above and thereby avoid obscuring viewing of the array **385**, the array **385"** is present to assist in providing additional light curtain functionality.

[0191] It has also been indicated by dotted lines on fig. **40a** that e.g. two columns of markings and two rows of markings could be possible, although the number of rows and/ or columns could be more than two.

[0192] Alternative or supplementary to the interspaced markings **385', 385"'** indicated on fig. **40a**, there could be located markings **395, 396** and **397** in the form of solid lines, as indicated on fig. **40b**.

[0193] It is possible to have a column or row configuration of markings or a joint column and row configuration.

[0194] Fig. **37a** exhibits two half-images **360** and **361**, as previous discussed, whereas fig.**37b** exhibits a generalized full image **386** as provided by the available pixels on a camera image sensor matrix **401'** (see fig. **37c**). The dotted line **387** and/ or **387'** on fig. **37b** (not

shown on fig. **37a** for clarity reason) denotes, relative to the camera image, a fraction or fractions of matrix pixels being a selected part of the available sensor matrix pixels. Said fraction **387** of sensor matrix pixels is dedicated to detection of the array or column of markings, as well as any events observable by said fraction of pixels and which could trigger an action, such as stopping operation of a motor, e.g. motor **404** or **422** with reference to figs. **46, 47, 48, 49** and **51**. Similarly, said fraction **387'** of sensor matrix pixels is dedicated to detection of the array **385"** or row of markings, as well as any events observable by said fraction of pixels and which could trigger an action, such as stopping operation of a motor, e.g. motor **404** or 422 with reference to figs. **46, 47, 48, 49** and **51**. As indicated above, the arrays **385** and **385"** of markings **385'** and **385"'** could both be present, yielding that both fractions **387** and **387'** will be active for detection of markings and observable events.

[0195] A background area **314 ; 350** is located in the camera field of view, and as shown on e.g. fig. **40a**, said background area in a part thereof exhibits the array **385** of distinguished markings **385'**.

[0196] As indicated on e.g. figs. **26** and **40a**, and derivable from fig. **46**, the background area **313; 350** is located in a camera viewing chamber of a reverse vending machine. The chamber or input receiving area **210** (figs. **6 – 9**) has entry opening (see **425** on fig.**46**) into which an object **10** in the form of an empty beverage container to be viewed by the camera, is insertable. From fig. **40a** is noted that the array **387** of markings is located at an entry opening or region **425** of said viewing chamber **210**. The in-feed direction for objects is indicated by reference numeral **388** on fig. **37b**. As indicated on figs. **37a, 37b** and **40a** the array of markings is in a predefined pattern, suitably a column **385** of mutually spaced markings **385'**. However, as disclosed above there could be as an alternative or in combination with the pattern **385** an additional predefined pattern **385"** of mutually spaced markings **385"'** extending as e.g. an upper row, to provide an addition light curtain and to safeguard against any safety hazards caused by someone trying to put e.g. a hand into the viewing chamber from above, as e.g. indicated by reference numeral **388'**.

[0197] As indicated above, the fraction **387** and/ or fraction **387'** of sensor matrix pixels **401'** in the camera **400** will be dedicated to providing an image of said markings **385'** and / or **385"'** against said background area. The fraction **387** and/ or fraction **387'** of pixels will be readable by an operating unit **408**, the response of which is dictated by its hardware functions and inputs to the unit **408.** The operating unit **408** is operatively linked with the camera **401** to read said fraction of sensor matrix pixels. Further, the operating unit **408** is

linked to a digital processing and control unit **400**, said unit **400** controlling operation of the camera, i.e. when a camera image is to be taken.

[0198] The operating unit has a set of stored reference pixel signal values which are respectively related to pixels in said fraction of sensor matrix pixels, and which are related to said background area **313; 350** and said array **387** of distinguished markings thereon.

[0199] The operating unit **408** is capable of comparing a read pixel signal value from a respective pixel in said fraction of pixels with corresponding reference signal value assigned to such respective pixel, and to output respective comparison signal, however said operating unit **408** having an output **408'; 408"** capable of changing signal state of delivered signal **393**, suitably into a disabling or deactivating signal when said comparison signal or for that matter a set of such comparison signals departs from a predefined condition.

[0200] The signal **393**, when in a disabling or deactivating state, is effective to cause disablement or halted operation of functional equipment **404; 422** having movable parts, e.g. a motor and its motor controlled parts. In a preferred mode of the invention, the operating unit **408** will, when the comparison satisfies the predefined condition, provide a signal **393** which enables the equipment to remain in operation. Such equipment could e.g. be found in a reverse vending machine as disclosed in the description and shown on the drawings.

[0201] As indicated above, the operating unit **408** is made to execute hardware functions, and the operating unit can be of a logic network of a type well known to any skilled person in the art and connected to execute the required functions. The operating unit can made from a plurality of discrete functional building blocks or a single integrated circuit (IC) as an application specified integrated circuit (ASIC) , e.g. as a so-called Gate Array, or as an implementation in a programmable circuit, so-called Field Programmable Gate Array (FPGA).

[0202] The operating unit **408** may include a watchdog timer **403** which is designed to check that reading of pixel signals from said fraction of pixels and comparison with reference pixel signal values are made at a minimum rate of iteration. The reading of pixels is initiated from the processing and control unit **400**. If said minimum rate of iteration is below a set value, the operating unit **408** may output said signal **393** in a state thereof causing disablement or shut-down of operation of equipment controlled by the unit **408**.

[0203] The signal **393** in a deactivating state will normally be present until such a point of time when a new surveillance image taken meets all preset criteria for not issuing such deactivation type of signal.

[0204] In order to provide proper operation, it is considered that there should be a synchronization of the camera and a light source providing a bright or illuminated background area. Preferably there is used a light reflective material **313** at the camera field of view onto which said dark squares **385'** have been applied. However, if the background **350** is a back-lit or illuminated panel, it could be visualized synchronized operation thereof with the operation of the camera.

[0205] In order to provide a proper safety function, it is appreciated that surveillance images of the chamber or area **210** will have to be generated frequently. Using the camera **401**, it will by means of the operating unit **408** and with aid of the unit **400** be checked first if a complete bright line exists, i.e. all matrix pixel values above a predefined dark level threshold. If this is the case, there will be a search for alternating dark and bright areas along a predefined column, such as column **385**. In a preferred embodiment, the detected image of dark areas **385'** should be within minimum and maximum length requirements to pass acceptance. Further, the bright areas must be of a minimum length before accepted. Also, the image must end with an accepted bright area. Finally, an accumulated number of accepted dark areas must equal a predefined number.

[0206] Fig. **37c** is a system block diagram specifically related to the light curtain functionality, and should be considered essentially as part of the block schematic shown on fig. **46**. The camera **401** is controlled by a digital processor **400** associated with the operating unit. This processor is in fig. **46** denoted as a processing and control unit **400**. Line **389** denotes camera control, and the camera delivers image data signals on line **390** to the operating device **408**. The operating device **408** has a watchdog timer **403** connected thereto. The unit **400** suitably controls triggering of camera imaging, as well as synchronization of the camera and any background illumination. Image data are conveyed from the operating unit **408** to the processor **400** via line **392**, and the processor **400** provides the operating unit 408 with certain control signals via line **392**. The processor **400** is suitably the main processor of the overall system, although this is not necessarily so.

[0207] Most importantly, to avoid the drawbacks known from prior art and as mentioned in the introduction, the dedicated set of sensor matrix pixels forming a fractional part of the the total number of sensor matrix pixels is not selected through use of software, but is instead related to a limited number of physical pixels or elements on the camera image sensor matrix. As the light curtain function is important from an operational safety point of view, it is therefore absolutely essential that the light curtain function is not at all software based.

[0208] From fig. **38** it is noted that the bright background **313 ; 350** has an aperture **365** therein in order to let the camera read via said aperture illuminated marking **366** on a token **367** to be dispensed in a controlled manner. Such token **367** is configured to be related to observed objects , e.g. **10 ; 10' ; 10" ; 10"'** which are supported and to be removed by an object supporting means, e.g. of a type shown on fig. **26** or fig. **32.**

[0209] Suitably, said camera is configured to alternately, selectively or repeatedly a) cause detection of object contour, said light curtain related markings **385'** and **385"'** and events related thereto, and said token marking **366**, and b) cause reading of identifying features, e.g. **10""** or **364** located on the object **10**; denoted on fig. **37a** by reference **362.**

[0210] All embodiments of fig. **25 - 36** can be used with the light curtain function, but the light curtain functionality according to the invention is not limited to the configuration shown on these drawing figures.

[0211] **A Token System**

[0212] As noted from figs. **26, 35, 38, 40a, 40b , 41** and **42** the background area , e.g. **313** or **350** may have an aperture **365** therein in order to allow the camera which views the first region **306** to detect illuminated, pre-printed or pre-provided marking **366** on a token **367** which is arranged to be dispensed in a controlled manner from stack of tokens. Such a token could be related to information such as both a token serial number and a return or redemption value of an object or objects which have been viewed and considered by an RVM. On image part **360** it is indicated how the camera may view such marking, denoted by **366'** through the viewable aperture **365'.**

[0213] In order to obtain an efficient reading of such marking **366** without using an additional light source, the markings on the tokens are suitably made from a retro-reflective material. Alternatively, the token itself could be made from a retro-reflective material and the markings in such a case from non-retro-reflective material.

[0214] As shown on figs. **38, 41a** and **42** said markings are camera readable via a mirror 368 located adjacent the aperture **365** in background area **313; 350**. This may be a practical solution if tokens, e.g. in the form of cards, are dispensable from a dispenser unit **369**. If cards are merely to be inserted into a guide **370** in the front of a RVM (see figs. **26** and **41b**) to be read by the camera and then withdrawn, the card guide may be located at the back of the light reflective area **313** or the panel **350,** so as to place the card with its face having markings **366** parallel to the back of the area **313** or panel **350**.

[0215] In case a light emitting background panel **350** is used, the panel **350** constitutes the first light source which is primarily dedicated to assist camera viewing of object contour. However, light from the second light source will not necessarily impinge upon the marking **366** of a token **367** viewable through the aperture **365**, but if such light in fact impinges upon the marking, it may either be non – parallel light rays or insufficient light in order for the camera to clearly see and cause detection of the markings. In such a case, it is suitable to use an optical beam splitter **371**, as depicted on fig. **35** and a separate light source **372**.

[0216] In the case of using an optical beam splitter covering part of the camera field of view, as shown in figs. **25, 26, 28** and **33**, the camera **308** is suitably configured to take an image of both of said first and second regions simultaneously. However, image taking may just as well be based on taking an image of said first and second regions alternately, or selectively taking a partial image of said first region or said second region.

[0217] In the case where an optical beam splitter covers completely the camera field of view, as seen from figs. **27** and **34**, the camera **308** is configured to take an image of both of said first and second regions simultaneously to form a two part image, as e.g. shown on fig. **37a**. However, it would also be feasible to consider taking a full image of said first and second regions alternately, or selectively taking a partial image of said first region or said second region.

[0218] In the embodiments of figs. **29 - 31**, as well as figs. **35** and **36**, the camera **340; 345; 351; 356; 358** could suitably take images alternately or selectively, although it could be visualized taking two partial images of the viewing region simultaneously, one dedicated to contour recognition and the other to identifying features on the object. The embodiments of figs. **30, 35** and **36** in addition provides for reading of marking on a token, as disclosed e.g. in relationship to fig. **38 – 42.**

[0219] It has been disclosed above that the second light source 301, or for that matter also the light sources **344, 349** and **359** can be constituted by a plurality of light sub-sources, and the light source **301** has been indicated to have e.g. four such sub-sources **302 – 305**, although there could be fewer sub-sources or more. For the other sources **344, 349** and **359** three or four sub-sources have been indicated, without labeling each. The reason for more than one light sub-source is that light reflexes from the object or position of the light sub-source relative to the identifying feature on the object may cause the reading of the feature to be difficult or even impossible. In view thereof the light sub-sources are suitably selectively activated, although activation would be possible individually, in pairs or in groups, or in a cycle.

[0220] Figs. **43 - 45** illustrate a preferred card dispenser **369** to be used for dispensing tokens, e.g. cards **367**. The dispenser **369** has a dispensing outlet **373** for dispensing cards **367** one-by-one from a stack of cards contained in a storage compartment **374**. The markings **366** on the cards **367** are viewable through an opening **375** in the bottom of the dispenser. A pusher member **376** is provided to push out cards one-by one by a reciprocal motion of the pusher member or slide **376**, the reciprocal motion being provided by a controllable motor **377** having control wires **378** for controlling power to the motor. Suitably, the motor **377** has a pinion (not shown) in engagement with a rack **379** on the pusher or slide to enable the reciprocal movement thereof.

[0221] **<u>RVM Operational System Overview</u>**

[0222] Fig. **46** depicts an overall system in which the various aspects of the present invention are implemented.

[0223] The reverse vending machine (RVM) has said processing and control unit **400** which receives video data from the camera **401** via a video analyzer **402**. The camera **401** is also linked to the operation unit **408**, and the operation unit includes the watchdog timer **403** and a motor control. The motor #1 and its control, denoted **404**, are related to the drive of the supporting means **325, 327**, or the unit **333** as disclosed earlier. A motor overload sensor **405** is also provided to inhibit operation of motor #1 in case of jam not detected by the operational unit **408** or a jam detector **406**. The sensor **405** could be in the form of a pressure sensitive bar, or the roller **243** could have its weight sensor **253** (in fig. **46** denoted by **419**) modified in order to also indicate pressure against the roller caused by a jam due to an object not fully located in the recess or space **222**.

[0224] The operation unit **408** is, as disclosed earlier linked with the camera **401** and the processing and control unit (processor) **400**, and in the present example the unit **408** controls the motor controls **404** and **422** directly, although such control could be via the processor **400**.

[0225] As indicated earlier , optically readable cards will normally be read by e.g. camera **401**. However, if a card is a magnetic readable/ writable card or an r.f. readable/ writable card, there will be the need of a card reader / card encoder unit **411**. The card dispenser **361** as disclosed earlier is on fig. **38** denoted by **412** .

[0226] Suitably, the tokens are ready made, pre-coded cards, like the cards **367** which are dispensable one by one from the dispenser means **369; 412** (fig.**46**) and which upon the feed-out from the dispenser **412** via output **412'** is code-read by a code reader/ encoder **411**, in particular if the card is a magnetic stripe or r.f. card. Alternatively, if the card is an optically readable card, the card is read by the camera **401** via aperture **424** and inclined mirror **424'** as more closely disclosed in connection with figs. **38, 41a** and **42** (see references **365** and **368**).

[0227] If the card is a magnetic stripe card or an r.f. card and with no information on the card when it is located in the dispenser, the code reader/ encoder **411** will be able to encode the card with a card code, such as e.g. a serial number or other identity, or the combination of a card code or serial number or other identity and a redemption value to be rewarded or paid, as the cards are fed out from the dispenser one-by-one.

[0228] If the cards to be used for reward of empty beverage containers deposited in the RVM are not to be delivered from a card dispenser, such token could be a personal token which the customer brings with him to the RVM and uses to transfer card identity data from the card to the RVM. If the card is an optically readable card, it can be read by the camera **401** and as indicated further by reference **411'** when inserted into a slot (see reference **370**; fig. **26**) and viewable through an aperture (see reference **370'**; fig. **26**) in the light retro-reflective area (see reference **313**; fig. **26**). If the card is an r.f. readable card, the card could be readable by an r.f. reader **411"**, and if the card is a magnetic stripe readable card, the card could be readable by a magnetic stripe reader **411'"**.

[0229] The cards, irrespective of being optically readable, r.f. readable or encodable, or magnetic stripe readable or encodable, could be in the form of a reusable token, in particular because the cards are in any case validated and after reward has been paid, invalidated. The token could be retrieved from a stack or a band of cards. If a band of cards or a zig-zag

arranged band of cards is used, the dispenser **369** (**412** on fig. **46**) should suitably be replaced by a conventional type of dispenser for such card arrangement. Also, different type of encoder 411 may be required. In any case, the card should have at least an alphanumerical, machine readable code.

[0230] If the token is a card which is optically readable, the card should have a pre-made code thereon, suitably consisting of a bar code or other optically readable code readable by an optical reader such as the camera **401**. As indicated earlier, the bar code or other optically readable code is preferably retro-reflective to light. Such configuration of the card makes an additional light source for viewing the code on the card superfluous. Conversely, the card could be made of a retro-reflective material and the bar code be made of a non-reflective material.

[0231] The processor **400** will either directly, or via a central computer installation **413** transfer to a rewarding or check-out and payment station **414** information related to a readable token code and information related to said return value. Transfer of information to and from the processor to the computer **413** and the station **414** is suitably via a local area network (LAN) **415**. The station **414** has a card reader **416** to read the card before reward or redemption value is paid. The card is then invalidated through use of a token invalidation means **407** associated with the station **414** or through internal operation in the unit **400** and/ or the computer **413.** In an alternative embodiment the processor **400** communicates with a "tick-off" unit **417**, which could be in the form of a mini-computer, such as so-called PDA. This could be a solution useful for a small store, through which there is conveyed to the unit **417** from the processor displayable information such as visible card identity and sum to be paid. Upon payment of the required money, the operator ticks off the particular item displayed, which is then made void or invalid, cancelled in the unit **400** and/ or computer **413**, and suitably removed from the display on the unit **417**.

[0232] The RVM has suitably a display **418** to properly guide or inform an RVM user how to operate. If the display is a touch screen, the customer may communicate with the processor **400**. The container weight sensor **419** indicated on fig. **46**, which has been described earlier in the context of fig. **18** as sensor **253**, is provided to engage an end **247** of an axle **243'** (see fig. **26**) of the roller **243**, so as to spot whenever a too heavy beverage container is fed into the RVM through an opening **425** on the RVM. The term "too heavy" in this context is meant to imply that the unit **400**, upon receiving information related to shape and identity features, will compare these data with library data in the unit **400**, and thereby determine whether the

object in fact should weigh less or not. This has been disclosed in more detail earlier. Also as indicated, the weight sensor could suitably form or supplement the jam sensor **405**.

[0233] An interlock-mechanism **420** is provided for safety reasons. The mechanism is suitably a set of sensors and switches to ensure that the RVM cannot be operated unless all units are in proper place and all cabinet panels are in proper mounted position and cabinet doors are locked.

[0234] A power supply **421** is provided, suitably linked to power consuming units via the unit **400**.

[0235] A motor and control unit **422** is provided to cause the volume of a collection container **426** to be adjusted by winding or unwinding a flexible side and bottom **426'**. However, although fig. **51** shows a collection container **426**, it would be understood by the average expert in the art that other operational equipment could be installed and operated instead of the collection container. Such equipment could include one or more from the group of: conveyor; pusher unit; rotation means; compactor; disintegrator; sorter means. The positioning and evidently the configuration of such equipment in cooperation with the motor **422** could be substantially different from that of the collection container **426**. The collection container is particularly suitable for heavier objects, e.g. bottles of glass.

[0236] Reference numeral **423** in fig. **46** denotes a position sensor which is used to detect rotary positions of the drum **220**, or the plunger **270**, and will be described in slightly more detail in connection with figs. **50a** and **50b**.

[0237] The reference numeral **100** denotes generally a storage compartment for receiving objects delivered from the supporting, sorting, conveying and push-out unit**200**. The storage chamber or compartment **100**, as shown also in fig. **51** has been extensively disclosed earlier in the present disclosure, see disclosure related to figs. **1 - 24**, and figs. **2 – 8** in particular.

[0238] **Electro-mechanical Drive Device**

[0239] Figs. **47, 50a, 50b and 51** show that the unit **200** is powered by a motor **404** via a gear **500** which engages a gear **501** on the unit **200** to turn the drum **220** and in so doing also moving the element **223**. The roller **243** is forcibly moveable through interaction between a small gear **502** and the substantially larger gear **501**. Motor **404** is fixedly attached to the framework **503** of the RVM via brackets **504**, whereas the unit can be pulled out entirely from the RVM cabinet **428** (see reference **250** on figs. **18** and **19**) for cleaning, as indicated by arrow **505**, and be pushed into the cabinet again after cleaning for gear engagement between

gears **500** and **501**. No electrical parts are present on the unit **200**, just mechanical parts which stand wet cleaning, and even high pressure wet cleaning without any problem.

[0240] Thus, it is clearly seen that the advantages offered by the present invention reside in that the unit **200** is connected via a mechanically separable power transfer coupling formed by gears **500** and **501**, the gear **500** being operated by the motor **404** which is stationary fixed in the cabinet **428**. Thus the electrically powered drive **404, 500** is located separable from the unit **200** and its gears **501, 502**.

[0241] Figs. **48a** and **48b** show a collection container **426** powered by a motor **422**. The motor **422** has in a non-limiting example a winged male, spindle-like member **506** which is configured to fit in a releasable manner into a winged, female member **507** on a drive shaft **508**, the drive shaft **508** in this non-limitative example to be use for winding or unwinding the flexible side and bottom **426'**. The container **426** can be pulled out of the RVM cabinet **428** for emptying and cleaning, and pushed into the cabinet again for engagement between the members **506** and **507**. The motor **422**, like motor **404** is suitably fixedly attached to the framework **503** of the RVM cabinet or to the cabinet wall or any suitable stay in the cabinet. When the unit **200** or the container **426** are in position in the cabinet and with a cabinet front door closed, there will be full engagement between the power gear **500** and the gear **501** (see element **244** on fig. **10**), and similarly between members **506** and **507**. The wing configuration on members **506** and **507** ensures that full rotational locking engagement is provided.

[0242] Instead of the male/ female coupling **506/ 507** on figs. **48a** and **48b**, a male/ female coupling as shown on figs. **49a** or **49b** could be used. Suitably, the female part of the coupling would be on the handling unit side, and with the male part at the drive-motor side, although the arrangement could be vice versa.

[0243] In the example of fig. **49a**, the male part has a spring-loaded plug **509**, loaded by a spring **510** in a housing **511** and powered by a motor **512** via a drive shaft **513**. The female part has a housing **514** with a drive shaft **515** connecting to a drive mechanism (not shown) located on a handling unit, such as e.g. a handling unit like the unit **200** or **426**. The housing has a recess or socket **516** configured to fit the plug **509**. It is appreciated that when the handling unit is pushed into the cabinet, the end face **514'** of the housing **514** will more than likely abut the end face **509'** of the plug **509**, as in most cases the plug **509** is not aligned with the socket **516**. However, when the motor **512** (fixedly attached to the cabinet or the cabinet

framework or stays) starts to operate, the housing **511** with the plug **509** pushed into the housing **511** starts to rotate until the plug is aligned with the socket **516**, at which moment the plug **509** will pop out from the housing 511 and into the socket 516, whereby mechanical coupling is established between the motor 512 and the handling unit.

[0244] In the example of fig. **49b**, the male part **524** has a four-winged plug **525** with a spike **526**, powered by a motor **512** via a drive shaft **513**. The female part has a housing **527** with a drive shaft **528** connecting to a drive mechanism (not shown) located on a handling unit, such as e.g. a handling unit like the unit **200** or **426**. The housing has a socket **529** configured to fit the plug **525**. The spike **526,** which is for aligning the male and female parts **524; 527** fits into a recess **530** in the female part **527**. When the handling unit is pushed into the cabinet, the end face **527'** of the female part **527** will more than likely abut the end face **525'** of the plug **525**, as in most cases the plug **525** is not aligned with the socket **529**. The female part **527** will thus be pushed backwards about and along the shaft **528** against action from a spring **531**. However, when the motor **512** (fixedly attached to the cabinet or the cabinet framework or stays) starts to operate, the part **524** with the plug **525** starts to rotate until the plug is aligned with the socket **529**, at which moment the female part **527** will move by spring force towards the male part **524** and allow the socket **529** to be mechanically engaged with the plug **525**, whereby mechanical coupling is established between the motor **512** and the handling unit.

[0245] If required, releasable locking means, suitably easily reachable by maintenance staff, could be provided to fully lock units like those labeled **200** and **426** in position relative to the RVM cabinet.

[0246] As indicated on fig. **46**, sorter or drum rotary position detectors **423** may be provided. Fig. **50a** shows position detectors **517** and **518** interacting with markings **517', 518'** on the drum cog-wheel **519**. The detectors may be of a magnetic type detecting metal elements constituting said markings . The markings may be of an optical type if the detectors are of optical type. In fig. **50b** optical detectors **520, 521** interact with a code-disk attached to the rotation-shaft **523** of the drum.

[0247] Modification of the various elements, means and devices related to the numerous aspects of the present invention would be conceivable within the scope of the invention as defined in the attached claims.

C L A I M S

1.

Upwardly oriented storage (100) having an interior space (110, 112) for storing height-wise returnable items (10), such as bottles, cans and the like of plastic, glass or metal, said storage comprising:

a) a bottom (120, 121, 122) and at least one side wall (130, 131, 132),

wherein the storage further comprises:

b) a feed opening (140, 142) arranged

i) in the bottom or

ii) in the sidewall and at a relatively short distance height-wise from the bottom such that a substantial part of the storage space is located above the feed opening, and

c) a conveyor means (200) adjacent to the feed opening and adapted to force a returnable item towards the feed opening, and

wherein the storage space exhibits a width dimension (111) being a multiple of the width dimension or in excess of a length dimension of a returnable item for storage in said upwardly oriented storage, whereby a plurality of returnable items can be accommodated in said interior space as one of more of: substantially side by side, at least in part side by side, and in a random "criss-cross" manner.

2.

Upwardly oriented storage according to claim 1, wherein the conveyor means is adapted to effect forced pushing or thrust-like forcing of a returnable item towards the feed opening.

3.

Upwardly oriented storage according to claim 1 or 2, further comprising an upper part (150) having a substantially unitary and in a vertically direction movable top section (151) which by its upwards movement provides an increase of the interior space volume, or by its downwards directed movement provides a reduction of the interior space volume, accordingly.

4.

Upwardly oriented storage according to claim 1 or 2, further comprising an upper part (150) having at least one foldable wall (152) which by its expansions provides an increase of the interior space volume, and by its collapsing provides a reduction of the interior space volume, respectively.

5.

Upwardly oriented storage according to claim 1 or 2, comprising an overflow opening (160) arranged in an upper part of said storage for providing communication from the interior space to a supplementary storage volume (161).

6.

Upwardly oriented storage according to any one of the previous claims, wherein at least a part of the bottom (120, 121, 122) is movable for providing a bottom opening for emptying of the storage.

7.

Upwardly oriented storage according to any one of the previous claims, wherein at least one part of a side wall (130, 131, 132) of the storage is movable for providing an opening for emptying of the storage.

8.

Upwardly oriented storage according to any one of the previous claims, wherein at least a part of a side wall (130, 131, 132) of the storage is movable for providing a modification of the shape of the interior space (110, 112), particularly for providing an increase of the cross section (11, 113) of the interior space in an area proximal to an opening provided for emptying the storage.

9.

Upwardly oriented storage according to any one of the claims 1 - 8, wherein the conveyor means (200) includes:

- a drum (220) adapted for coupling to a drum drive, said drum being rotary about a central longitudinal axis (221) and having in an axial direction an elongate and radially extending recess (222) adapted to receive a returnable item,

- an elongate element (223) provided in said recess (222), which element (223) is adapted to be movable in a piston-like way in a radial direction relative to said drum between a retracted position and an advanced position,

- an element drive (230) adapted to provide a movement of said element between said retracted position in a secondary rotary position of said drum and in an advanced position in a first or third rotary position of said drum,

- an allocated input area (210) for receiving returnable items to be placed on an upper circumferential part of the drum when the drum is in said first rotary position, which input area is located above said drum, the element drive being adapted to position the element in the retracted position when the drum is positioned in the second rotary position with the recess in the drum facing upwards towards the input area, and

- a first output (224) provided in communication with the storage in-feed opening, proximal to an outer surface level (228) of said drum, and covering an angular interval for the drum rotation that includes the third rotary position, and

wherein the conveyor means (200) is arranged such that a returnable item having been deposited in the input area and received in the recess when the drum is in the second rotary position with the recess facing upwards towards the input area and the element in the retracted position will be driven out of the recess and towards the first output and into the storage in-feed opening by the element when the drum by its rotation in a first direction of rotation is brought to the third rotary position as the element is moved to the advanced position.

10.

Upwardly oriented storage according to claim 9, wherein a recess limiting means (229) is situated adjacent the recess and adapted to prevent any axial movement beyond the length of the drum of the returnable object/ item deposited in the recess.

11.

Upwardly oriented storage according to claim 9 or 10, wherein the conveyor means further comprises a guide means (241) adapted to retain a returnable item deposited in the recess as the drum is positioned in a rotary position between the second rotary position and the first output or a second output.

12.

Upwardly oriented storage according to claim 11, wherein the guide means is provided by a curved plate adapted to a curved outer contour (228) of the drum, and which plate substantially covers the recess opening as the drum is positioned between the second rotary position and said first output or said second output

13.

Upwardly oriented storage according to claim 11, wherein said second output is at a fourth rotary position or at the first rotary position.

14.

Upwardly oriented storage according to any one of claims 9 - 13, wherein an outer surface of the element (223) in the advanced position, particularly when the drum is placed in a rotary position with the recess opening facing an exit, is substantially flush with or outside an outer contour (228) of the drum.

15.

Upwardly oriented storage according to any one of claims 9 - 13, wherein the conveyor means includes a frame into which the drum is rotatably supported.

16.

Upwardly oriented storage according to any one of claims 9 - 15, wherein the frame includes a cabinet adaptor means (242) for providing movable positioning of the conveyor means in a corresponding receiving means (251) in a cabinet (250).

17.

Upwardly oriented storage according to any one of claims 9 - 16, further comprising a leading means (243), preferably provided by way of a rotatable leading roller, arranged above and proximal to said drum, such that the leading means, by rotation of the drum, contributes to a rotation of a returnable item when the returnable item has been positioned on the drum through the input area.

18.

Upwardly oriented storage according to claim 17, further comprising a leading roller drive (224) for driving the rotatable leading roller.

19.

Upwardly oriented storage according to claim 18, wherein the leading roller drive provides a drive of the leading roller (243) in a direction of rotation that corresponds to a direction of rotation for a drum and with a peripheral velocity that substantially corresponds to a peripheral velocity of the drum outer surface (228).

20.

Upwardly oriented storage according to any one of claims 17 - 19, wherein a first bearing support (245) for the leading roller is provided in connection with a weighing cell (246) for determining a mass of a returnable item.

21.

Upwardly oriented storage according to claim 20, wherein the conveyor means comprises a frame providing a bearing point for the rotation of the drum, and wherein the weighing cell (246) is connected to the frame.

22.

Upwardly oriented storage according to any one of claims 17 - 19, wherein the conveyor means includes a frame (240) in which the drum is suspended for its rotation, said drum being adapted for mounting into a cabinet, and wherein the leading roller is adapted for a first bearing point (247) and a second bearing point (246), and wherein the second bearing point has been provided connected to the frame (240) and the first bearing point (247) is provided with a leading roller bearing means (252) connected to the cabinet (250).

23.

Upwardly oriented storage according to claim 22, wherein the leading roller bearing arrangement (252) is connected to the cabinet by way of a weighing cell (253) for determining a mass of a returnable item.

24.

Upwardly oriented storage according to any one of claims 9 - 23, comprising a facility (20) for non-contacting identification of a returnable item positioned on an outer surface of the drum or on the element when the element is in the advanced position.

25.

Upwardly oriented storage according to claim 24, wherein the facility (20) for non-contact identification is adapted to employ an energy wave transmitted from the facility and the drum is provided with a directional reflector for reflecting the transmitted energy wave substantially back towards the facility.

26.

Upwardly oriented storage according to any one of claims 1 - 8, wherein the conveyor means (200) comprises:

- an allocated input area (210),
- an elongate house (260) having a plunger (270) arranged movable in a piston like way in an interior space (261) lengthwise in the housing between at least a first position and a second position, the house being positioned under the input area and being provided with an input opening (262) for providing communication between the input area and the interior space, which housing at least at one end has an exit (263; 264) positioned proximal to the storage feed opening (140 ;141; 142), and
- a plunger drive (280) for driving the plunger to and between the first and second positions,

said conveyor means further adapted such that a returnable item which has been positioned in the input area will

a) fall through the input opening and into the interior space when the plunger is positioned in the first position, and

b) be forced out of the housing through said exit and towards the storage feed opening by the plunger when the plunger is driven from the first position to the second position.

27.

Upwardly oriented storage according to claim 26, wherein the plunger drive is adapted to place the plunger in a third position in which it by its form and positioning substantially covers the input opening, and whereby a returnable item which has been received in the input area is blocked from falling through the input opening by remaining on the plunger when the plunger is placed in the third position.

28.

Upwardly oriented storage according to claim 26 or 27, wherein the plunger is provided with an upper surface (271) arranged to face the input opening, and wherein the conveyor means comprises a rotator means (273; 273') adapted for assisting in providing a rotation of a

returnable item positioned on the plunger, by a movement of the plunger about the third position.

29.

Upwardly oriented storage according to claim 28, comprising a rotator means drive (274; 274') adapted to effect a movement of a surface of the rotator means to a surface velocity corresponding substantially to a surface velocity of the upper surface of the plunger when it is moved past the third position.

30.

Upwardly oriented storage according to claim 29, wherein the rotator means is one of a rotary roller, a rotary cylinder, a band or a movable plate.

31.

Upwardly oriented storage according to claim 30, wherein the rotator means is rotatably carried by a supporting mounting (275) provided with a weighing cell (276) for determining a mass of a returnable item.

32.

Upwardly oriented storage according to claim 27, wherein the housing has two alternative exits, one at each end of the housing.

33.

Upwardly oriented storage according to claim 32, further comprising a third exit opposite and below the input opening.

34.

Upwardly oriented storage according to claim 31, wherein the plunger on its upper surface (271) has a frictional structure.

35.

Upwardly oriented storage according to any one of claims 26 - 34, comprising an identification facility (20) for non-contact identification of a returnable item being placed in the input area.

36.

Upwardly oriented storage according to claim 35, wherein the identification facility (20) is adapted to employ an energy wave transmitted from the facility (20), and wherein a directional reflector (21) is arranged on the conveyor means (200) for reflecting a transmitted energy wave back towards the identification facility, in particular when the plunger is in the third position.

37.

Upwardly oriented storage according to claim 36, wherein the directional reflector is provided on the plunger.

38.

Upwardly oriented storage according to any one of the previous claims, comprising a return stop means (170) provided with the storage in-feed opening (140, 142) or an exit (224, 263) of the conveyor means for preventing any substantial return movement of a returnable item that has been forced towards the storage feed opening.

39.

Upwardly oriented storage according to any one of claims 9 - 25, wherein the conveyor means comprises a second exit (226, 226') and the plunger drive is adapted to move the element to

the advanced position by rotation of the drum in a second direction of rotation to a third rotational position with the recess opening facing the second exit, which third rotary position is different from the first and second rotary positions, and wherein a returnable item which has been received in the recess when the drum is in the second rotational position with the element in the retracted position will be forced out of the recess and towards the second output by placement of the drum in the first or a fourth rotary position.

40.

Upwardly oriented storage according to any one of claims 1 - 8, wherein the conveyor means comprises at least one of:

a) a drive element being adapted to in forced pushing or thrust forcing way driving a returnable item towards the storage in-feed opening, and

b) a compactor with a compactor exit positioned proximal to the in-feed opening for forcing a compacted returnable item towards the storage in-feed opening.

41.

Upwardly oriented storage according to any one of claims 1 - 8, wherein the in-feed opening (140, 141) is adapted in size to a maximum returnable item dimension for which the storage is intended, and wherein the interior space (110, 112) exhibits at least one width dimension (111,113) that exceeds substantially the largest dimension of returnable items, whereby a plurality of returned items each exhibiting said largest dimension can be accommodated side by side within the interior space.

42.

Upwardly oriented storage according to any one of claims 9 - 41, wherein the interior space (110, 112) exhibits a width dimension (111, 113) being a multiple of a lateral dimension (235) of the recess (222) or a lateral dimension (266) of the input opening (262) of the elongated housing, whereby a plurality of returnable items can be accommodated substantially side by side in the interior space.

43.

Upwardly oriented storage according to any one of the previous claims, wherein the interior space (110, 112) is dimensioned such that it will effect an at least sideways or at least partly upwards movement of a returnable item being positioned in the interior space when the interior space has been filled up to the feed opening and a further returnable item is forced into the storage by the conveyor means.

44.

Upwardly oriented storage according to any one of claims 26 - 38, wherein the housing (260) on a second end has a second exit (264), adapted for being positioned in communication with a second feed opening (142) in second interior space (112), and

wherein the conveyor means is adapted such that a returnable item which has been received in the input area will:

a) fall through the input opening (262) and into the interior space (261) when the plunger (270) is positioned in the second position, and

b) being forced out of the housing through the second exit (264), preferably also towards the second feed opening of the second interior space, by the plunger when the plunger is driven from the second position and to the first position.

5.

Upwardly oriented storage according to any one of claims 27 - 38, wherein the housing (260) exhibits a closable third exit (265) arranged underneath the input opening (262) and in connection with a third feed opening (144) to a third interior space (114) whereby a free passage is provided in the conveyor means from the input area (210) towards the third interior space when the plunger is positioned in a position that is different from the third position and the closable third exit is in an open state.

46.

Upwardly oriented storage according to any one of the previous claims, wherein a deflector (180) is provided in the interior space (110).

47.

Upwardly oriented storage according to claim 10, wherein the recess limiting means is provided by drum end walls (229).

48.

Conveyor means for a facility for receiving returnable items, in particular containers such as bottles, cans and the like of plastic, glass or metal, comprising:

- a drum (220) adapted for coupling to a drum drive, said drum being rotary about a central longitudinal axis (221) and having in an axial direction an elongate and radially extending recess (222) adapted to receive a returnable item,

- an elongate element (223) provided in said recess (222), which element (223) is adapted to be movable in a piston like way in a radial direction relative to said drum between a retracted position and an advanced position,

- an element drive (230) adapted to provide a movement of said element between said retracted position in a secondary rotary position of said drum and in an advanced position in a first or third rotary position of said drum,

- an allocated input area (210) for receiving returnable items to be placed on an upper circumferential part of the drum when the drum is in said first rotary position, which input area is located above said drum, the element drive being adapted to position the element in the retracted position when the drum is positioned in the second rotary position with the recess in the drum facing upwards towards the input area, and

- a first output (224) provided in communication with the storage in-feed opening, proximal to an outer surface level (228) of said drum, and covering an angular interval for the drum rotation that includes the third rotary position, and

wherein the conveyor means (200) is arranged such that a returnable item having been deposited in the input area and received in the recess when the drum is in the second rotary position with the recess facing upwards towards the input area and the element in the retracted position will be driven out of the recess and towards the first output and into the storage in-feed opening by the element when the drum by its rotation in a first direction of rotation is brought to the third rotary position as the element is moved to the advanced position.

49.

Conveyor means according to claim 48, wherein the drum at least adjacent to the recess is provided with a recess limiting means (229) being adapted to prevent any axial movement of the object/ item deposited in the recess beyond the lengthwise extension of the drum.

50.

Conveyor means according to claim 48 or 49, wherein the conveyor means further comprises a guide means (241) adapted to secure a returnable item deposited in the recess as the drum is positioned in a rotary position between the second rotary position and the first output or a second output.

51.

Conveyor means according to claim 50, wherein the guide means is provided by a curved plate adapted to a curved outer contour (228) of the drum, and which plate substantially covers the recess opening as the drum is positioned between the second rotary position and said first output or said second output.

52.

Conveyor means according to claim 50, wherein said second output is at a fourth rotary position or at the first rotary position.

53.

Conveyor means according to any one of claims 48 - 52, wherein an outer surface of the element (223) in the advanced position, in particular when a drum is placed in a rotary position with the recess opening facing an exit, is substantially flush with or outside a circumferential outer contour (228) of the drum.

54.

Conveyor means according to any one of claims 48 - 53, further comprising a rotatable leading roller (243) arranged above or adjacent to the drum, such that the rotational roller, by rotation of the drum, contributes to a rotation of a returnable item having a substantially circular cross section when the returnable item via the input area has been placed on a recess free, upwardly facing part of the drum circumferential surface.

55.

Conveyor means according to claim 54, further comprising a leading roller drive (224) for driving the rotatable leading roller.

56.

Conveyor means according to claim 55, wherein the leading roller drive effects drive of the leading roller in a directional rotation that corresponds to the direction or rotation of the drum and with a peripheral velocity that substantially corresponds to a peripheral velocity of the drum.

57.

Conveyor means according to any one of claims 54 - 56, wherein a bearing point (254) of the leading roller is provided with a weighing cell (246) for determining a mass of a returnable item.

58.

Conveyor means according to claim 57, wherein the conveyor means comprises a frame (140) carrying the drum supported for its rotation, and wherein the weighing cell (246) is connected to the frame.

59.

Conveyor means according to any one of claims 54 - 56, wherein the conveyor means comprises a frame (240) carrying the drum supported for its rotation, which frame is adapted for mounting in a support structure (250), and wherein the leading roller is adapted with a first bearing point (247) and second bearing point (246), said second bearing point being carried by the frame (240) and said first bearing point (247) being carried by a bearing arrangement (252) connected to the cabinet (250).

60.

Conveyor means according to claim 59, wherein the bearing arrangement is connected to the cabinet by way of weighing cell (253) for determining a mass of a returnable item.

61.

Conveyor means according to any one of claims 48 - 60, wherein the element drive is adapted to move the element to an advanced position by placement of the drum in a fourth rotational position or the first rotational position with the recess opening thus facing a second exit (226; 226'), whereby a returnable item received in the recess when the drum is in the second rotational position with the element in the retracted position will be forced out of the recess and towards the second exit or by placement of the drum in the fourth position or the first position, respectively.

62.

Conveyor means according to any one of claims 48 - 61, further comprising a facility (20) for non-contact identification of a returnable item that has been positioned on an outer surface of the drum or on the element when the element is in the advanced position.

63.

Conveyor means according to claim 62, wherein the facility (20) for non-contact identification is adapted to employ an energy wave transmitted from the facility, and the drum

is provided with a directional reflector for reflecting the transmitted energy wave substantially back towards the facility.

64.

Conveyor means according to any one of the previous claims 48 - 63, further comprising a vertically oriented storage for height-wise storing of returnable items, said vertically oriented storage comprising:

- a bottom and at least one side wall, and
- a feed opening arranged adjacent to the first exit (224) and
  - i) in the bottom, or
  - ii) in the side wall and in a relatively small distance height-wise from the bottom

such that a substantial part of the storage is located above the feed opening.

65.

Conveyor means according to claim 64, wherein the vertically oriented storage further comprises a unitary upper and in a vertically direction movable part which through its upwards movement provides an increase of a storage volume, and by its downward movement provides a reduction of a storage volume, respectively.

66.

Conveyor means according to claim 64, wherein the vertically oriented storage further comprises an upper part having at least one foldable sideway which by its expansion provides an increase of the storage space, or by its retraction provides a reduction of the storage space, respectively.

67.

Conveyor means according to any one of claims 64 - 66, wherein the vertically oriented storage further comprises an overflow opening provided in an upper part of the storage for

communication with a surplus storage volume, such that an overflow is provided from the storage to the surplus volume.

68.

Conveyor means according to any one of claims 64 - 67, wherein a bottom of the vertically oriented storage is movable for provision of a bottom opening for emptying of the storage.

69.

Conveyor means according to any one of claims 64 - 68, wherein a sidewall of the vertically oriented storage is movable for providing an opening for emptying of the storage.

70.

Conveyor means according to any one of claims 64 - 69, wherein a sidewall of the vertically oriented storage is movable for effecting an adaptation of the inner shape of the storage, particularly for increase of a cross section adjacent to an opening for emptying of the storage, for facilitating emptying of the storage by gravity.

71.

Conveyor means according to any one of claims 64 - 70, further comprising a return flow blocker (170) adapted to provide a return movement of a returnable item that has been forced towards the feed opening.

72.

Conveyor means according to claim 10, wherein the recess limiting means is provided by drum end walls (229).

73.

Conveyor means (200) for a facility for receiving returnable items, particularly containers such as bottles, cans and the like of plastic, glass or metal, wherein it comprises:

- an allocated input area (210),
- an elongate housing (260) having a plunger (270) arranged movable in a piston-like way in an interior space (261) lengthwise in the housing between at least a first position and a second position, the housing being positioned under the input area and being provided with an input opening (262) for providing communication between the input area and the interior space, which housing at least at one end has an exit (263; 264) positioned proximal to the storage feed opening (140 ;141; 142), and
- a plunger drive (280) for driving the plunger to and between the first and second positions,

said conveyor means further adapted such that a returnable item which has been positioned in the input area will

a) fall through the input opening and into the interior space when the plunger is positioned in the first position, and

b) be forced out of the housing through said exit and towards the storage feed opening by the plunger when the plunger is driven from the first position to the second position.

74.

Conveyor according to claim 73, wherein the plunger drive is adapted to place the plunger in a third position in which it by its form and positioning substantially covers the input opening, and whereby a returnable item which has been received in the input area is blocked from falling through the input opening by remaining on the plunger when the plunger is placed in the third position.

75.

Conveyor according to claim 74, wherein the plunger is provided with an upper surface (271) arranged to face the input opening, and wherein the conveyor means comprises a rotator

means (273; 273') adapted for assisting in providing a rotation of a returnable item positioned on the plunger, by a movement of the plunger about the third position.

76.

Conveyor according to claim 75, further comprising a rotator means drive (274) adapted to effect a movement of a surface of the rotator means to a surface velocity corresponding substantially to a surface velocity of the upper surface of the plunger when the plunger is moved about the third position.

77.

Conveyor according to claim 76, wherein the rotator means is one of a rotary cylinder, a rotary roller, a band or a movable plate.

78.

Conveyor according to claim 76, wherein the rotator means is rotatably carried by a supporting mounting (275) provided with a weighing cell (276) for determining a mass of a returnable item.

79.

Conveyor according to claim 74, wherein the housing has two alternative exits, one at each end of the housing.

80.

Conveyor according to claim 79, further comprising a third exit opposite and below the input opening.

81.

Conveyor according to claim 73 or 74, wherein the plunger on its upper surface (271) has a frictional structure.

82.

Conveyor according to any one of the previous claims 73 - 81, comprising a identification facility (20) for contact-less identification of a returnable item placed in the input area, and

a control means associated with the identification facility for controlling the plunger to effect a sorting of received returnable items in dependence of their identity.

83.

Conveyor according to claim 82, wherein the identification facility (20) is adapted to employ an energy wave transmitted from the facility (20), and wherein a directional reflector (21) is arranged on the conveyor (200) for reflecting the transmitted energy wave back towards the identification facility, in particular when the plunger is placed in the third position according to claim 74.

84.

Conveyor according to claim 83, wherein the directional reflector is arranged on the plunger.

85.

Conveyor according to any one of the previous claims 73 -84, further comprising a return blocker (170) arranged at the exit (263) of the conveyor to prevent a substantial return movement of a returnable item which has been forced out through the exit.

86.

Conveyor according to any one of the previous claims 73 - 85, wherein the housing (160) at a second end has a second exit (264) positioned adjacent to a second feed opening (142) of a

second storage space (112), and wherein the conveyor is arranged such that a returnable item which has been received in the input area will:

a) fall through the input opening (262) and into the interior space (261) when the plunger (270) is placed in the second position, and

b) be forced out of the housing through the second exit (264) and towards the second feed opening (142) in the second storage (113) by the plunger when the plunger is driven from the second position and to the first position.

87.

Conveyor according to any one of the previous claims 73 - 86, wherein the housing (260) is provided with a closable third exit (265) arranged opposite and below the input opening (262) and in connection with a third in-feed opening (144) of a third storage space (114), whereby the conveyor provides a free passage from the input area (210) to the third feed opening (114) when the plunger is placed in a position that is different from the third position and the closable third exit is in an open state.

88.

Conveyor means according to any one of the previous claims 73 - 87, further comprising a vertically oriented storage for height-wise storing of returnable items, said vertically oriented storage comprising:

- a bottom and at least one side wall, and
- a feed opening arranged adjacent to the first exit (263) and
  - i) in the bottom, or
  - ii) in the side wall and in a relatively small distance height-wise from the bottom such that a substantial part of the storage is located above the feed opening.

89.

Conveyor means according to claim 88, wherein the vertically oriented storage further comprises a unitary upper and in a vertically direction movable part which through its

upwards movement provides an increase of a storage volume, and by its downward movement provides a reduction of a storage volume, respectively.

90.

Conveyor means according to claim 86, wherein the vertically oriented storage further comprises an upper part having at least one foldable sideway which by its expansion provides an increase of the storage space, or by its retraction provides a reduction of the storage space, respectively.

91.

Conveyor means according to any one of claims 88 - 90, wherein the vertically oriented storage further comprises an overflow opening provided in an upper part of the storage for communication with a surplus storage volume, such that an overflow is provided from the storage to the surplus volume.

92.

Conveyor means according to any one of claims 88 - 91, wherein a bottom of the vertically oriented storage is movable for provision of a bottom opening for emptying of the storage.

93.

Conveyor means according to any one of claims 88 - 92, wherein a sidewall of the vertically oriented storage is movable for effecting an adaptation of the inner shape of the storage, particularly for increase of a cross section adjacent to an opening for emptying of the storage, for facilitating emptying of the storage by gravity.

94.

Conveyor means according to any one of claims 88 through 93, further comprising a return flow blocker adapted to provide a return movement of a returnable item that has been forced towards the feed opening.

95.

A device for enabling camera viewing of characteristic features of an object in order to subsequently enable processing of signals related to viewed features ,

wherein a single camera having a field of view arranged to carry out viewing of at least a first and a second region of the object when the object is at an observation location,

wherein a first light source is configured to assist the camera in viewing contour of an object, and

wherein the second light source is configured to assist the camera in viewing any identity feature located on the object.

96.

A device according to claim 95, wherein a light emitting background area forming a bright background is provided against which the contour of an object can be viewed by the camera, said first light source providing light emission from said background area.

97.

A device according to claim 95 or 96, wherein the light emitting background area is retro-reflective to light provided by said first light source.

98.

A device according to claim 97, wherein a light path of light emitted from said first light source is through a lens and from the lens then towards said retro-reflective background area as parallel light.

99.

A device according to claim 95 or 96, wherein the light emitting background area is a light emitting, back-lit or illuminated background panel.

100.

A device according to claim 99, wherein a lens is provided between the camera and said location in order to let the camera view contour of the object by aid of parallel light rays.

101.

A device according to claim 95, 96 , 97 or 99, wherein the second light source is located outside the camera field of view and in a region between the camera and said location.

102.

A device according to claim 98 or 100, wherein the second light source is located outside the camera field of view and in a region between the lens and said location.

103.

A device according to anyone of claims 95 - 102, wherein light from the first light source has a spectral range or composition which is different from light from the second light source.

104.

A device according to anyone of claims 95 - 103, wherein said any identity feature is at least one of: barcode, graphic symbol and, alphanumeric characters.

105.

A device according to claim 95, 96 , 97, 101 or 102, wherein the first light source is arranged to illuminate the first region via a light path which includes an optical beam splitter, at least one mirror and a lens.

106.

A device according to claim 95, 96, 97, 101, 102 or 105, wherein the single camera is located to view the first region via a light path which includes an optical beam splitter, at least one mirror and a lens.

107.

A device according to claim 105 or 106, wherein two mirrors are included in the light path.

108.

A device according to claim 105, 106 or 107, wherein the optical beam splitter is located inclined in the camera field of view and covers at least part of said field of view.

109.

A device according to claim 108, wherein the optical splitter covers approximately half of the camera field of view.

110.

A device according to claim 108, wherein the optical splitter covers the complete camera field of view.

111.

A device according to one or more of claims 95 - 110, wherein the single camera viewing of said first region is via the optical beam splitter and said at least one mirror.

112.

A device according to one or more of the preceding claims 95 - 111, wherein the first region is viewed by the camera with line of sight towards the object shifted by 90°± 30° relative to line of sight of the camera towards the object upon camera viewing the second region.

113.

A device according to one or more of claims 104 – 112, wherein the camera is configured to view the second region via the optical beam splitter, and wherein the second light source is located outside the camera field of view and in a region between the optical beam splitter and an object supporting means at said location.

114.

A device according to one or more of claims 104 - 112, wherein the camera is configured to view the second region outside a location of the optical beam splitter, and wherein the second light source is located outside the camera field of view in a region between the optical beam splitter and an object supporting means at said location.

115.

A device according to one or more of claims 104 - 112, wherein the camera is configured to view the second region via the optical beam splitter, wherein the second light source is located outside the camera field of view in a region between the optical beam splitter and the light reflective or light emitting background.

116.

A device according to claim 95 - 104, 108 , 110 or 115, wherein the single camera views the first and second regions via said beam splitter and a lens.

117.

A device according to one or more of claims 95 - 98, 102 – 104, 108, 109 and 113, wherein there is located an optical beam splitter inclined in the camera field of view and covering the complete camera field of view, wherein the first light source illuminates the first region via the beam splitter and a lens, and wherein the second light source is located outside the camera field of view at a region located between the lens and said second region.

118.

A device according to anyone of claims 95 - 104, wherein the single camera is located to view the first and second regions of the object via a lens, and wherein the second light source is located outside the camera field of view at a region located between the lens and an observation location of the object.

119.

A device according to anyone of claims 95 – 104, wherein the single camera is located to view the first and second regions of the object via a mirror and a lens, and wherein the second light source is located outside the camera field of view at a region located between the lens and an observation location of the object.

120.

A device according to anyone of claims 95 – 104, wherein the camera is located to view directly the first and second regions of the object, and wherein the second light source is located outside the camera field of view at a region between the camera and an observation location of the object.

121.

A device according to anyone of the preceding claims 95 - 120, wherein the first and second regions are fully or partly overlapping.

122.

A device according to one or more of claims 95 - 121, comprising an object supporting means in the form of a rotary drum with an auxiliary roller, the drum and the roller being controllable to rotate the object on a portion of a circumference of the drum, said drum having at least one radial inwardly directed, adjustable space for receiving the object after its rotation and for transporting the object through rotation of the drum to an output location.

123.

A device according to claim 122, wherein the object is camera observable while located in said space and while said space is in at least part of the camera field of view.

124.

A device according to claim 122 or 123, wherein at least a part of the rotary drum is provided with a light retro-reflective coating.

125.

A device according to one or more of the claims 95 – 124, comprising an object supporting means in the form of a housing with an object receiving opening and a movable plunger slidably located therein, preferably with at least one auxiliary roller for roller support upon rotation of the object on the plunger when the plunger moves with its upper surface past said opening, the plunger being controllable to move inside said housing to a position beyond said opening to allow the object to drop into the housing through said opening and by return movement causing the object to be pushed out of the housing to an output location.

126.

A device according to claim 125, wherein the object is observable by the camera while in a location in said housing below said opening and while said location is in at least part of the camera field of view.

127.

A device according to claim 125, wherein at least an upper part of the plunger is provided with a retro-reflective coating.

128.

A device according to anyone of the preceding claims 95 - 127, wherein camera viewing of the first region of the object contour in addition includes detection of presence or absence of said identifying features located on the object.

129.

A device according to one or more of the claims 95 - 128, wherein the camera provides for an image field which is subdivided into at least two partial images, a first partial image being dedicated to detection of object contour and/ or detection of presence or absence of said identifying features, and a second partial image being dedicated to recognition of said identifying features.

130.

A device according to one or more of the preceding claims 95 - 129, wherein the light emitting or bright background area has an aperture therein in order to allow the camera to read an illuminated marking on a token located adjacent a rear side of the background area, said token to be dispensed in a controlled manner and configured to be related to at least one observed object supported by said object supporting means.

131.

A device according to claim 128, wherein said marking on the token is made from one of : a light reflective material, a retro-reflective material, and non –reflective material on a reflective token material.

132.

A device according to claim 130 or 131, wherein said marking is camera readable via a mirror located adjacent the aperture in said light emitting or bright background area.

133.

A device according to claim 130, 131 or 132, wherein said first light source provides illumination of said marking.

134.

A device according to claim 130, 131 or 132, wherein a third light source located behind the background area provides illumination of said marking.

135.

A device according to one or more of claims 95 –109, or one or more of claims 111 – 134 when made subordinate thereto , with an optical beam splitter occupying partly the camera field of view,

wherein said single camera is configured to view both of said first and second regions simultaneously.

136.

A device according to one or more of claims 95 –109, or one or more of claims 111 – 134 when made subordinate thereto, with an optical beam splitter occupying partly the camera field of view,

wherein said single camera is configured to view said first and second regions alternately.

137.

A device according to one or more of claims 95 –109, or one or more of claims 111 – 134 when made subordinate thereto, with an optical beam splitter occupying partly the camera field of view,

wherein said single camera is configured to selectively view said first region or said second region.

138.

A device according to one or more of claims 95 –108, or one or more of claims 111 – 134 when made subordinate thereto, with an optical beam splitter occupying completely the camera field of view, wherein said camera is configured to view both of said first and second regions simultaneously.

139.

A device according to one or more of claims 95 – 108 and 110, or one or more of claims 111 - 134 when made subordinate thereto, with an optical beam splitter occupying completely the camera field of view, wherein said camera is configured to view said first and second regions alternately.

140.

A device according to one or more of claims 95 – 108 and 110, or one or more of claims 111- 134 when made subordinate thereto, with an optical beam splitter occupying completely the camera field of view, wherein said camera is configured to selectively view said first region or said second region.

141.

A device according to one or more of the preceding claims 95 - 140, wherein the second light source consists of a plurality of light providing sub-sources, and wherein said light providing sub-sources are selectively activated.

142.

A device according to claim 141, wherein the light providing sub-sources are activated individually, in pairs or in groups.

143.

A device according to claim 142, wherein activation is made in a cycle.

144.

A device according to claim 141, 142 or 143, wherein at least some of the light providing sub-sources provide light in a spectral range differing from spectral range of light provided by one or more of remaining light providing sub-sources.

145.

A device according to anyone of claims 122 - 128, wherein said single camera for viewing of object contour and viewing of identifying features on the object, said object supporting means with its auxiliary roller, and the object receiving space with a push-out element are all located within a single chamber.

146.

A device according to claim 95, wherein said first light source is a light providing background area against which the object is viewed, wherein a lens is arranged between the camera and said observation location, and wherein said second light source means is arranged outside camera field of view and at a region between the lens and said location to illuminate said location for reading of barcode and for detection of any other identifying features located on the object.

147.

A device according to claim 95, wherein said first light source is a light providing background area against which the object is viewed, and wherein said second light source means is arranged outside camera field of view and at a region between the camera and said location to illuminate said location for reading of barcode and for detection of any other identifying features located on the object.

148.

A device for enabling camera viewing of characteristic features of two regions of an object, in order to subsequently enable processing of signals related to viewed features ,

wherein camera viewing is provided by means of a single camera viewing at least one object observation region via a light beam splitter, and

- wherein camera provides for an image which is subdivided into at least first and second partial images, the first partial image being dedicated to viewing and detection of a contour of the object and/or detection of presence or absence of identifying features on the object, and the second partial image being dedicated to recognition and/or identification of said identifying features.

149.

A device for enabling camera viewing of characteristic features of an object against a light providing or bright background area, in order to subsequently enable processing of signals related to viewed features , a single camera being configured to view a location where the object can be placed and thereby cause subsequent recognition of the contour of the object, a lens being arranged between the camera and said location,

wherein said single camera is also configured to view and cause identification or reading of identifying features located on the object when the object is at said location, and

wherein a light source means is arranged outside camera field of view and at a region between the lens and said location to illuminate said location for reading of barcode and for detection of any other identifying features located on the object.

150.

A device according to claim 149, wherein the camera is configured to view the location via a light beam splitter, and wherein light from another light source means is directed towards the lens via the light beam splitter.

151.

A device according to claim 150, wherein said another light source is configured to illuminate a background area adjacent said location via said lens with parallel light for camera viewing of a contour of an object.

152.

A device according to claim 149, wherein a light emitting or bright background area is provided adjacent said location for camera viewing of a contour of an object.

153.

A device according to claim 152, wherein said light emitting or bright background area is provided by a light emitting, illuminated or back-lit background panel

154.

A device for enabling camera viewing of characteristic features of an object against light providing or bright background area, in order to subsequently enable processing of signals related to viewed features , a single camera being provided and configured to view a location where the object can be placed and thereby cause detection of its contour,

- wherein said camera is also configured to view and cause detection of identifying features located on the object when the object is at said location, and

- wherein a light source means is arranged outside camera field of view to illuminate said location for reading of barcode and detection of any other identifying features located on the object.

155.

A device according to claim 154, wherein said light source means is arranged at a region between said camera and said observation location.

156.

A device according to claim 95, 148, 149, 154 or 155, wherein said object is viewable by the camera against a light providing or bright background area, and wherein said device further comprises an aperture in said background area to enable the camera to view and read through said aperture illuminated marking on a token to be dispensed in a controlled way from a token dispenser included in said device, said token having identification related to such object.

157.

A device according to any one of claims 149 - 155, wherein said light source means consists of a plurality of light providing sub-sources, and wherein the light providing sub-sources are selectively activated.

158.

A device according to claim 157, wherein the light providing sub-sources are activated individually, in pairs or in groups.

159.

A device using a camera to view characteristic features of an object against a light providing or bright background area, in order to subsequently enable processing related to viewed features, said device further comprising an aperture in said background area to enable the camera to view and read through said aperture illuminated object identifying markings on a token dispensable from a token dispenser.

160.

A device according to claim 156 or 159, wherein said marking(s) being camera readable via an inclined mirror.

161.

A safety apparatus for controlling operation of functional equipment having movable parts, said apparatus having a camera configured to view and cause detection of safety related event in a field of view of the camera,

- wherein a background area is in the field of view, said background area in a part thereof exhibiting a set of stationary markings,

- wherein a fraction of sensor matrix pixels in the camera is dedicated to providing an image of said markings, said fraction of pixels readable by a hardware configured operating unit,

- wherein said operating unit has a set of stored reference pixel signal values which are respectively related to pixels in said fraction of sensor matrix pixels, and which are related to said background area and said array of distinguished markings thereon,

- wherein said operating unit is hardware configured to compare a read pixel signal value from a respective pixel in said fraction of pixels with corresponding reference signal value assigned to such respective pixel, and to output respective comparison signal,

- wherein said operating unit has an output capable of changing its signal state of delivered signal when said comparison signal or a set of such comparison signals departs from a predefined condition, said delivered signal when in the form of a disabling or deactivating signal is effective to cause disablement or halted operation of said functional equipment .

162.

An apparatus according to claim 161, wherein said functional equipment is located in a reverse vending machine for receiving empty beverage containers.

163.

An apparatus according to claim 161, wherein said background area is located in a camera viewing chamber of a reverse vending machine, wherein the chamber has at least one entry opening into which an object in the form of an empty beverage container to be viewed by the camera is insertable, and wherein said set of markings is located at an entry region of said viewing chamber and/ or at one or more edge regions of the background area.

164.

An apparatus according to claim 161 or 163, wherein said set of markings includes a pattern of at least one column of mutually spaced markings

165.

An apparatus according to claim 161, 163 or 164, wherein said set of markings includes a pattern of at least one row of mutually spaced markings.

166.

An apparatus according to claim 161, 163 , 164 or 165, wherein said set of markings includes at least one lying, e.g. horizontal, marked line.

167.

An apparatus according to claim 161 or 163, wherein said set of markings form a pattern of mutually spaced markings arranged in at least one column and in at least one row.

168.

An apparatus according to claim 161 or 163, wherein said set of markings form a pattern of mutually spaced markings arranged in at least one column and at least one lying, e.g. horizontal, marked line.

169.

An apparatus according to anyone of claims 163 - 168, wherein said chamber has two entry openings , and wherein said set of markings are located at or adjacent to said openings.

170.

An apparatus according to anyone of claims 163 - 168, wherein said chamber has one entry opening and one exit opening aligned with each other, and wherein said set of markings are located at or adjacent to said openings.

171.

An apparatus according to anyone of claims 161 - 170, wherein said operating unit includes a watchdog timer to check that reading of pixel signals from said fraction of pixels and comparison with reference pixel signal values are made at a minimum rate of iteration.

172.

An apparatus according to claim 171, wherein said operating unit is configured at its output to change its signal state to a disabling or deactivating signal if said minimum rate of iteration is below a set value, in order to disable or halt operation of functional equipment having movable parts.

173.

An apparatus according to anyone of claims 161 - 172, wherein said operating unit is a logic network having a response dictated by its hardware functions and inputs thereto.

174.

An apparatus according to anyone of claims 161 - 173 wherein said operating unit is made from one of :

- a plurality of discrete functional building blocks;
- an application specified integrated circuit (ASIC) , e.g. as a so-called gate array, and
- an implementation in a programmable circuit of the type Field Programmable Gate Array (FPGA).

175.

A token system for use with a reverse vending machine suitable for receiving empty packaging in the form of empty beverage containers, the reverse vending machine being configured by means of a processor to determine return value of the empty packaging and to cause dispensing a token from a token dispenser said token being related at least to the return value, the processor being configured to transfer directly or via a central computer installation

to a rewarding unit or a check-out unit information related to a readable token code and information related to said return value, the rewarding unit or check-out unit having a second code reader in order to provide a reward related to the return value represented on the validated token, and invalidation means in order to make the validation of the token invalid,

- wherein the token is a ready made, pre-coded card which is dispensable from said dispenser operable with the reverse vending machine and a first code reader located at the dispenser to code read the code(s) on the card when dispensed, and wherein the first code reader operative with said processor.

176.

A token system for use with a reverse vending machine suitable for receiving empty packaging in the form of empty beverage containers, the reverse vending machine being configured by means of a processor to determine return value of the empty packaging and to cause the return value to be related to a token, the processor being configured to transfer directly or via a central computer installation to a rewarding unit or a check-out unit information related to the token and said return value in order to validate the token, the rewarding unit or check-out unit having a code reader in order to provide a reward related to the return value represented on the validated token, and invalidation means in order to make the validation of the token invalid,

- wherein the token is a personal card of a user of the reverse vending machine,
- wherein said card is presentable to an encoder means which is operative with said reverse vending machine, and
- wherein the encoder means is configured for entering into the card information in the form of either a card code or a card code plus said return value,
- wherein the encoder means is connected to said processor, and
- wherein the card is an r.f. - card or magnetic stripe card.

177.

A token system for use with a reverse vending machine suitable for receiving empty packaging in the form of empty beverage containers, the reverse vending machine being

configured by means of a processor to determine return value of the empty packaging and to cause the return value to be related to a token, the processor being configured to transfer directly or via a central computer installation to a rewarding unit or a check-out unit information related to the token and said return value in order to validate the token, the rewarding unit or check-out unit having a second code reader in order to provide a reward related to the return value represented on the validated token, and invalidation means in order to make the validation of the token invalid,

- wherein the token is an optically readable card, an r.f. readable card or a magnetic stripe readable card from which is transferable to the reverse vending machine processor via a first card reader information in the form of a card code.

178.

A token system related to a reverse vending machine which is configured to detect and identify characteristic features of an object, tokens being dispensable one-by-one from a token dispenser and configured to be related to an object being observable and detectable for object identification, wherein each token has pre-applied , optical marking(s) thereon being readable by means of a first dedicated optical reader, e.g. a camera arranged in relationship to a token output on the reverse vending machine.

179.

A system according to claim 175, 176, 177 or 178, wherein the token is a reusable token.

180.

A system according to claim 175, 176, 177 or 178, wherein the token is a single-use token.

181.

A system according to claim 179 or 180, wherein the token is retrievable from a stack of cards or a band of separable cards.

182.

A system according to claim 179 or 180, when made subordinate to claim 176 or 178, wherein the token is retrievable from a stack of cards or a band of separable cards, and wherein the stack of cards or band of separable cards is in or is associated with a dispenser means related to the encoder means.

183.

A system according to one or more of the preceding claims 175 - 182, wherein the token has an alphanumerical, machine readable code.

184.

A system according to one or more of claims 175, 177, and 178 –183 when dependent on claim 175 or 177 , for use with an optically readably card, wherein the token has a code consisting of a bar code or other optically readable code readable by the first optical reader being a camera.

185.

A system according to claim 184, wherein the bar code or other optically readable code is of a light reflective or light-retro-reflective material.

186.

A system according to one or more of claims 175, 177, and 179 – 183 when dependent on claim 175 or 177, wherein the token code is stored in a magnetic stripe readable by a magnetic operative reader.

187.

A system according to one or more of claims 175, 177, and 179 – 183 when dependent on claim 175 or 177, wherein the token code is stored in an r.f. – chip and is readable by an r.f. – circuit detector.

188.

A system according to claim 184 or 185, wherein said code is camera readable via an inclined mirror.

189.

A drive device in a reverse vending machine to forcibly drive at least one handling unit suited to handle empty packaging in the form of empty beverage containers,

- wherein the handling unit has a mechanical drive which is connected via a mechanically separable power transfer coupling to an electrically powered drive being located separate from the handling unit,

- wherein the handling unit is locatable in a releasable manner inside a cabinet of a reverse vending machine for empty beverage containers, and

- wherein the electrically powered drive is installed on a wall, a framework or part of the cabinet.

190.

A device according to claim 189, wherein the handling unit is one of: conveyor; pusher unit; rotation means; compactor; disintegrator ; storage container with adjustable volume; and sorter means.

191.

A device according to claim 189 or 190, wherein the handling unit is free of electrical wiring or electrical components and is configured to be fully cleanable through use of water or other cleaning agent.

192.

A device according to claim 189, wherein the handling unit has auxiliary means for releasable locking into position of the handling unit relative to a side of the coupling having said electrically powered drive.

193.

A device according to any one of the preceding claims 189 - 192, wherein said mechanically separable power transfer coupling has a first spring-loaded engagement member, and a second non-resilient engagement member, and wherein said members are configured to snap by spring force into engagement with each other when one member thereof starts to rotate and engagement elements on said members become aligned with each other.

194.

A drive device according to any one of claims 189 – 193, wherein a motor of the electrically powered drive is operatively connected with a position sensor means, said sensor means indicating operational state of the handling means, wherein said sensor means is attached to a wall, framework or part of the cabinet, and wherein said sensor means is co-operative with sensor trigger means located on said handling means, said trigger means being in non-physical contact with said sensor means and movable when a movable part of the handling means changes its operational state.

195.

A drive device according to claim 194, wherein said sensor trigger means is an indicator of absolute rotary position of and located on an end face of a rotary shaft of the handling unit.

196

A drive device according to claim 195, wherein the indicator is a magnetic device.

Fig.1a.

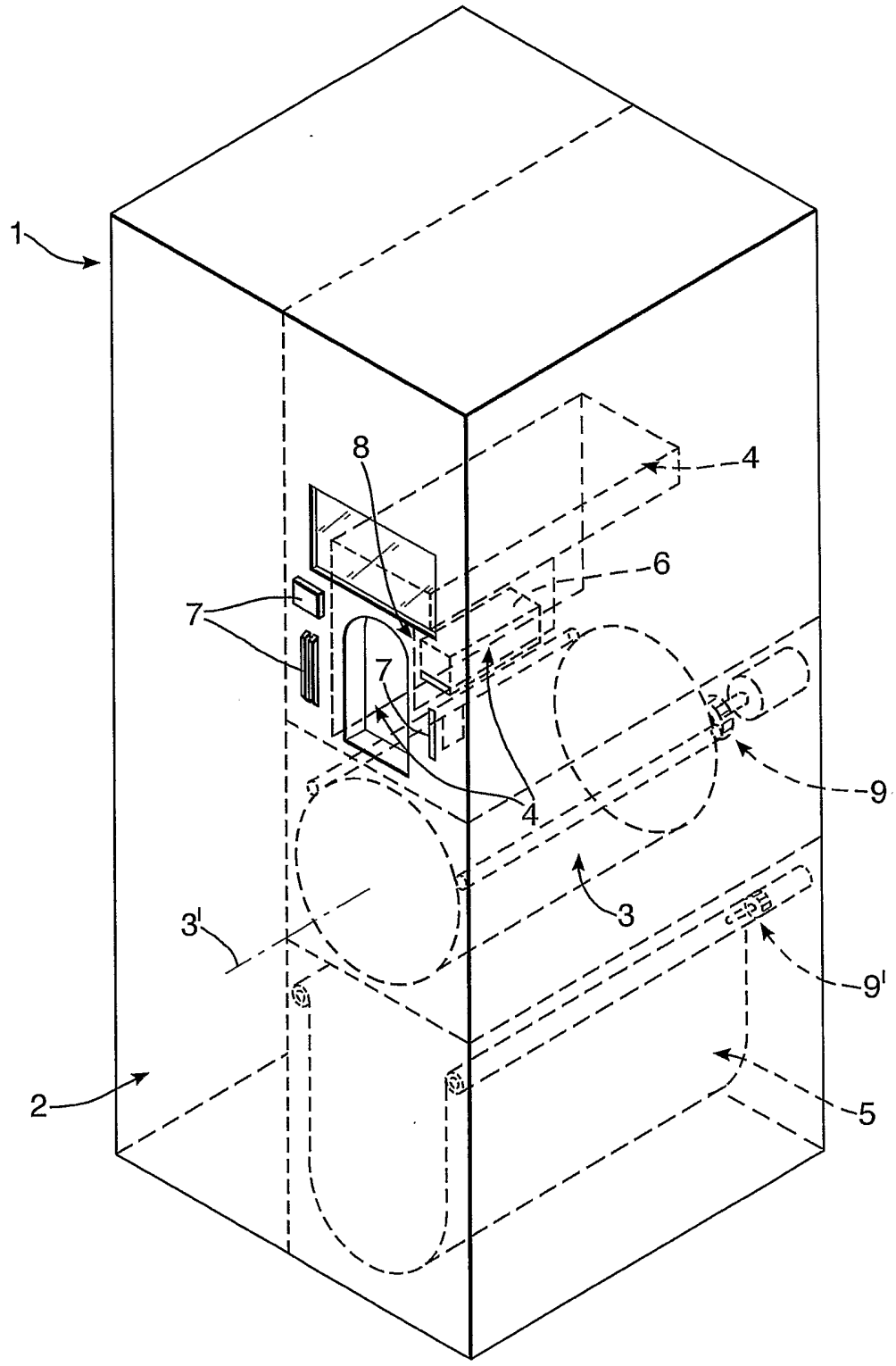


Fig.1b.

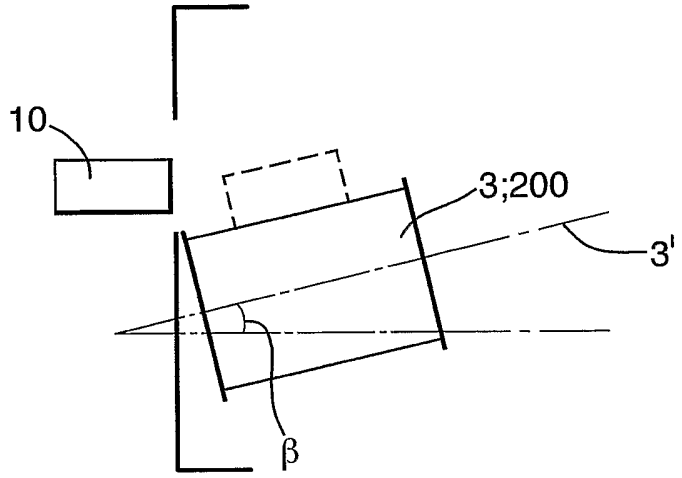


Fig.1c.

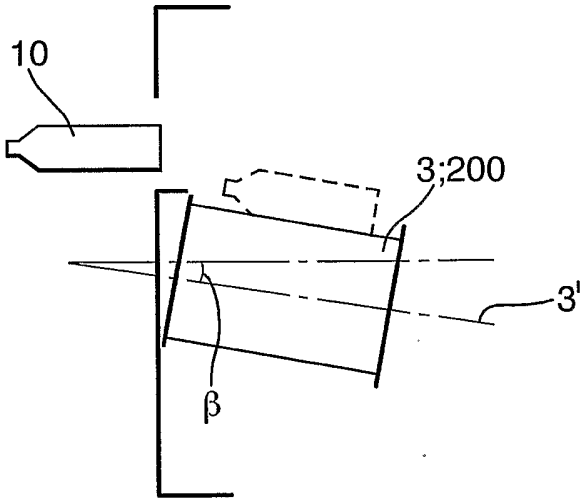


Fig.2a.

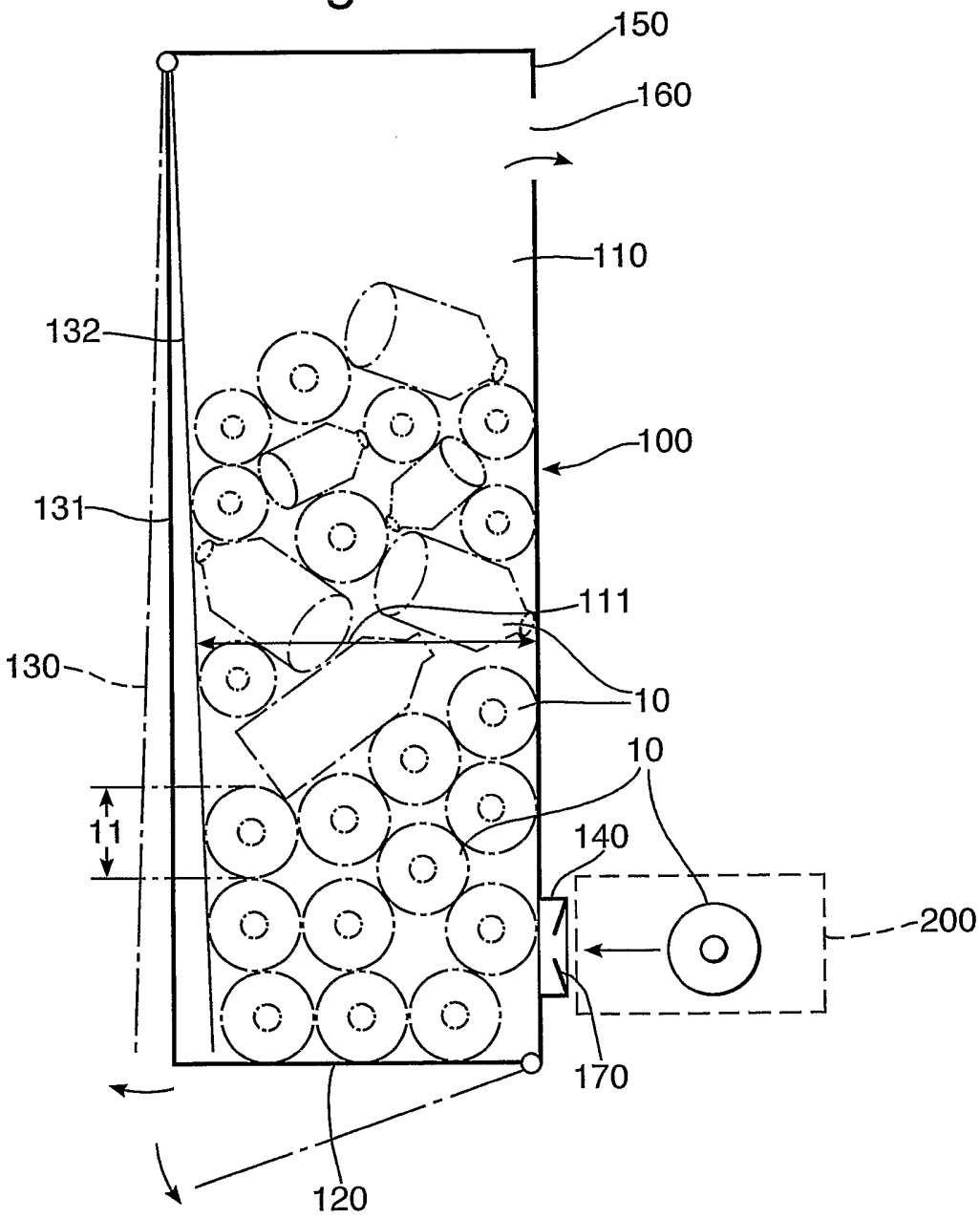


Fig.2b.

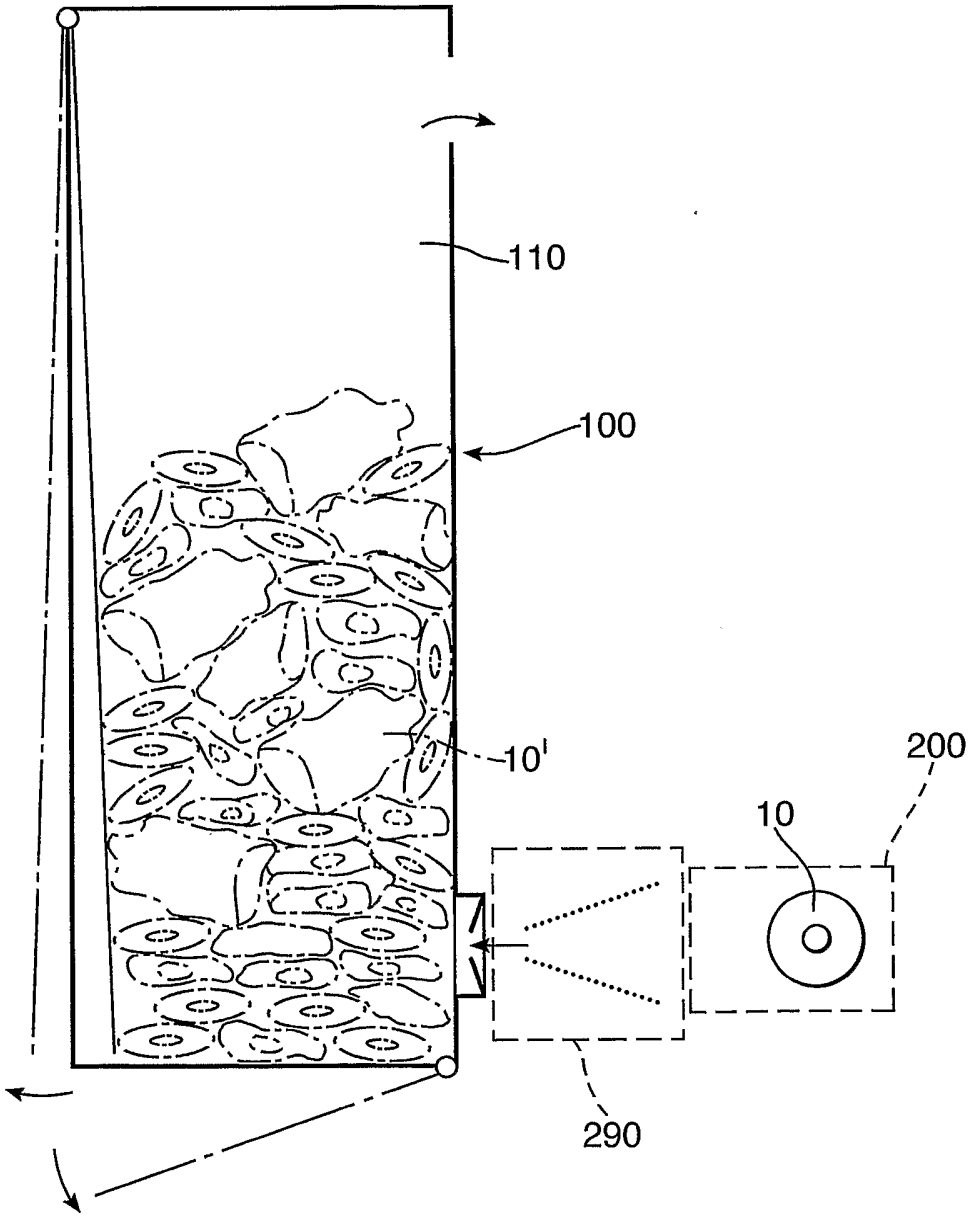


Fig.2c.

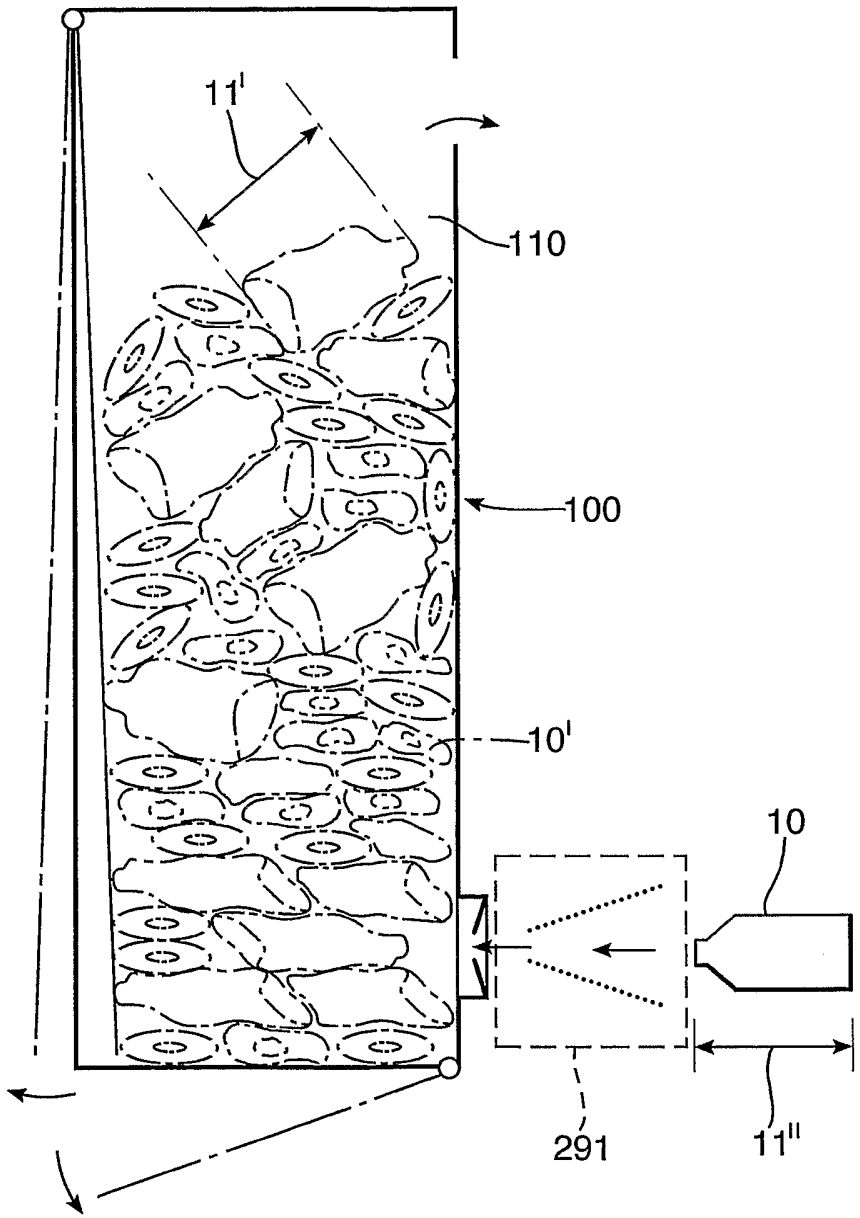


Fig.3.

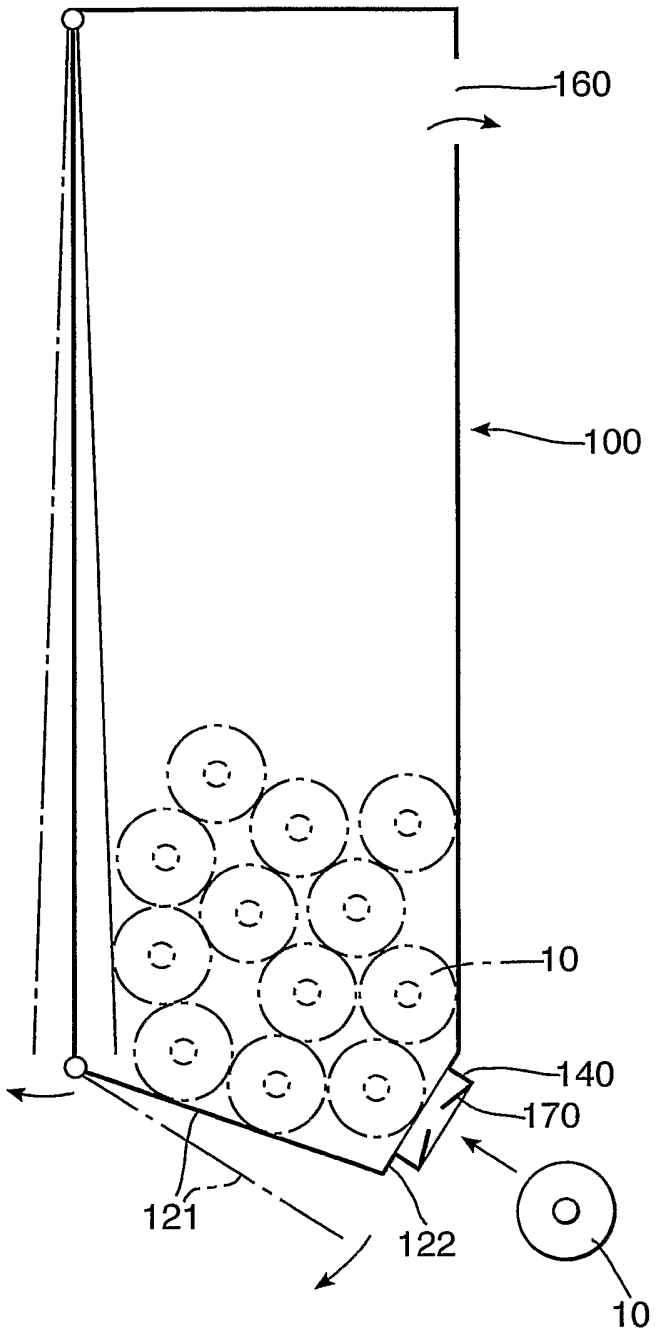
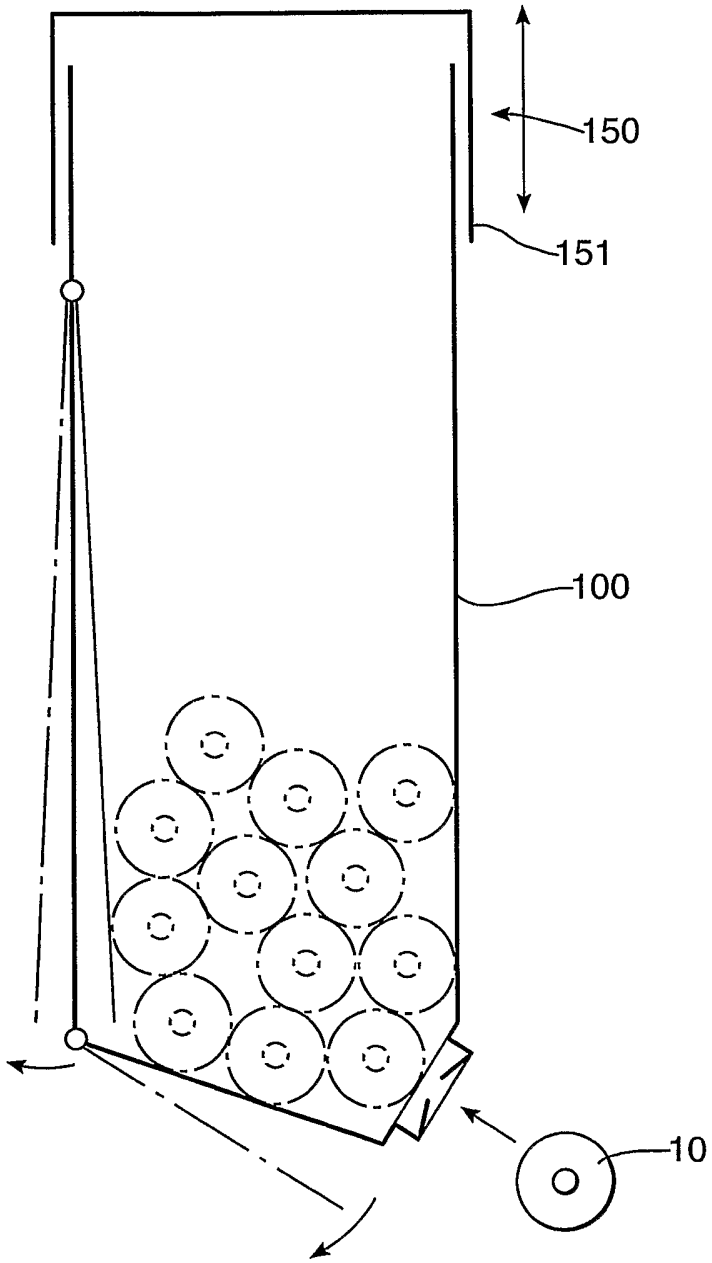


Fig.4.



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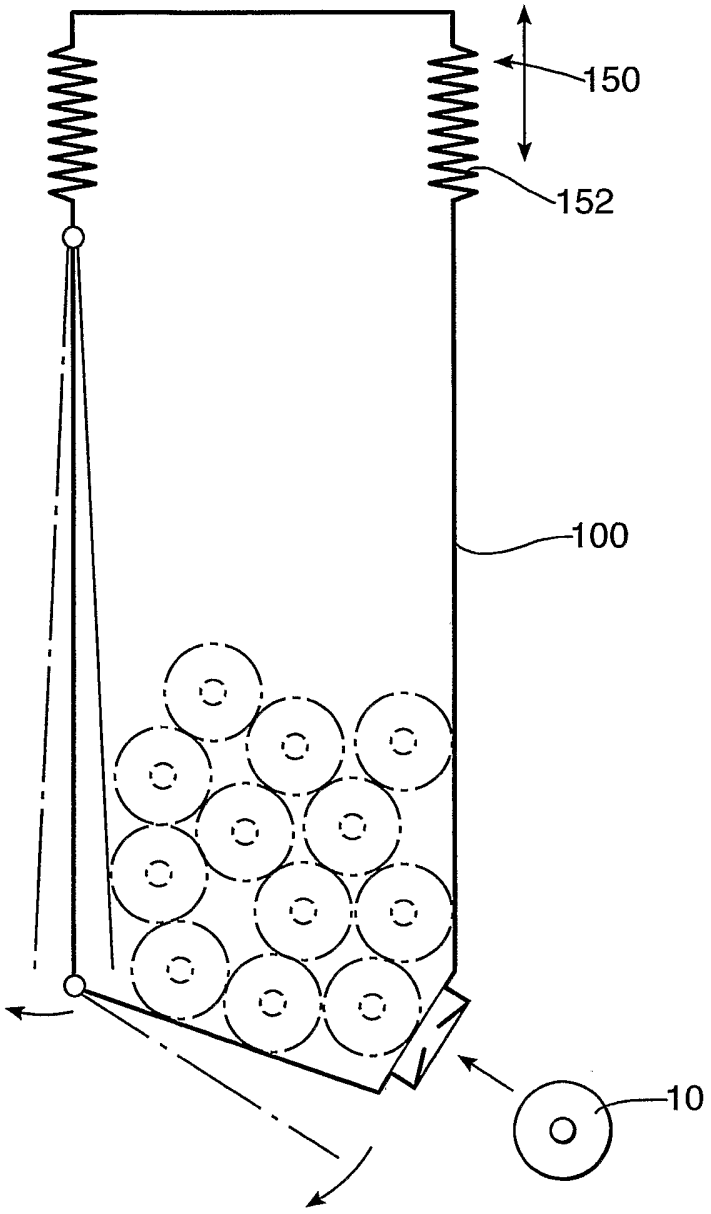

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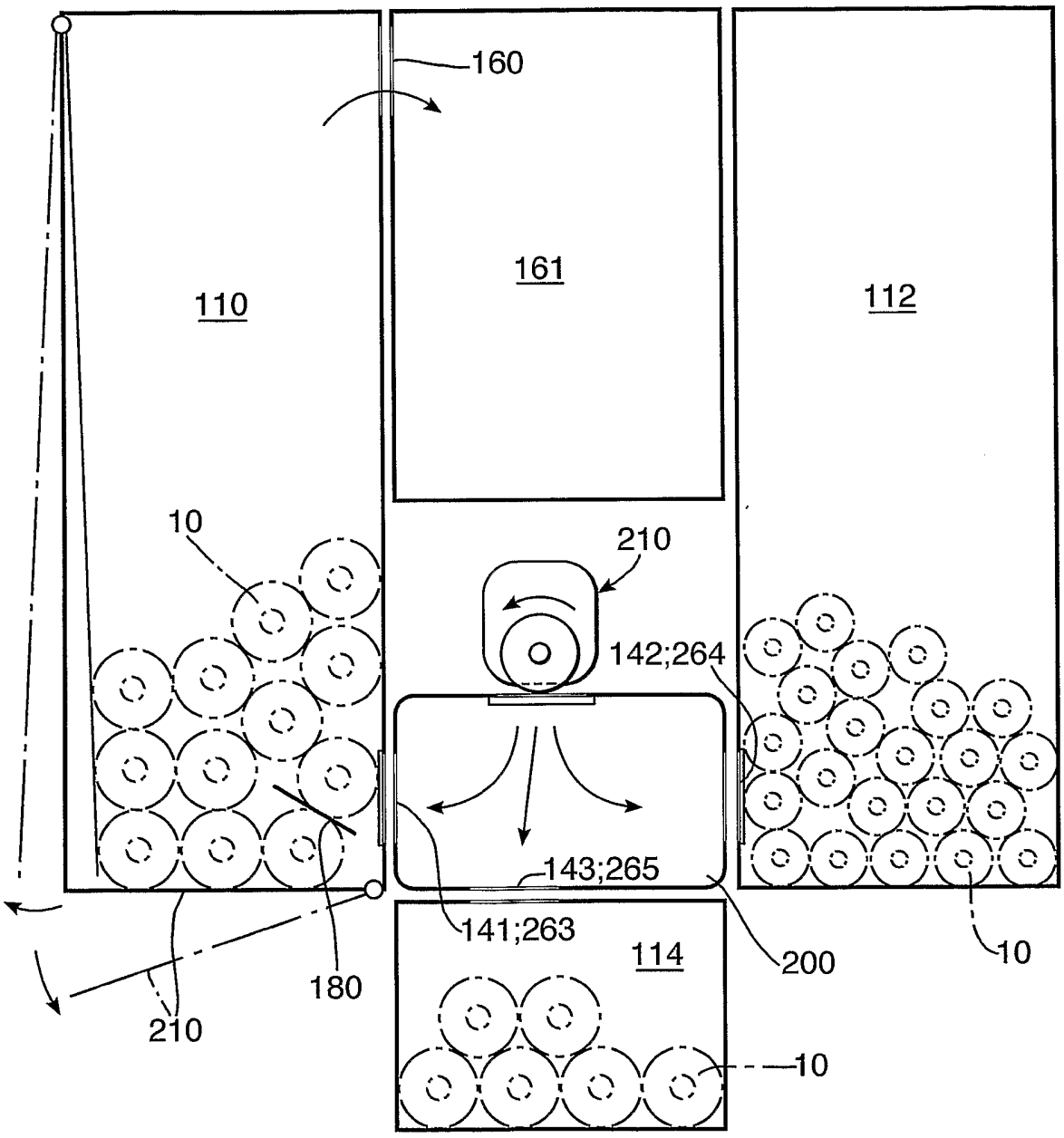
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Fig.7.

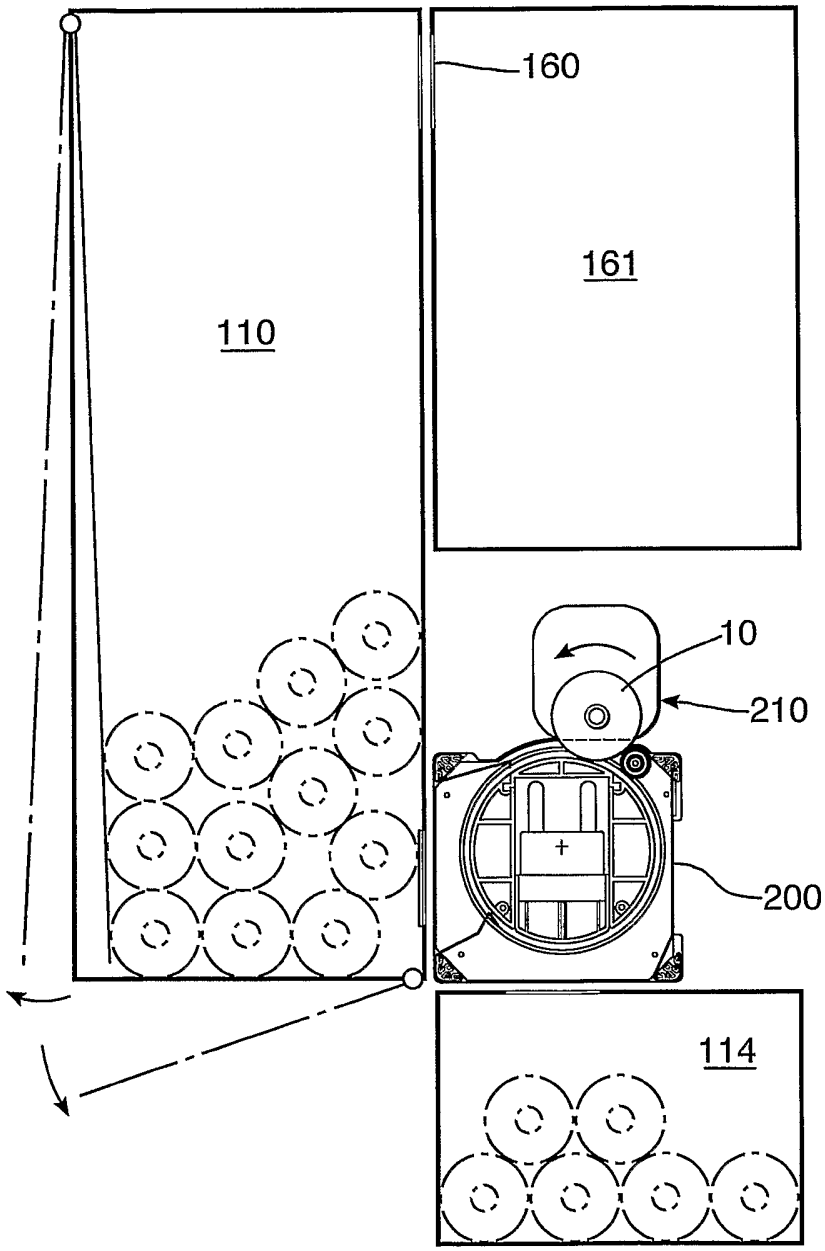


Fig.8.

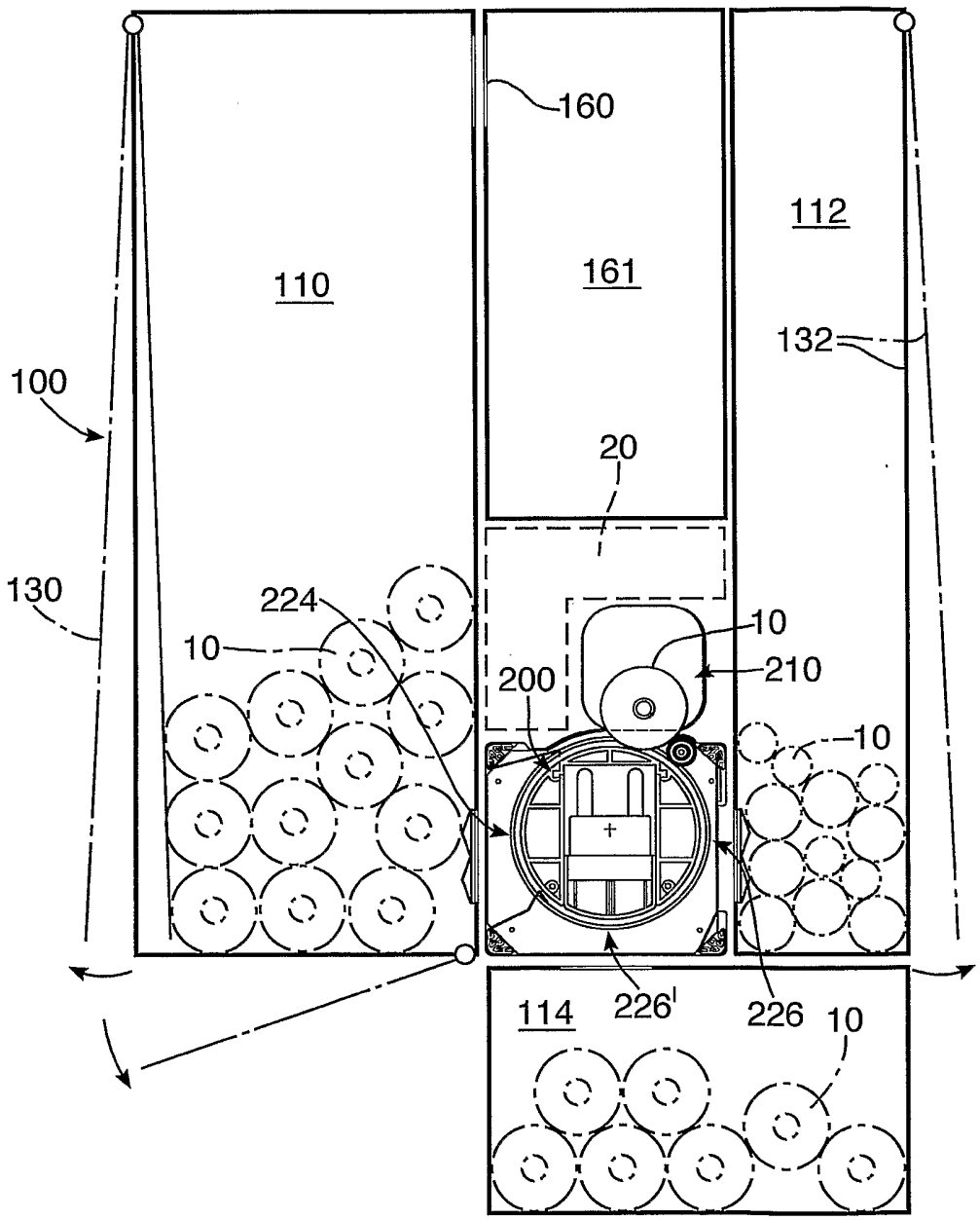


Fig.9.

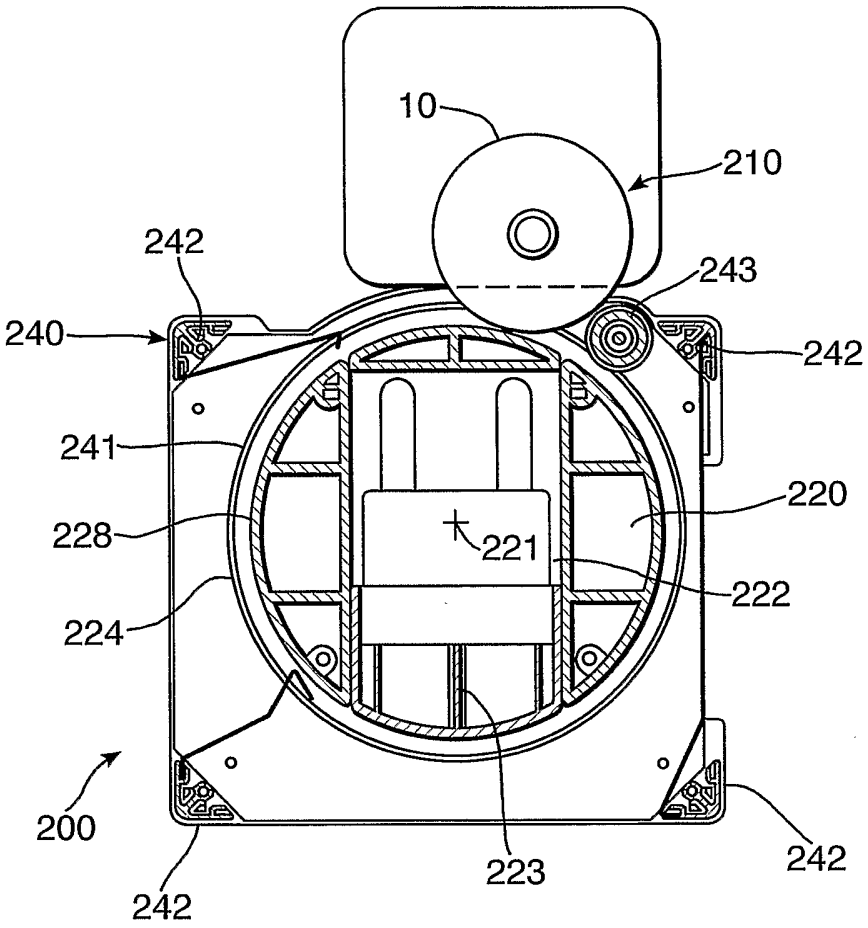


Fig.10.

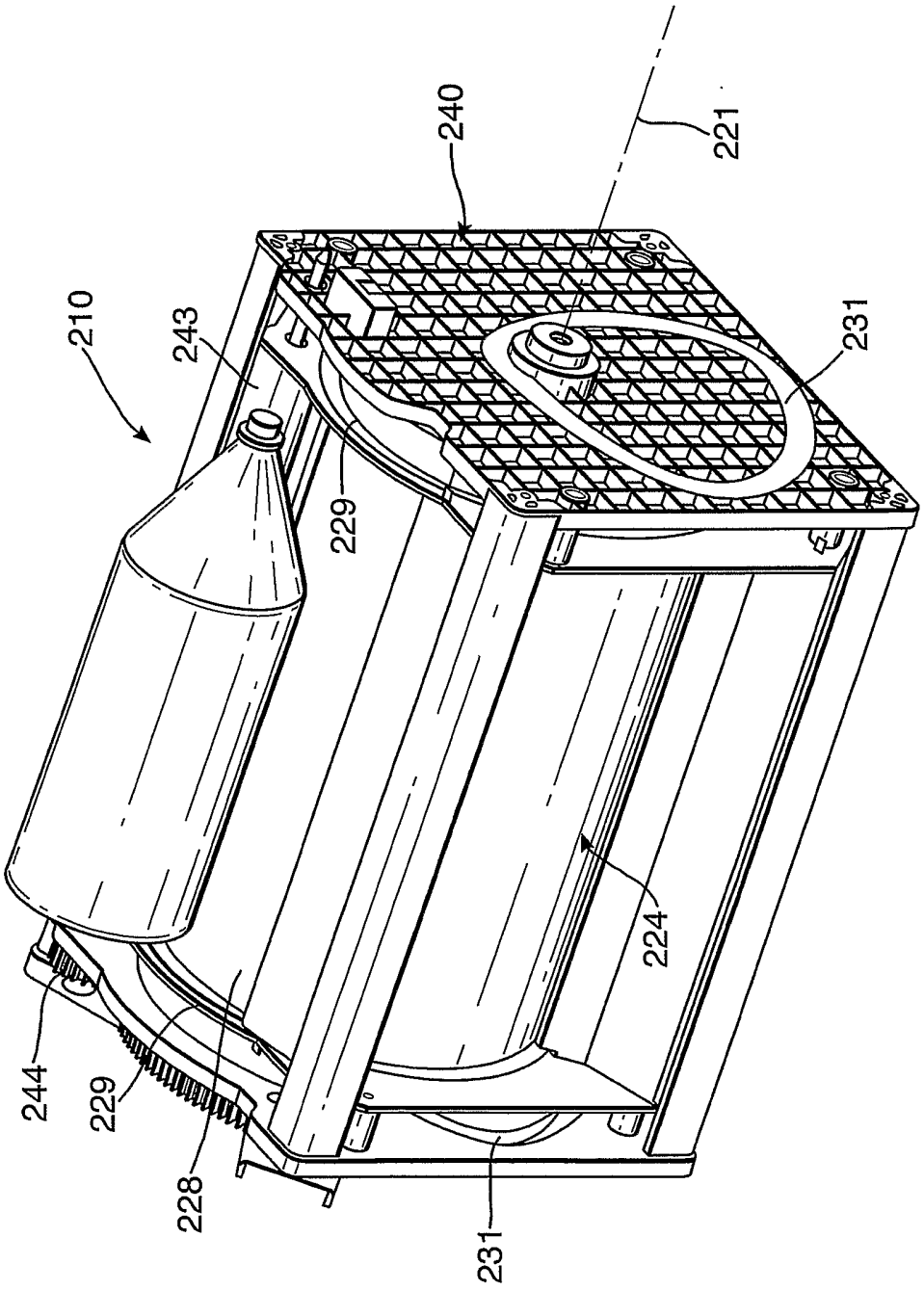


Fig.11.

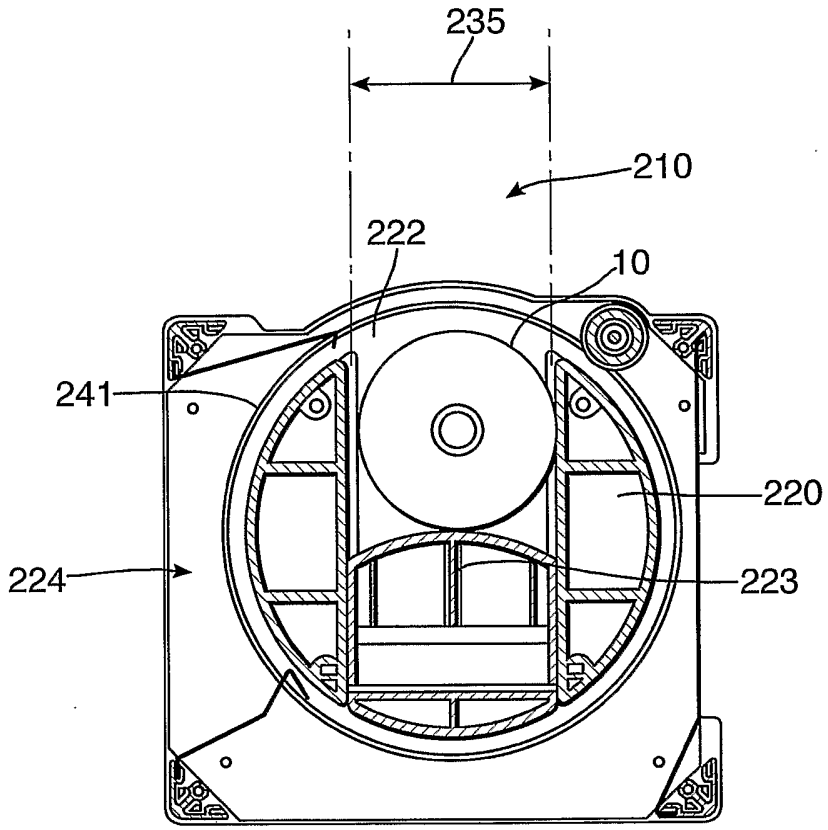


Fig.12.

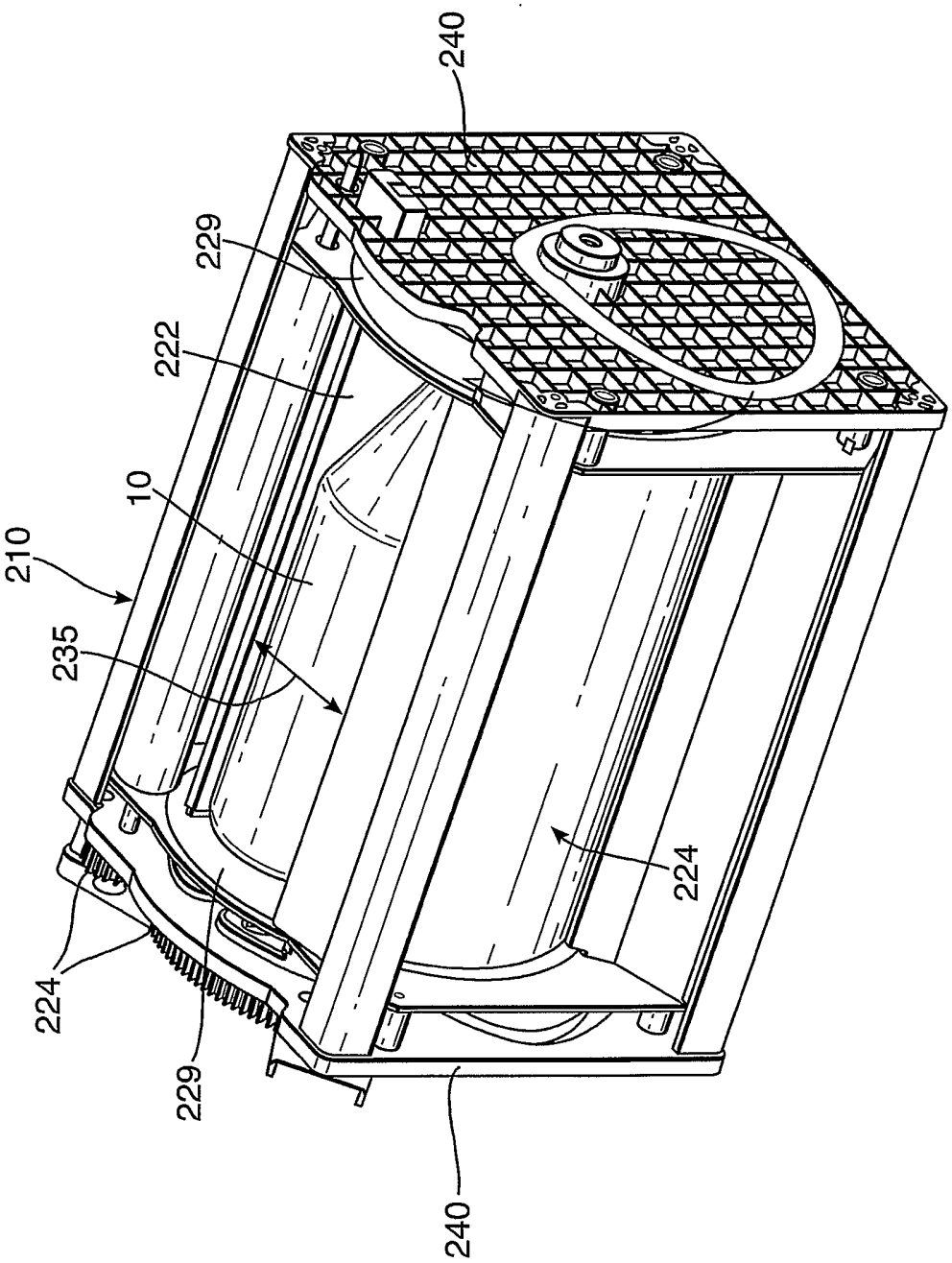


Fig.13.

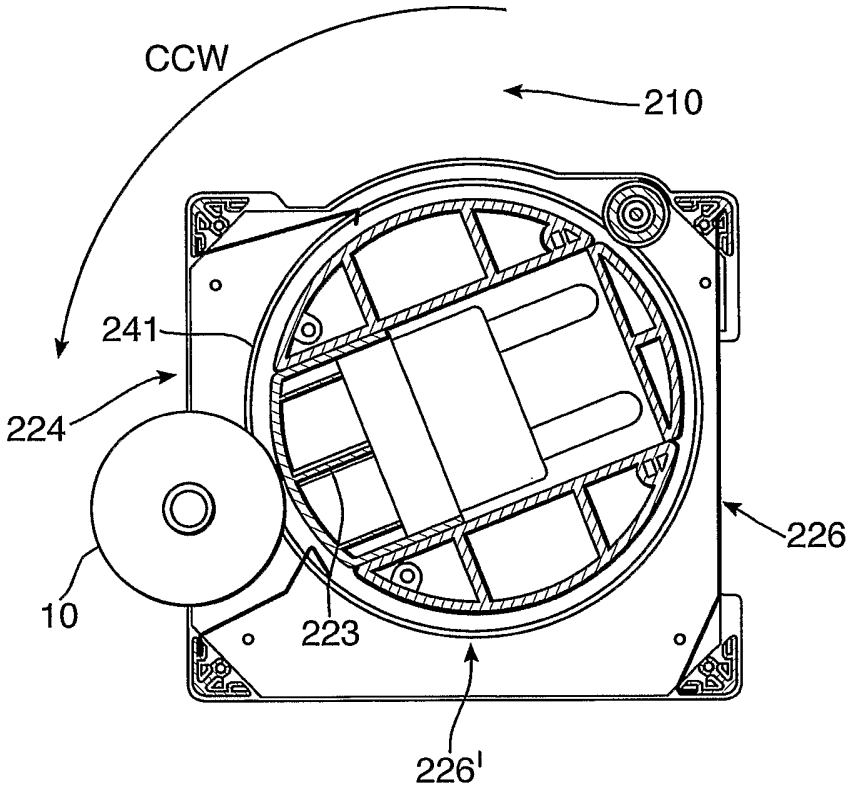


Fig.14.

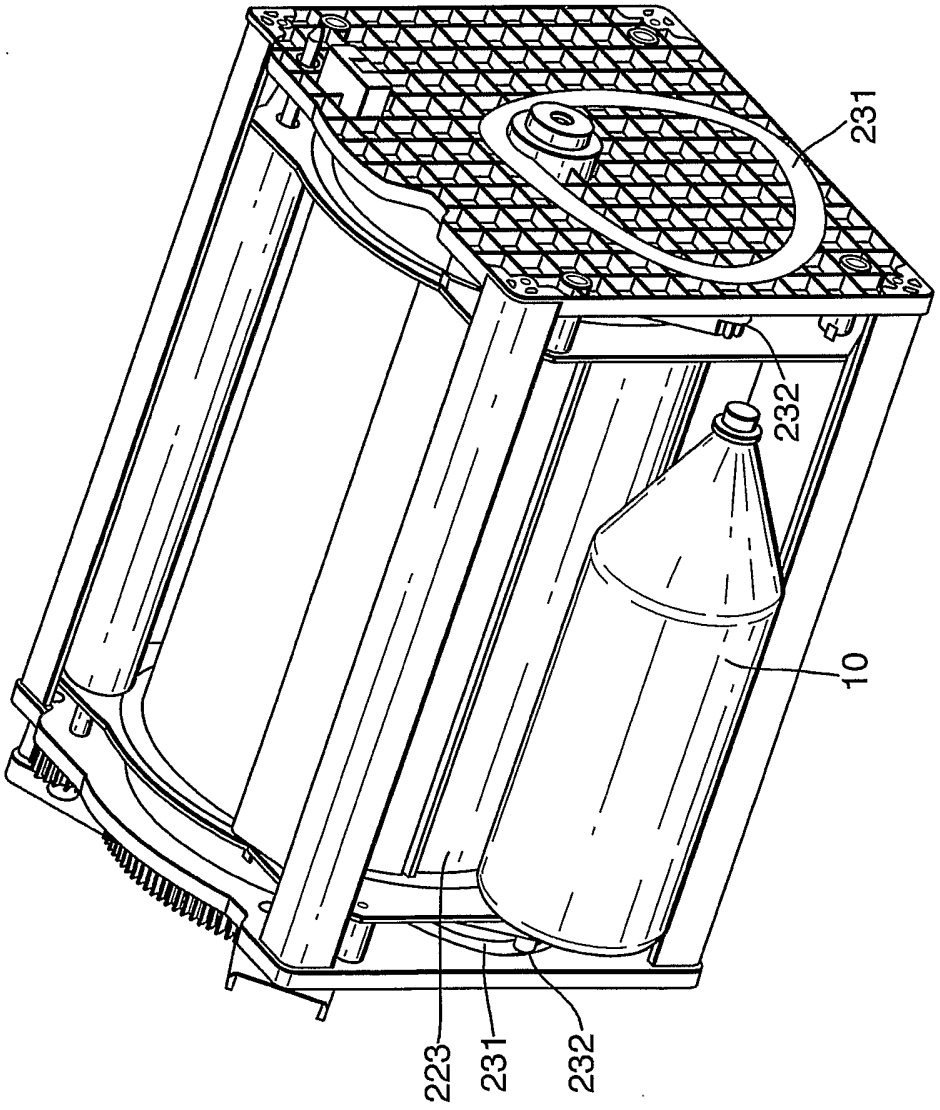


Fig.15.

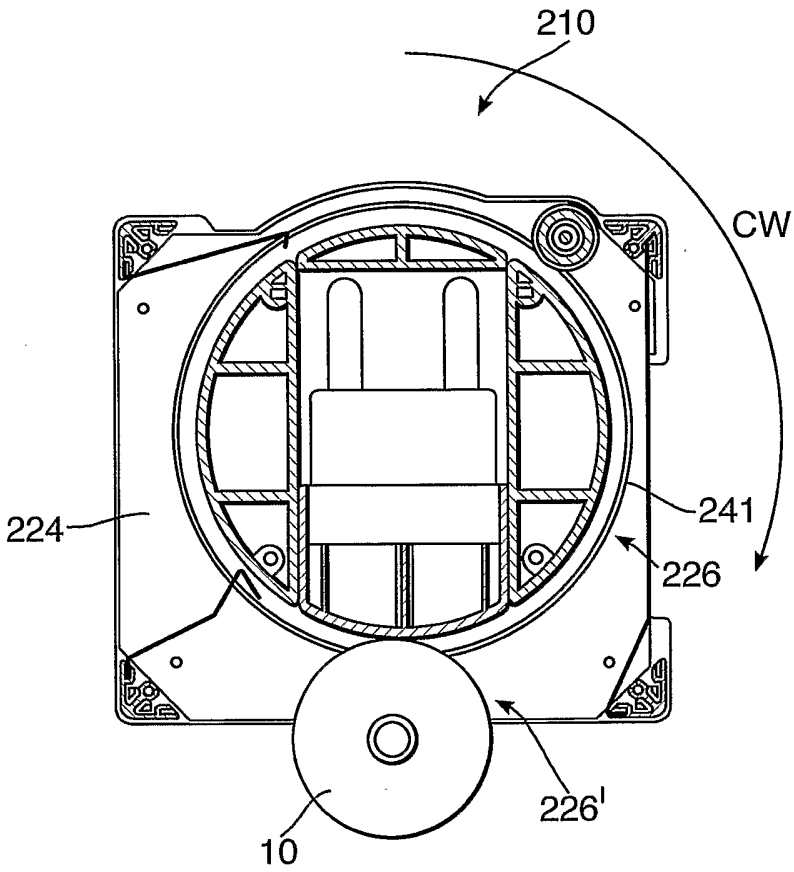


Fig.16.

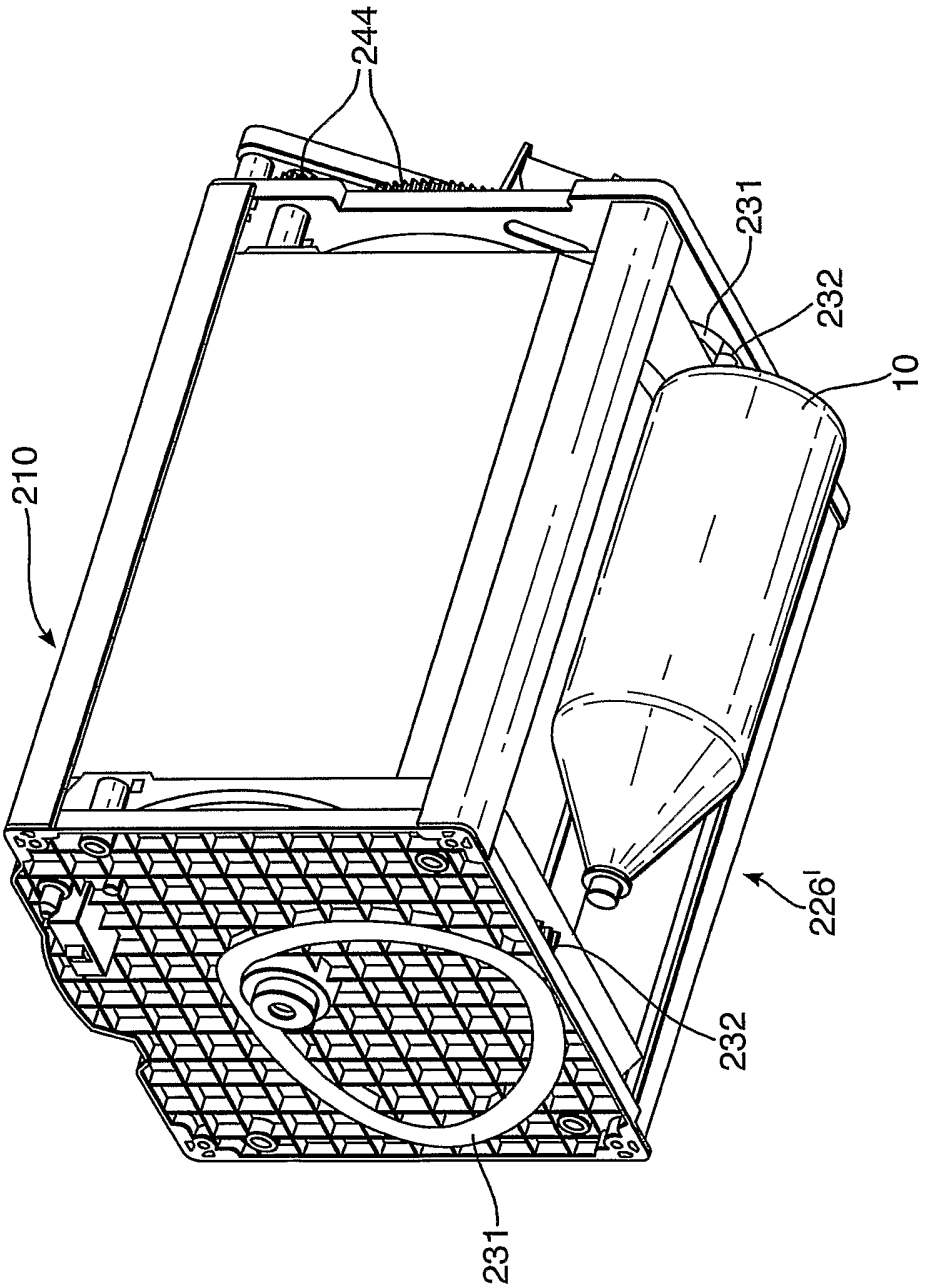
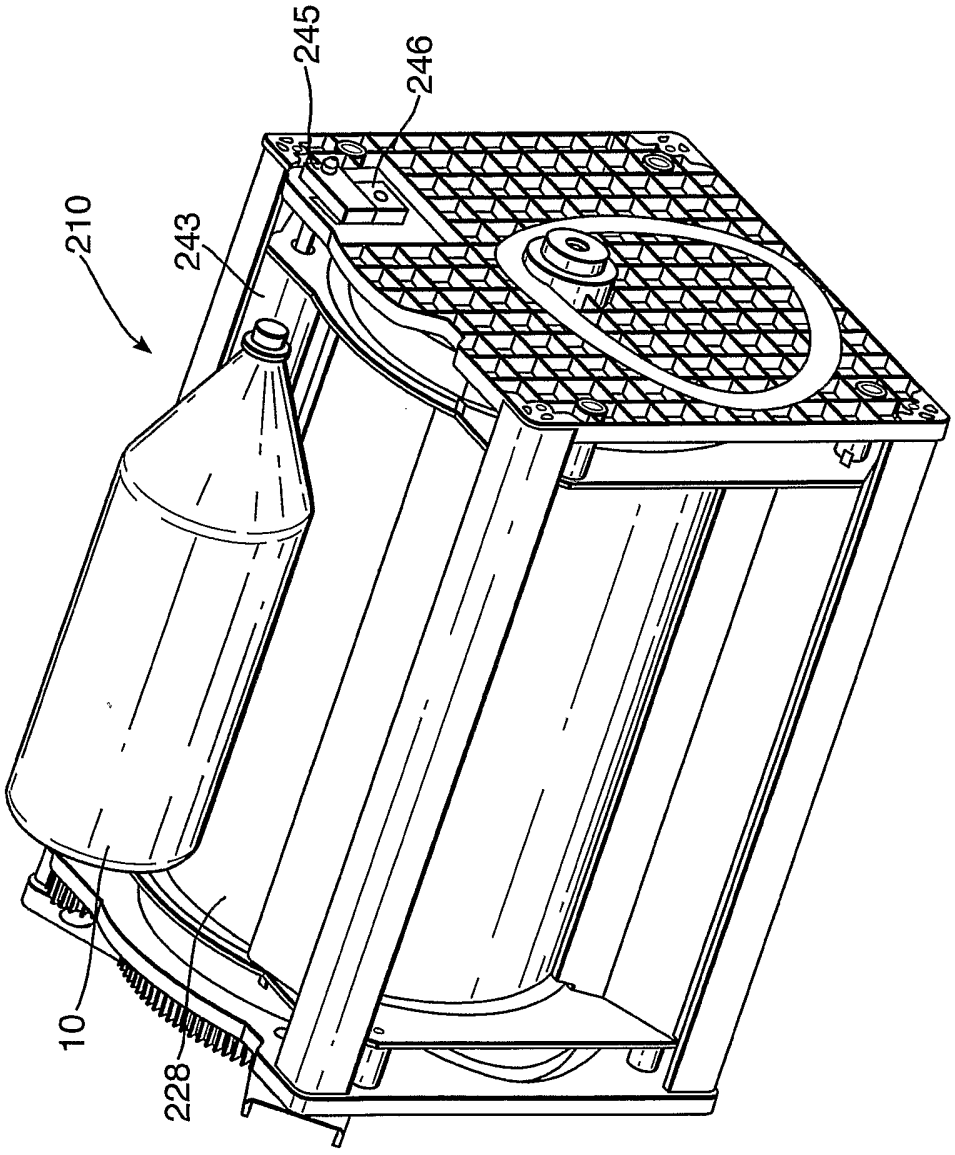


Fig.17.



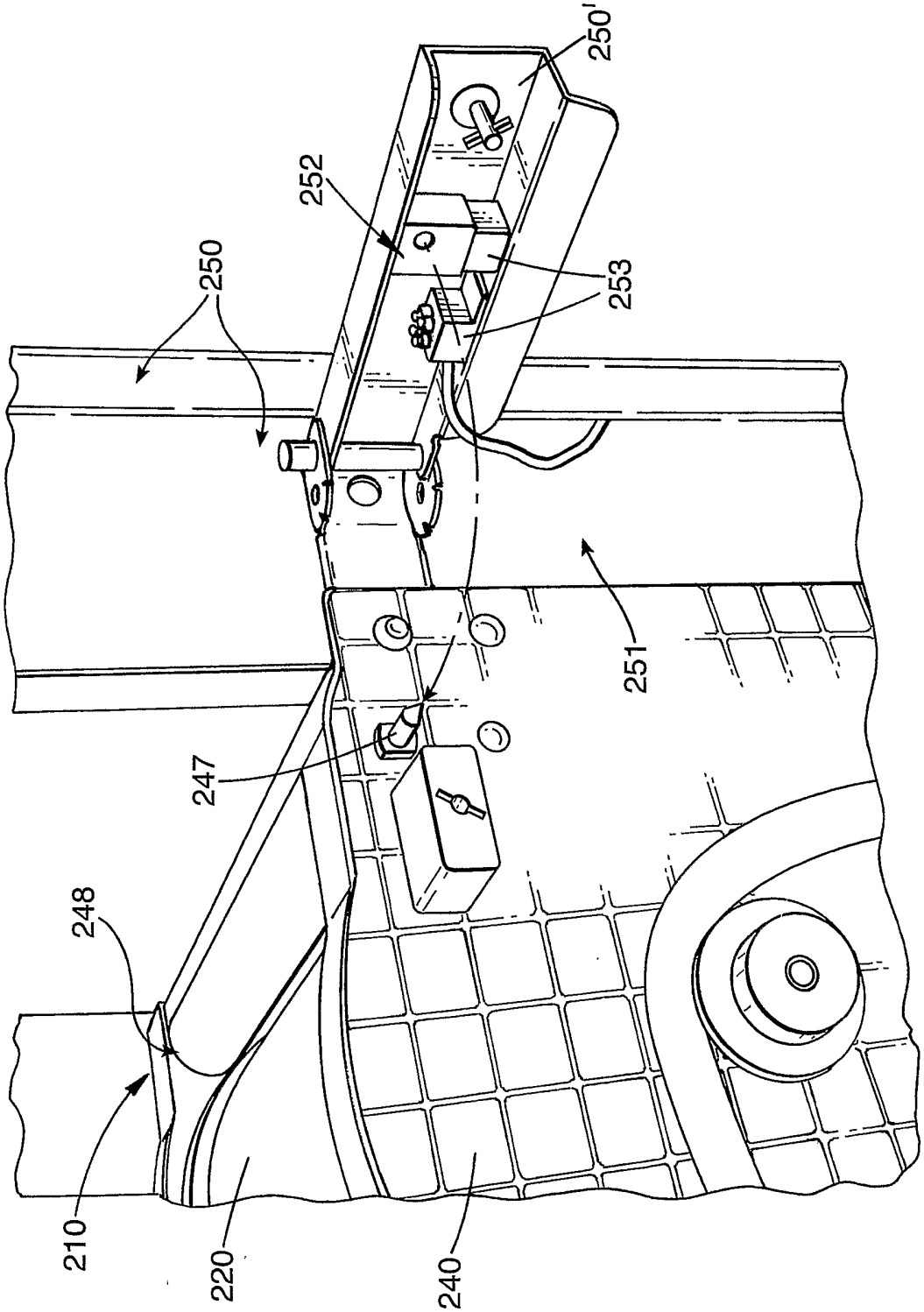
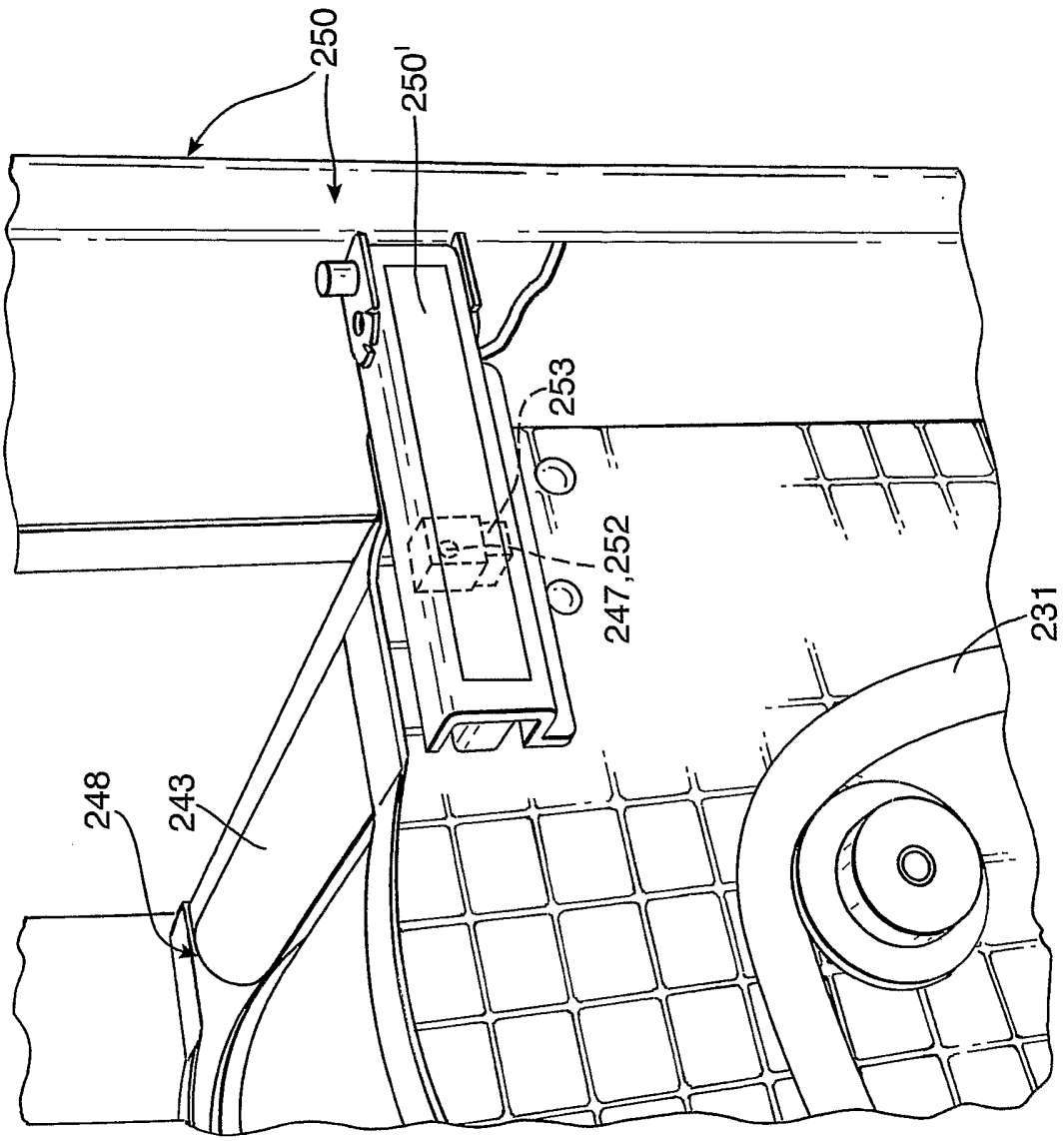


Fig.18.

Fig.19.



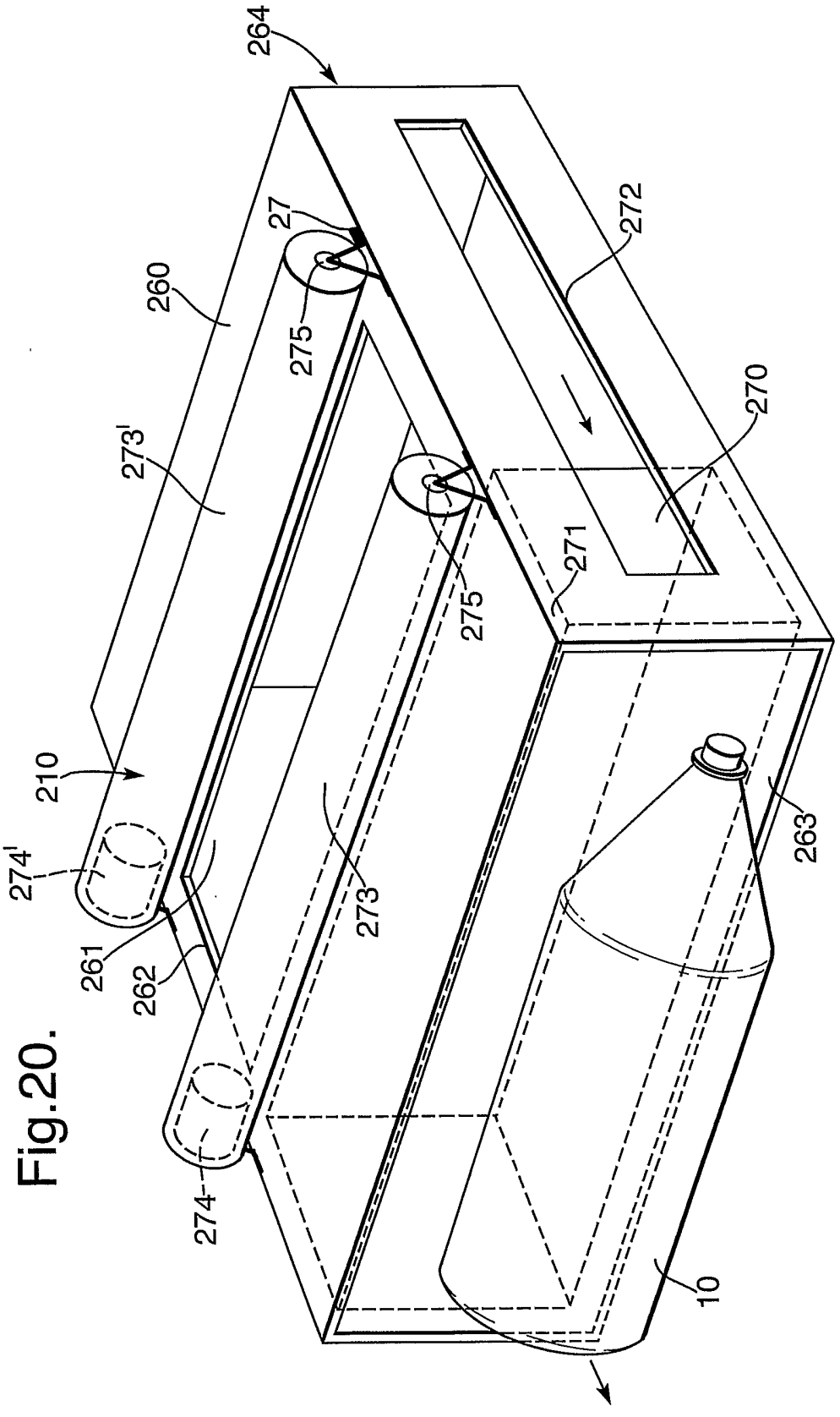


Fig.20.

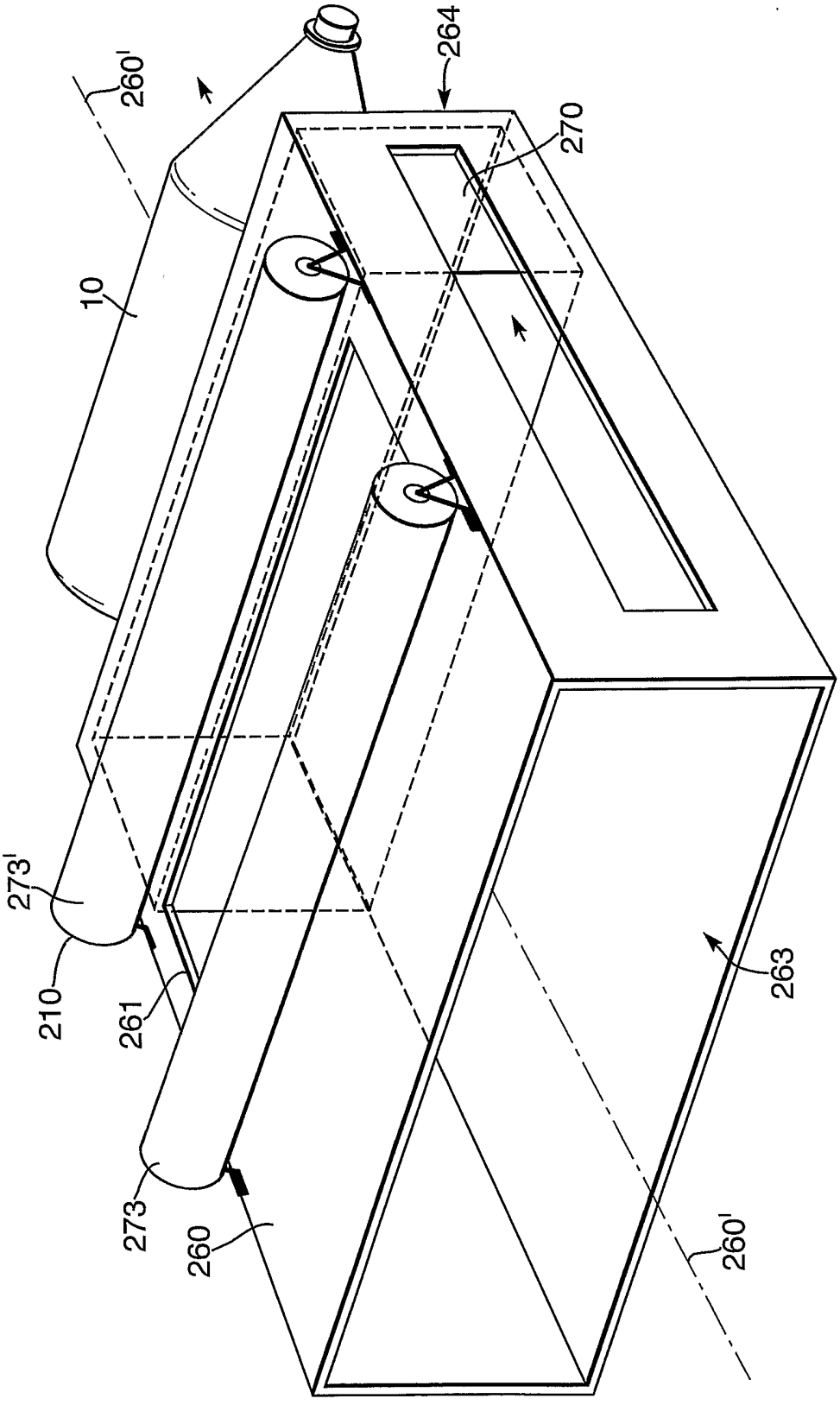


Fig.21.

Fig.22.

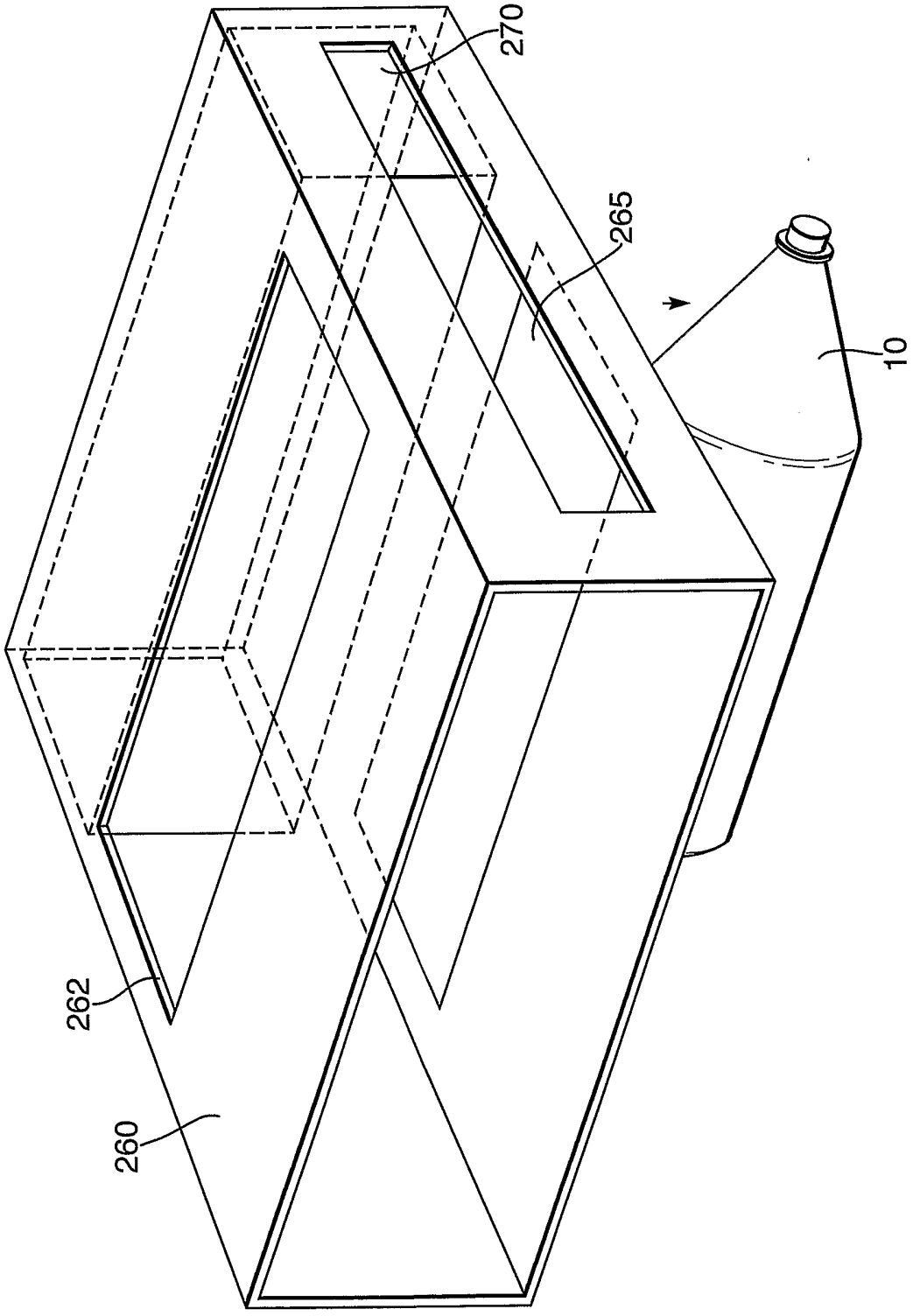
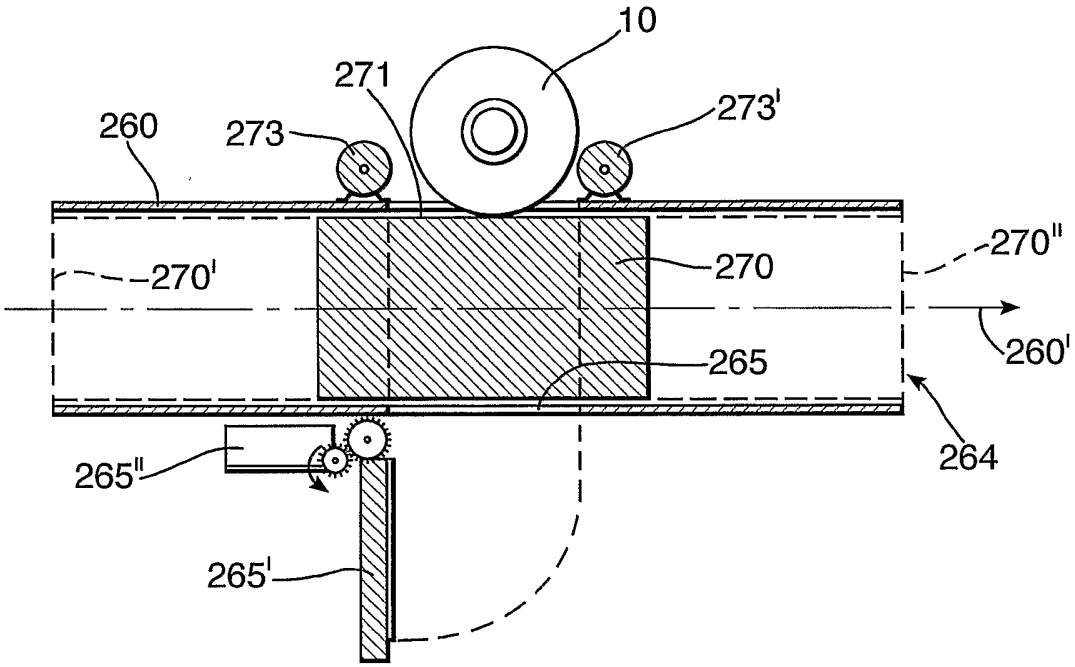


Fig.23.



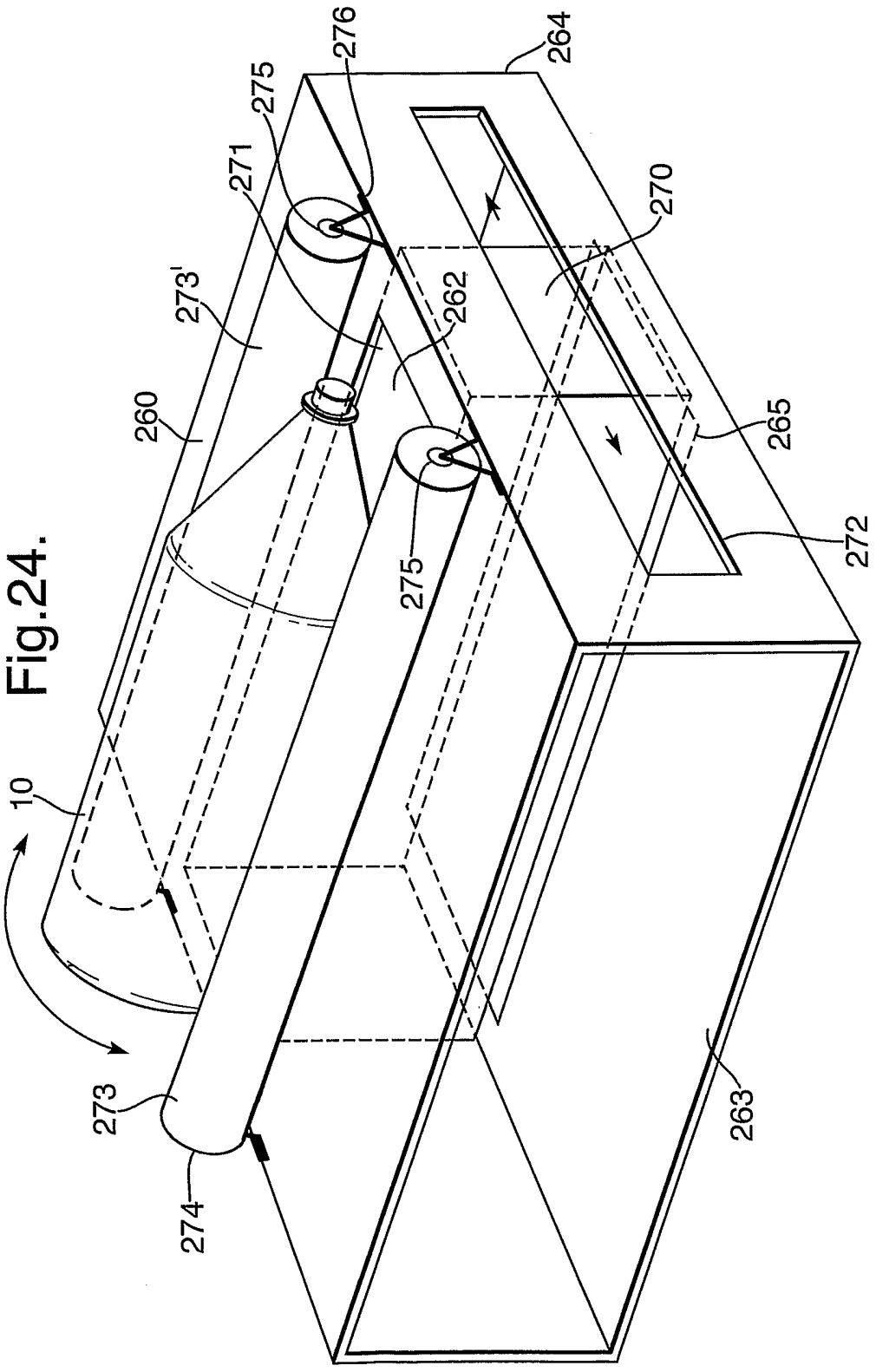


Fig.24.

Fig.25.

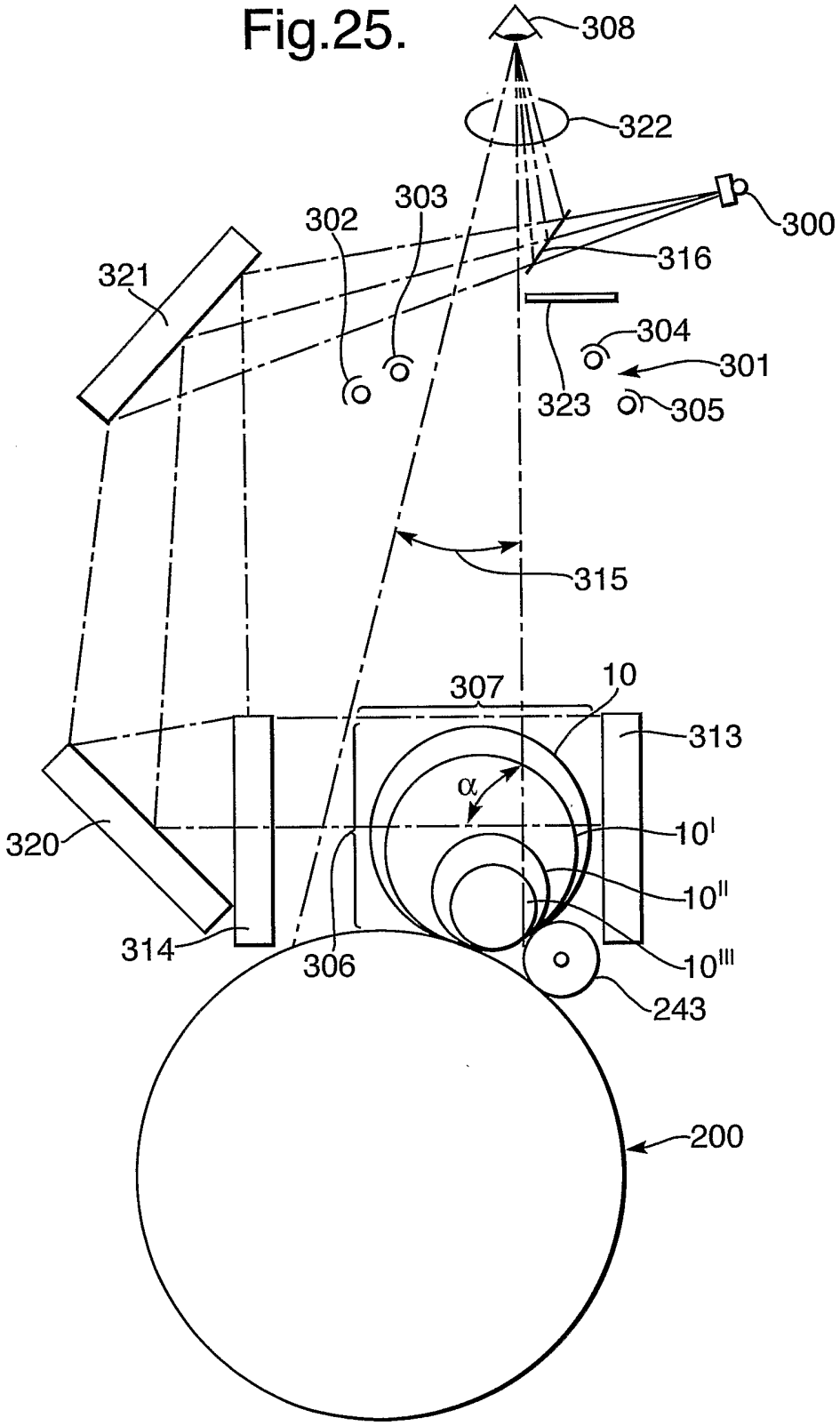

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Fig.26.

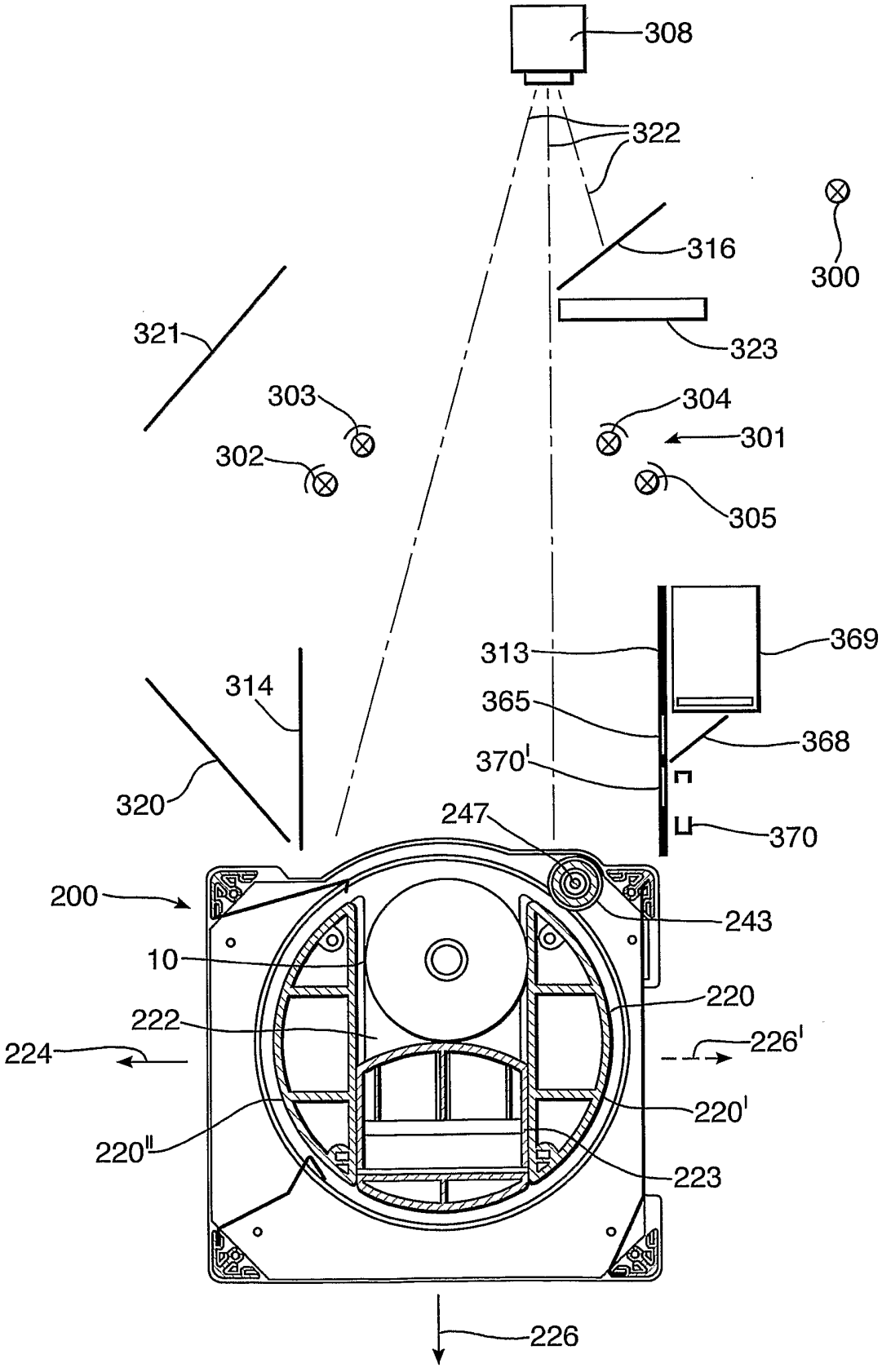
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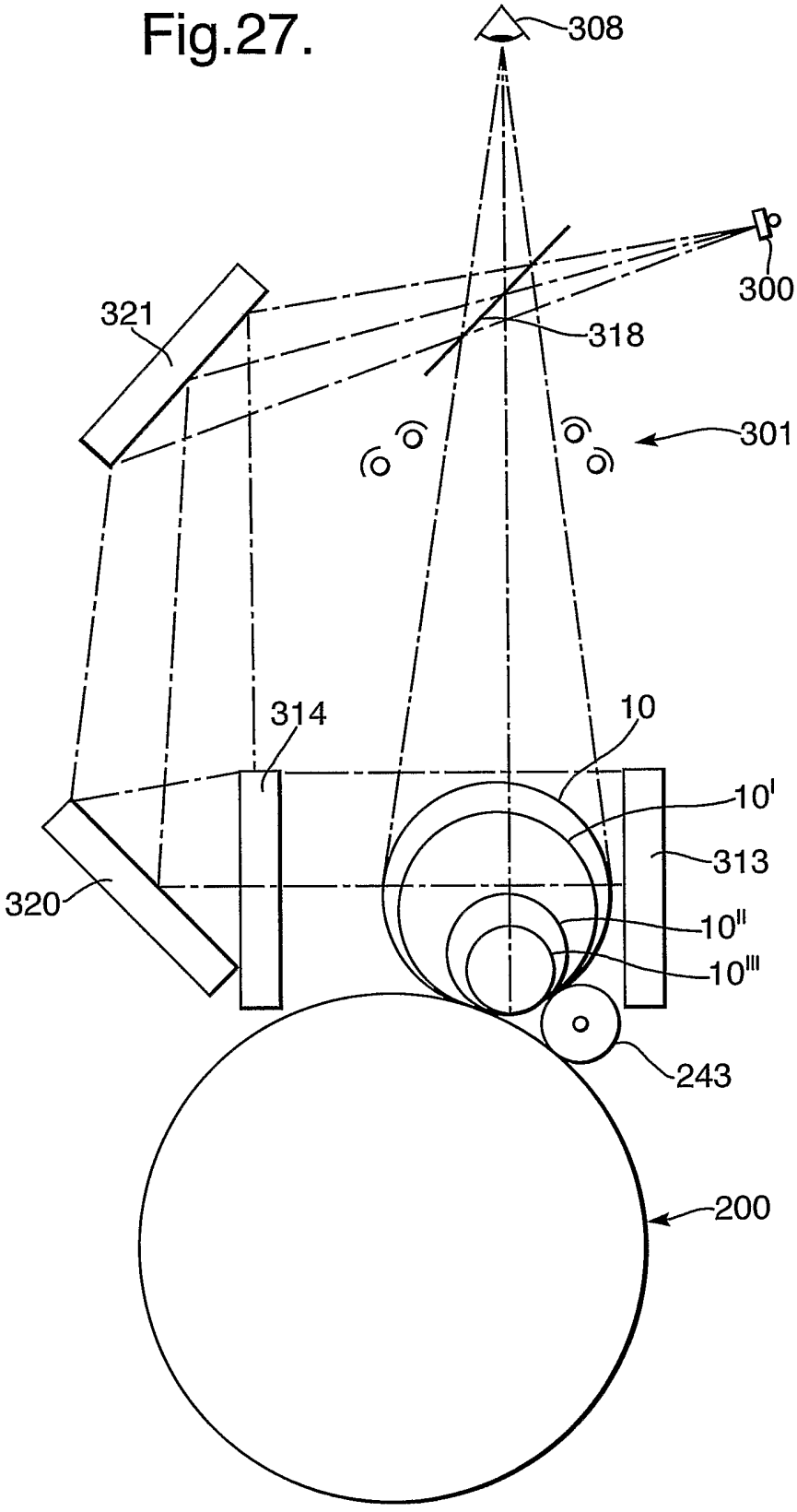
Fig.27.



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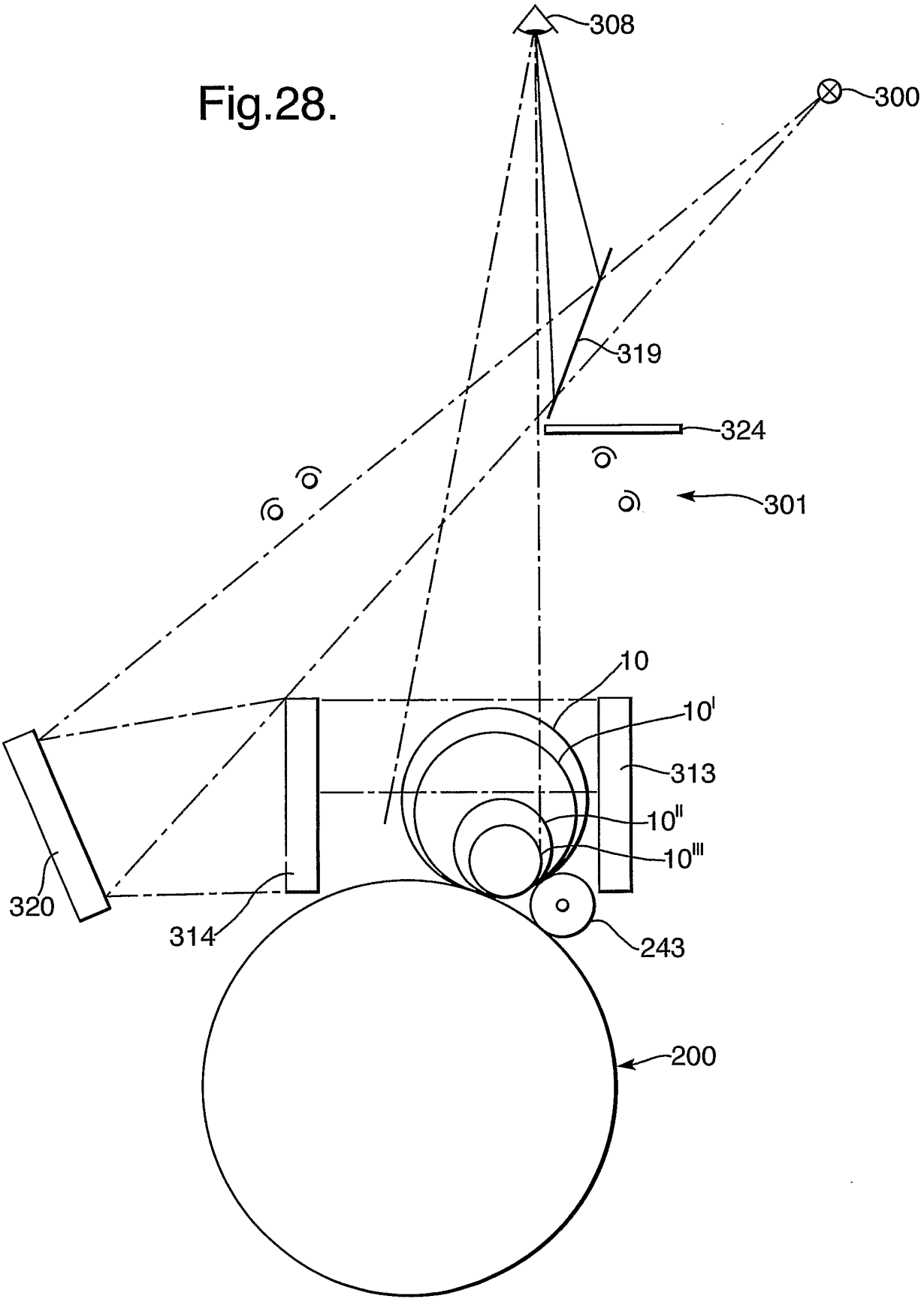


Fig.29.

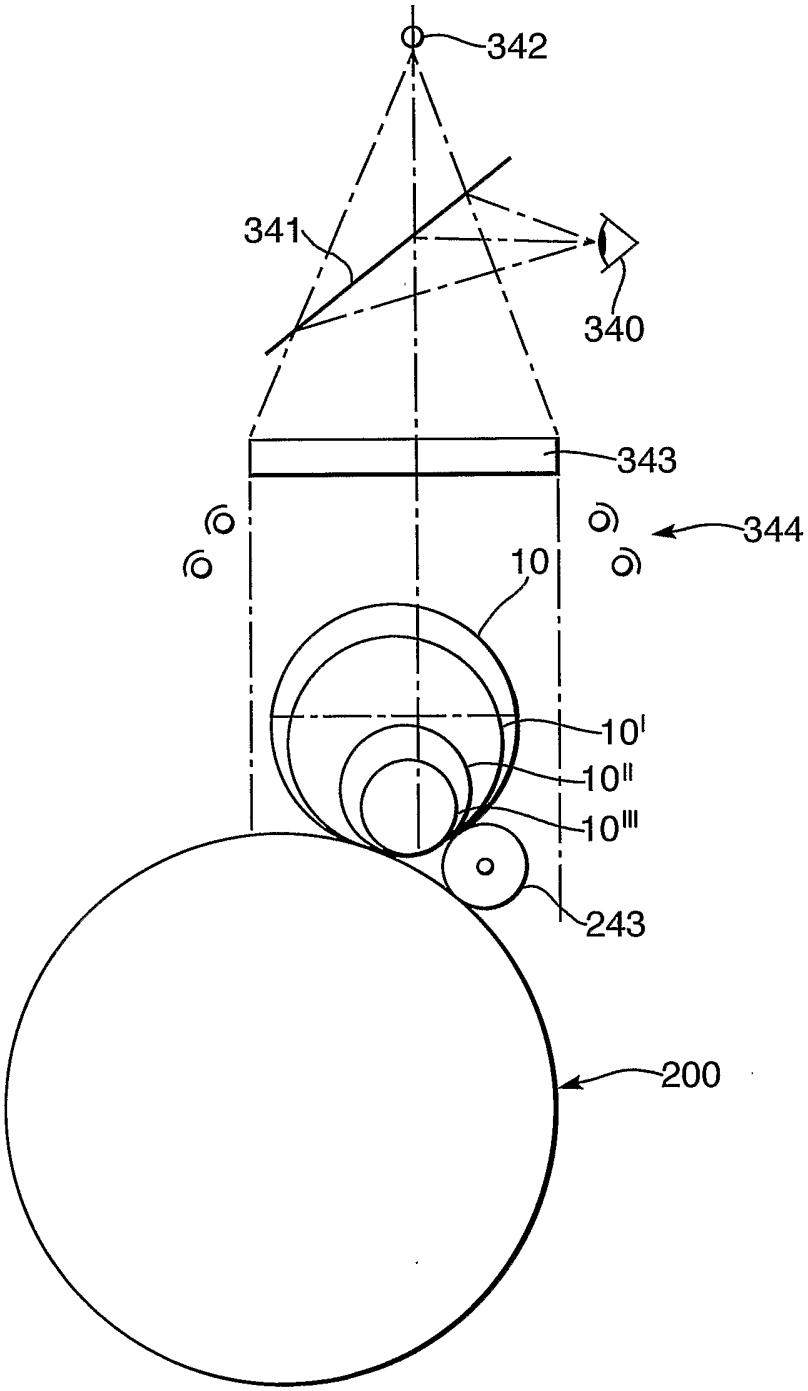


Fig.30.

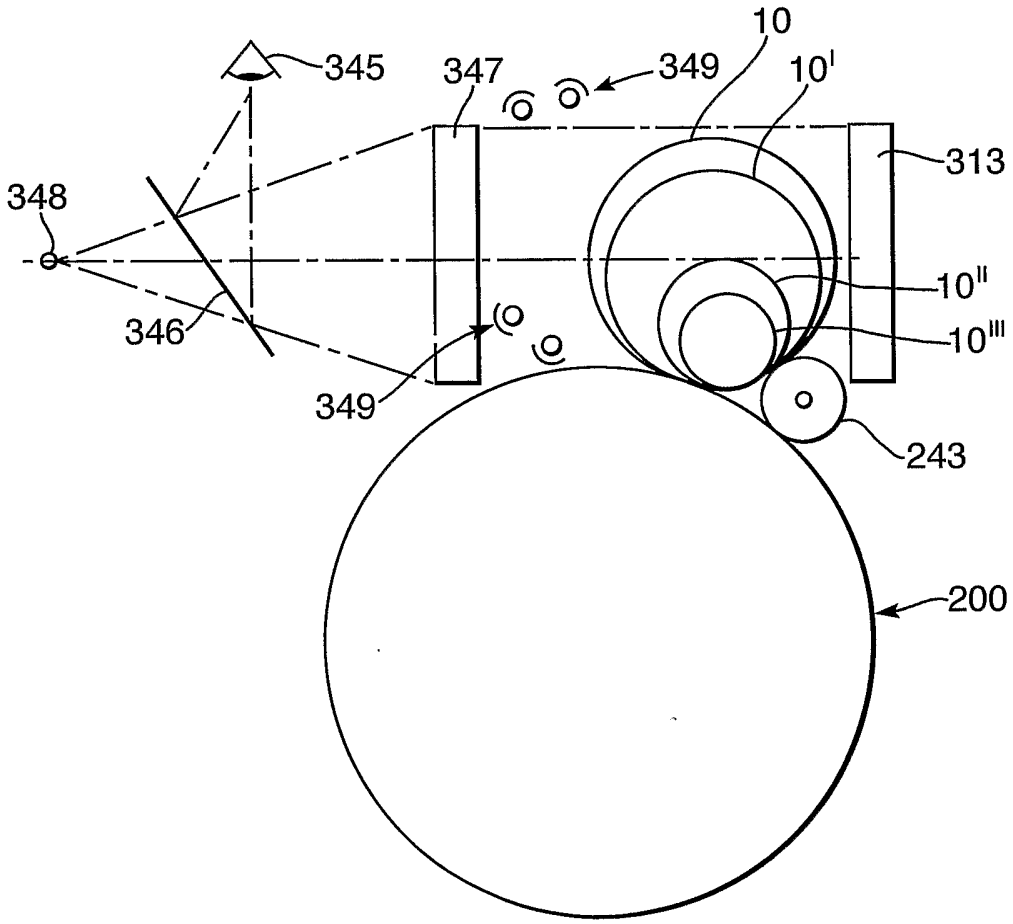


Fig.31.

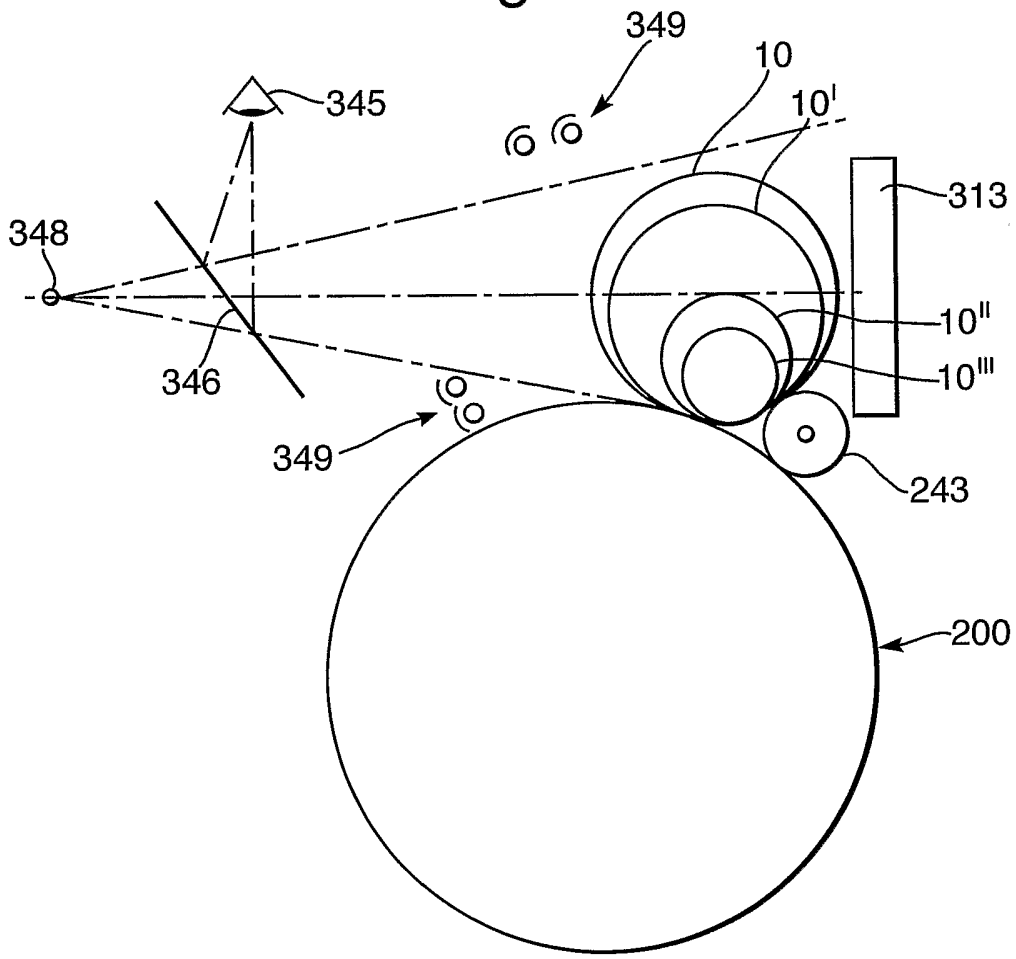


Fig.32.

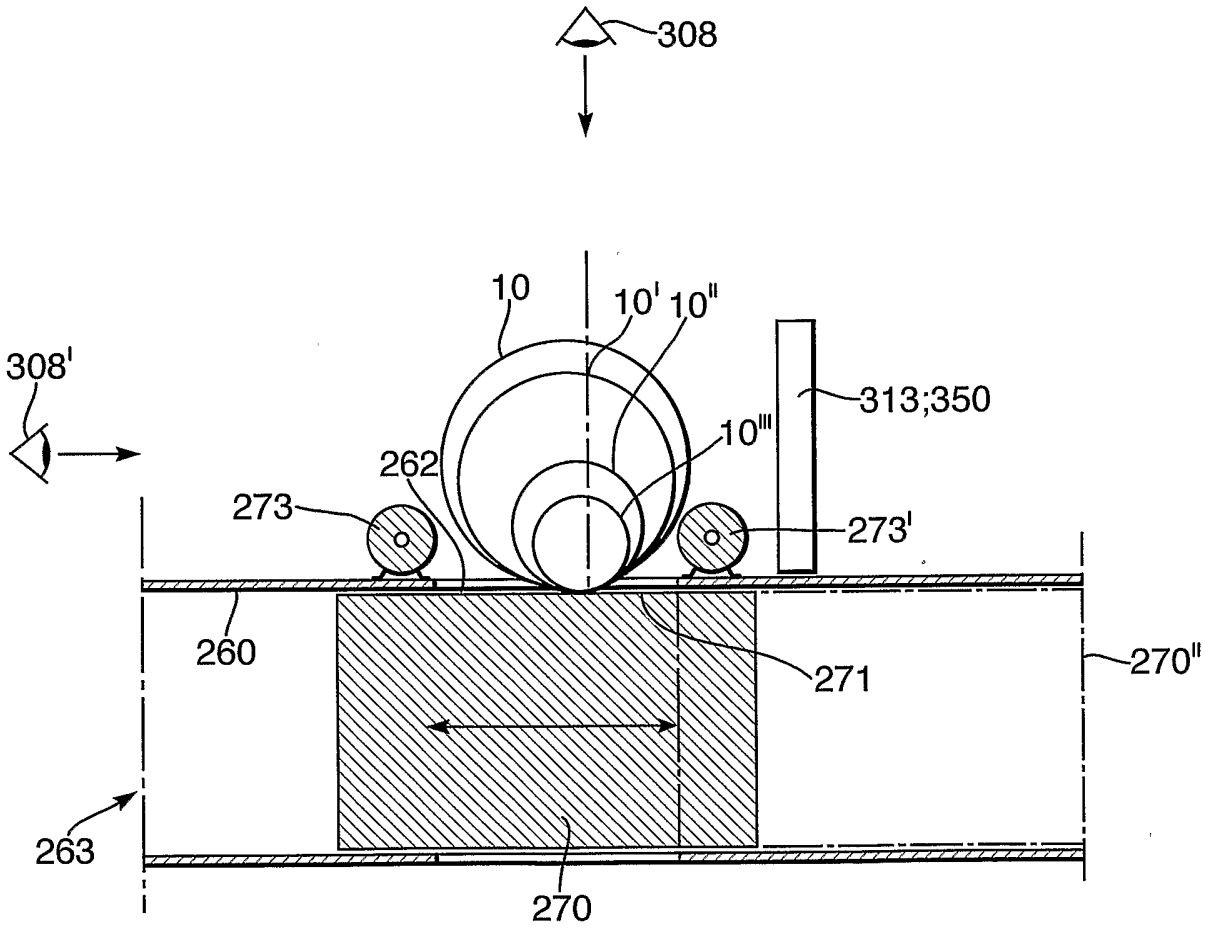
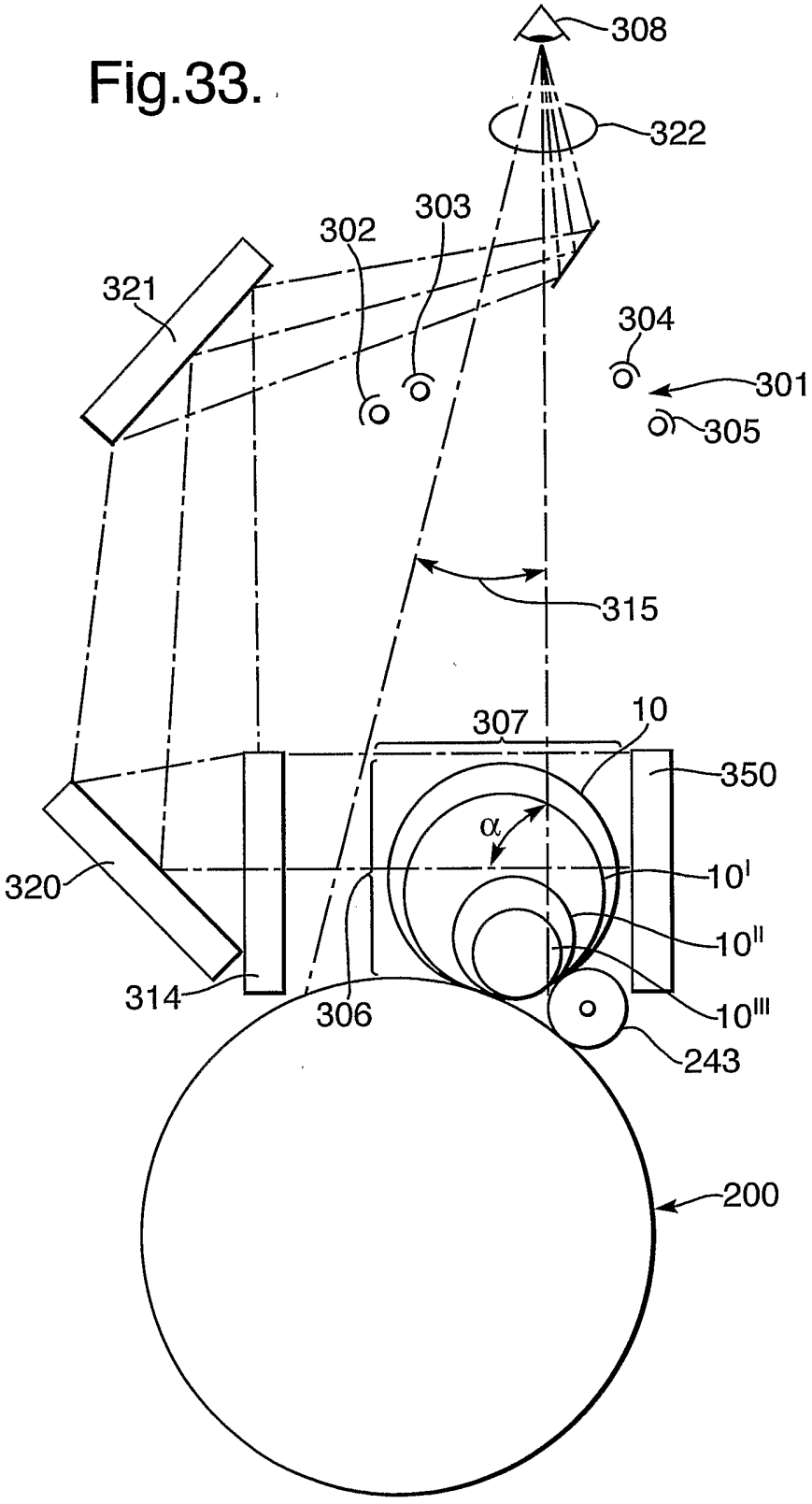


Fig.33.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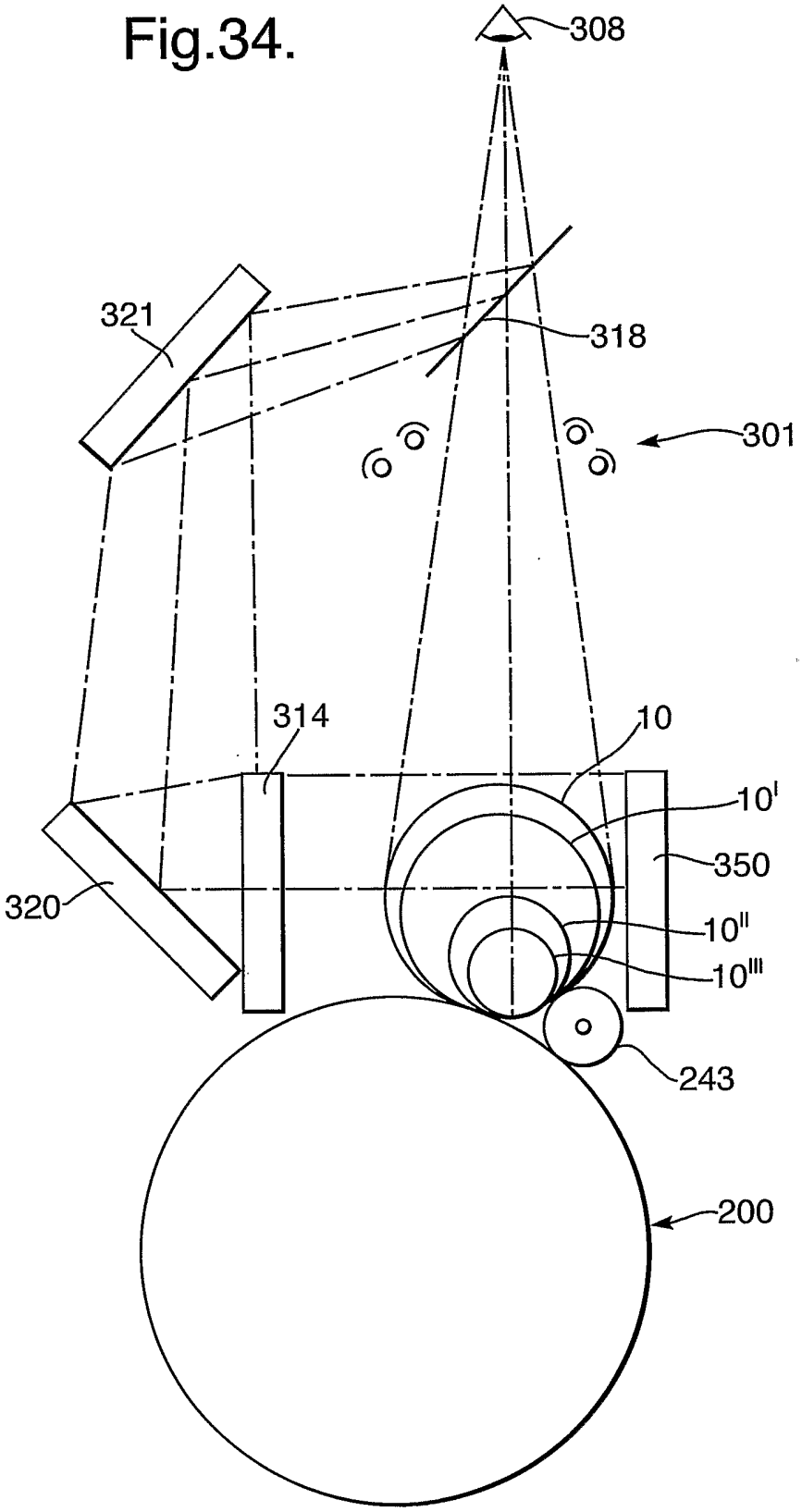
314
306
10'''
243
200

Fig.34.



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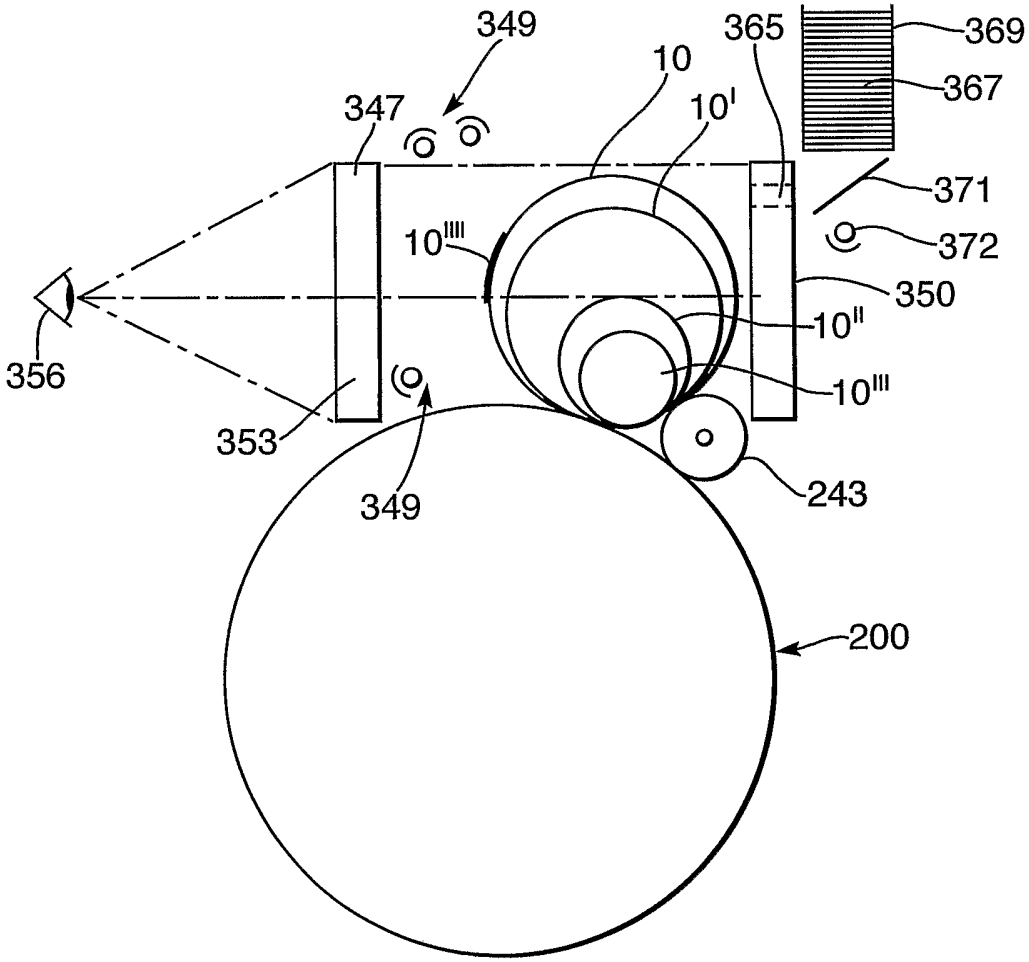

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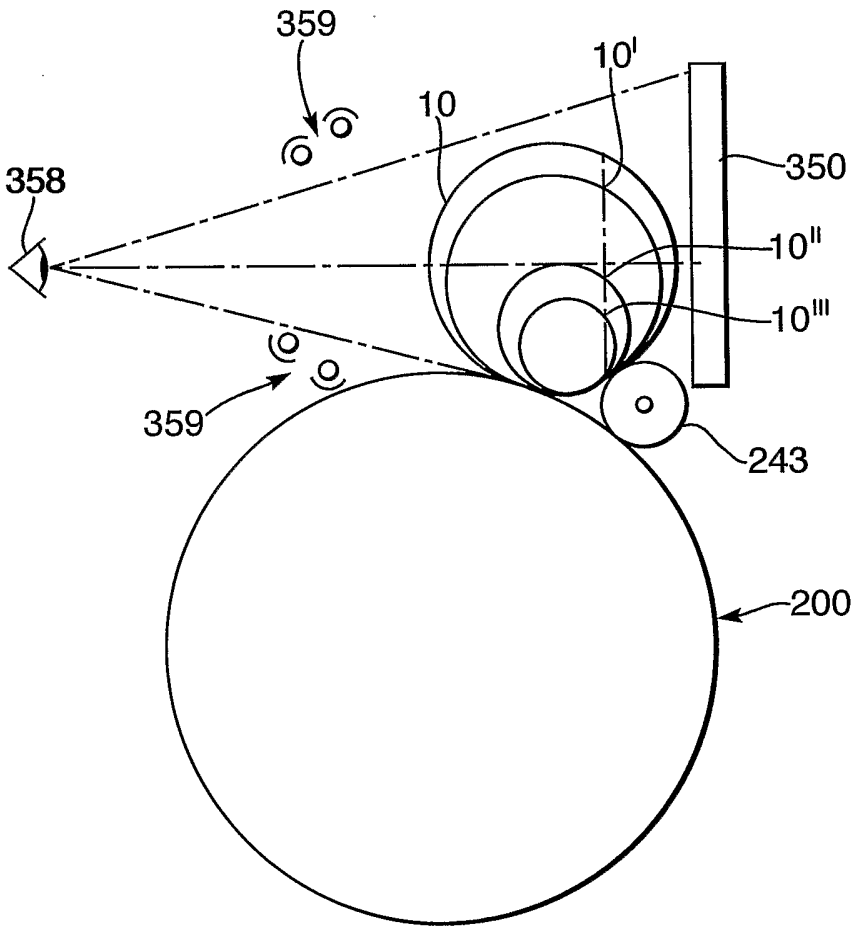
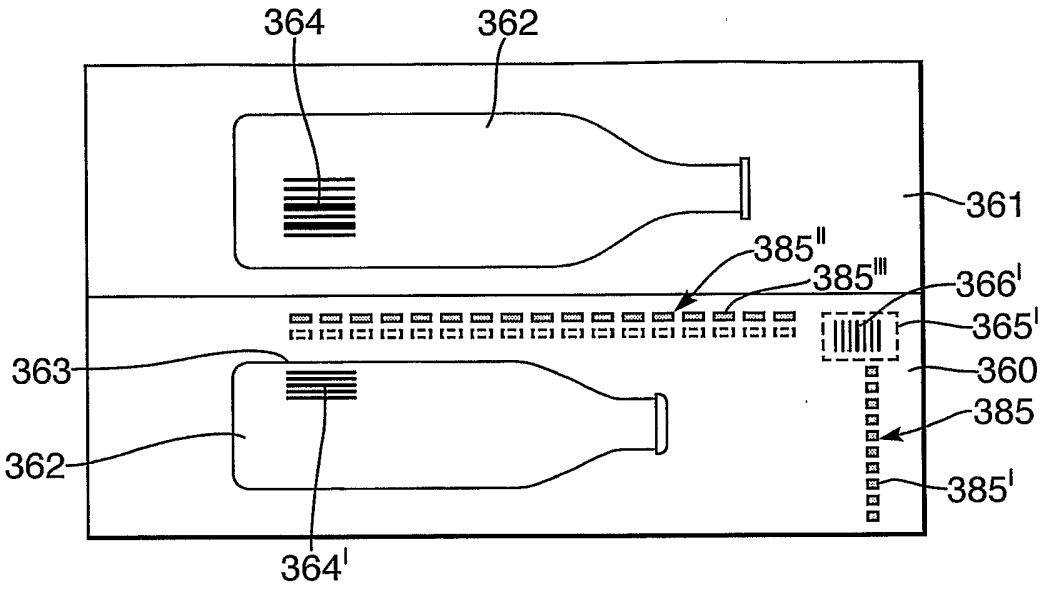


Fig.37a.



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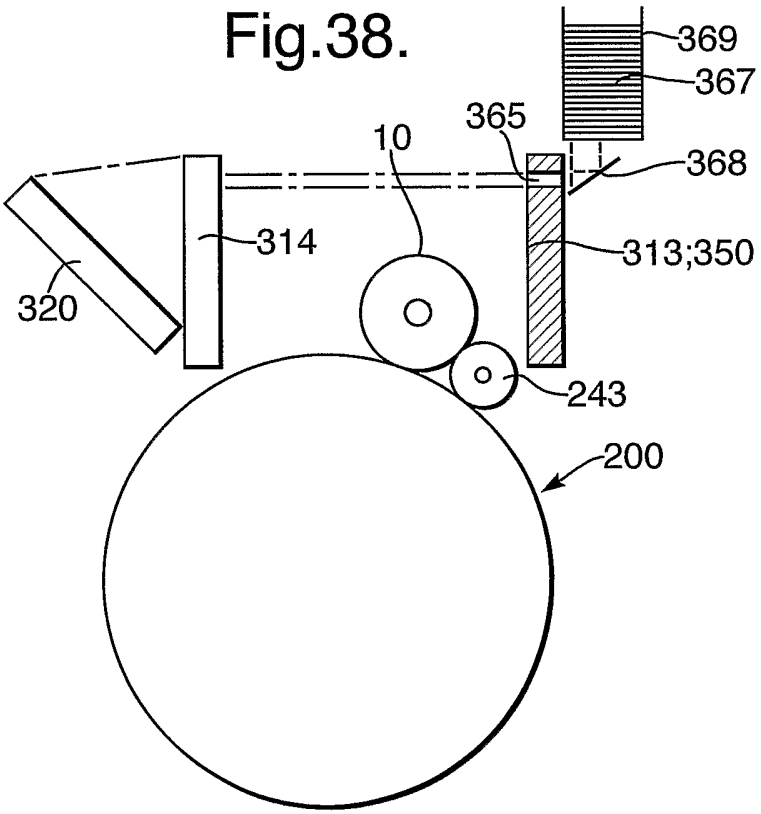


Fig.39.

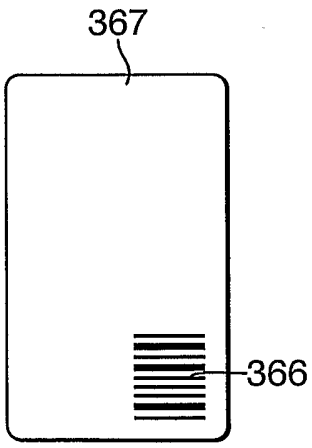


Fig.37b.

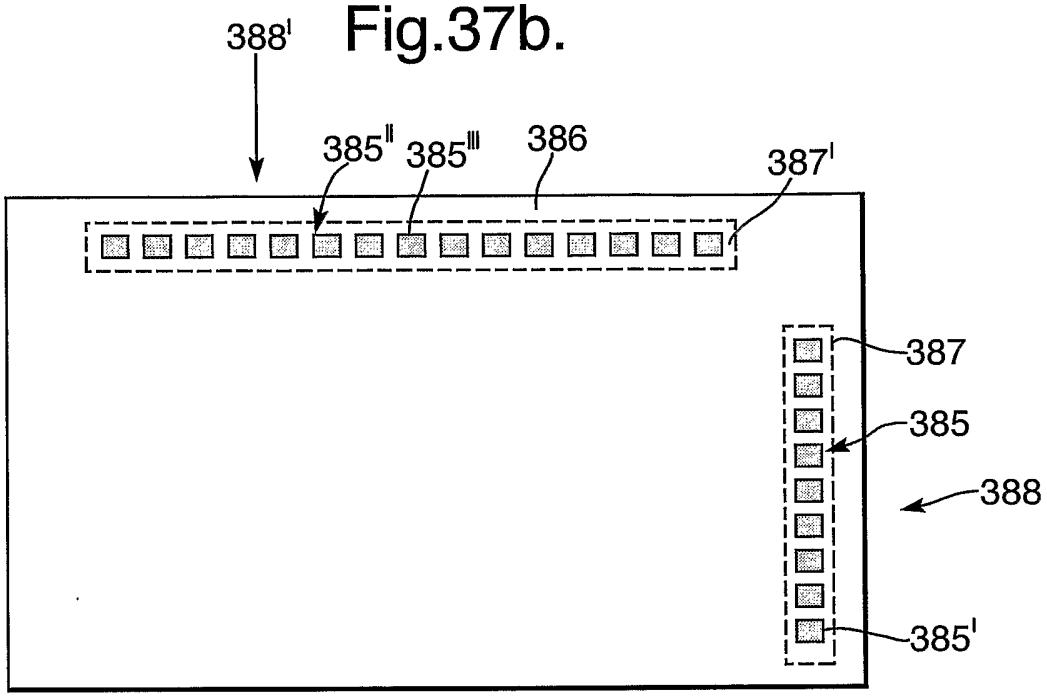


Fig.37c.

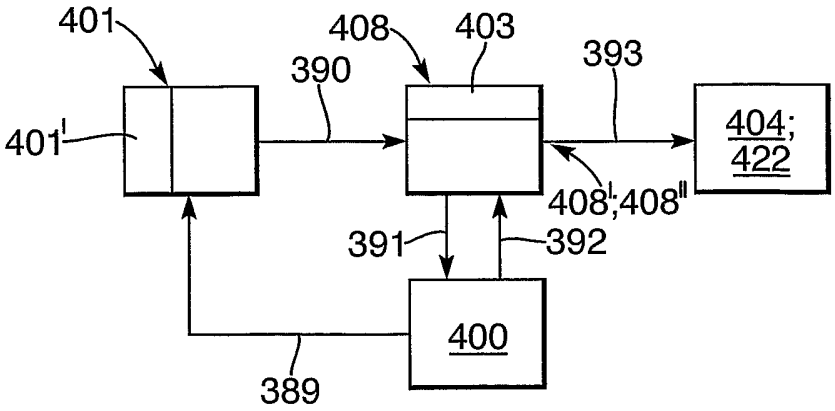


Fig.40a.

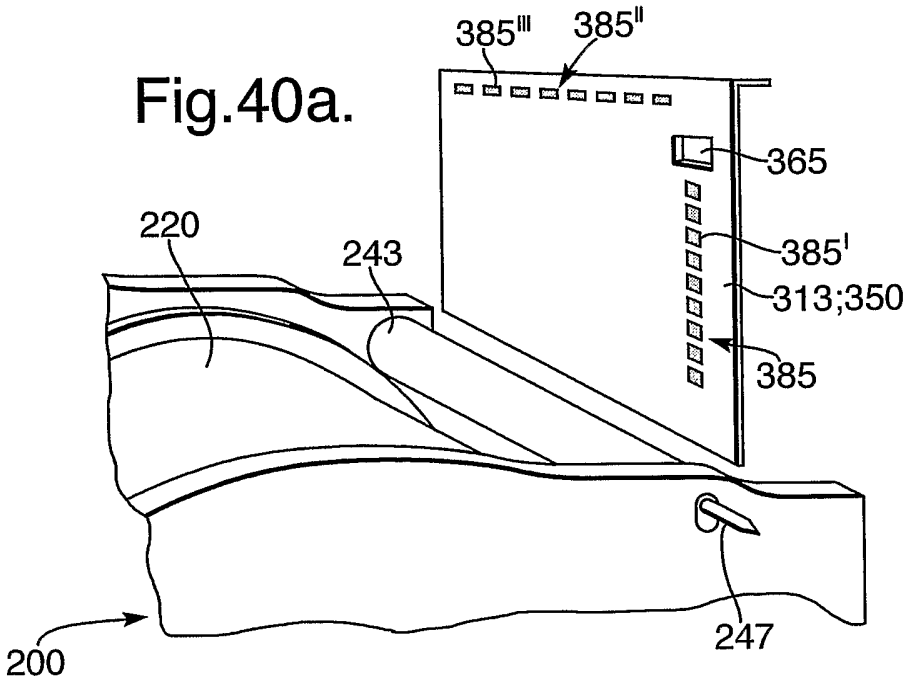


Fig.40b.

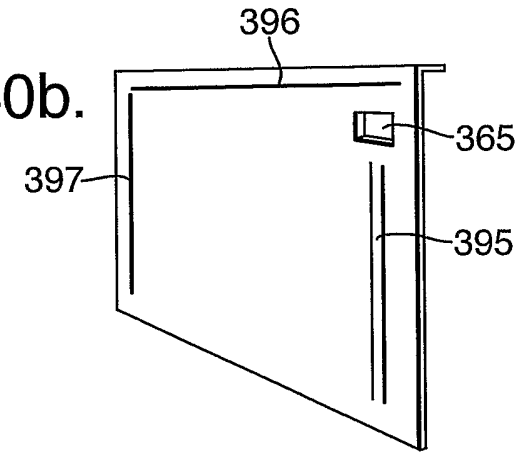


Fig.42.

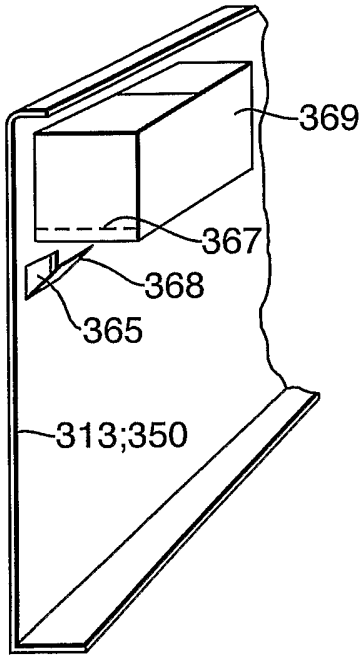


Fig.41a.

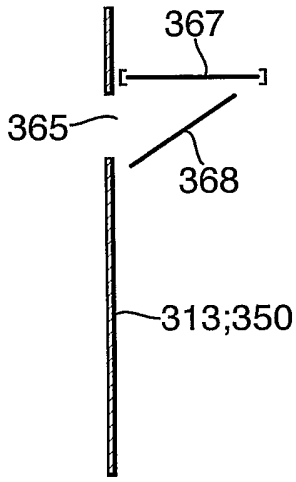


Fig.41b.

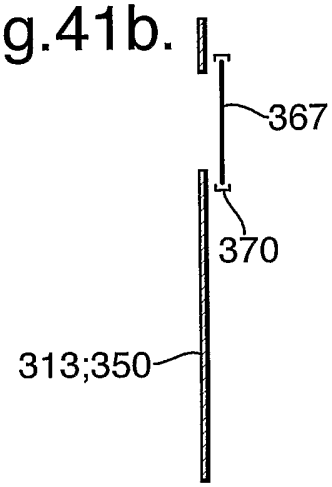


Fig.43.

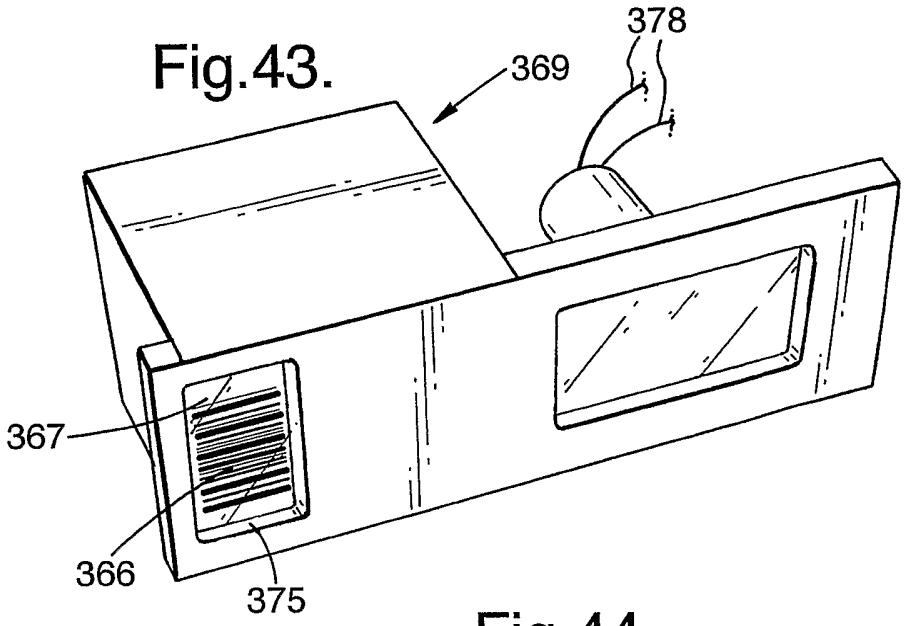


Fig.44.

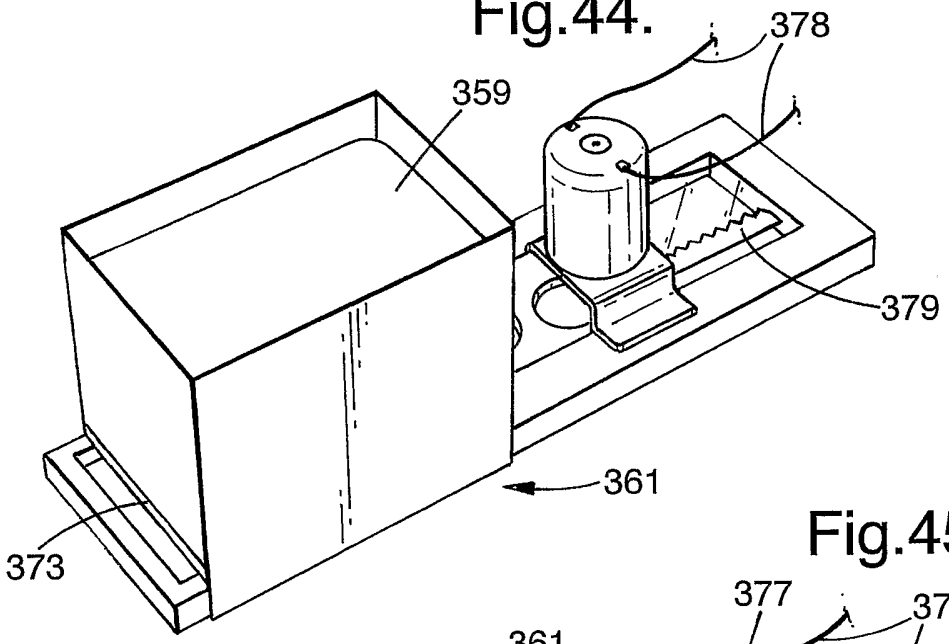
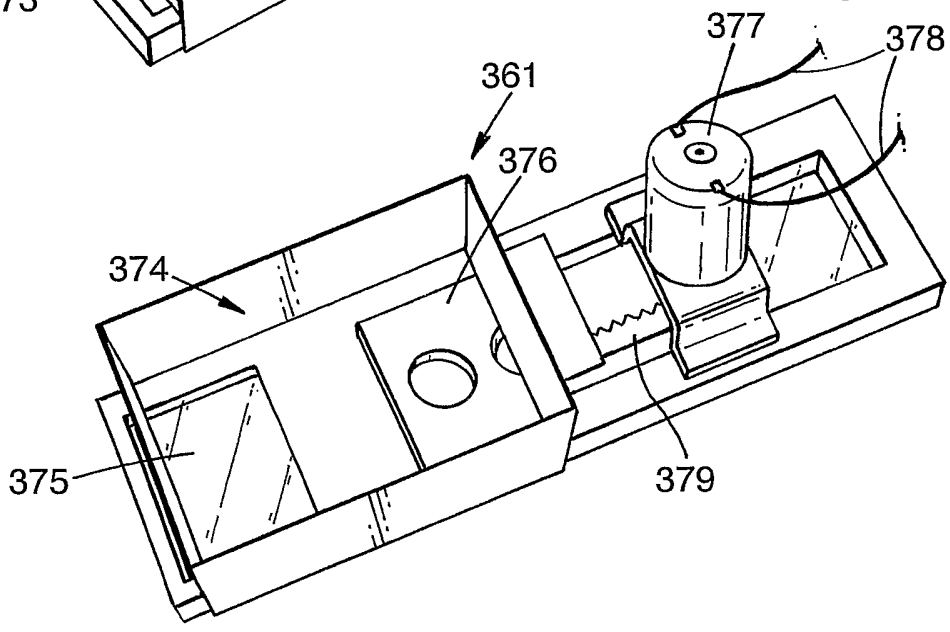
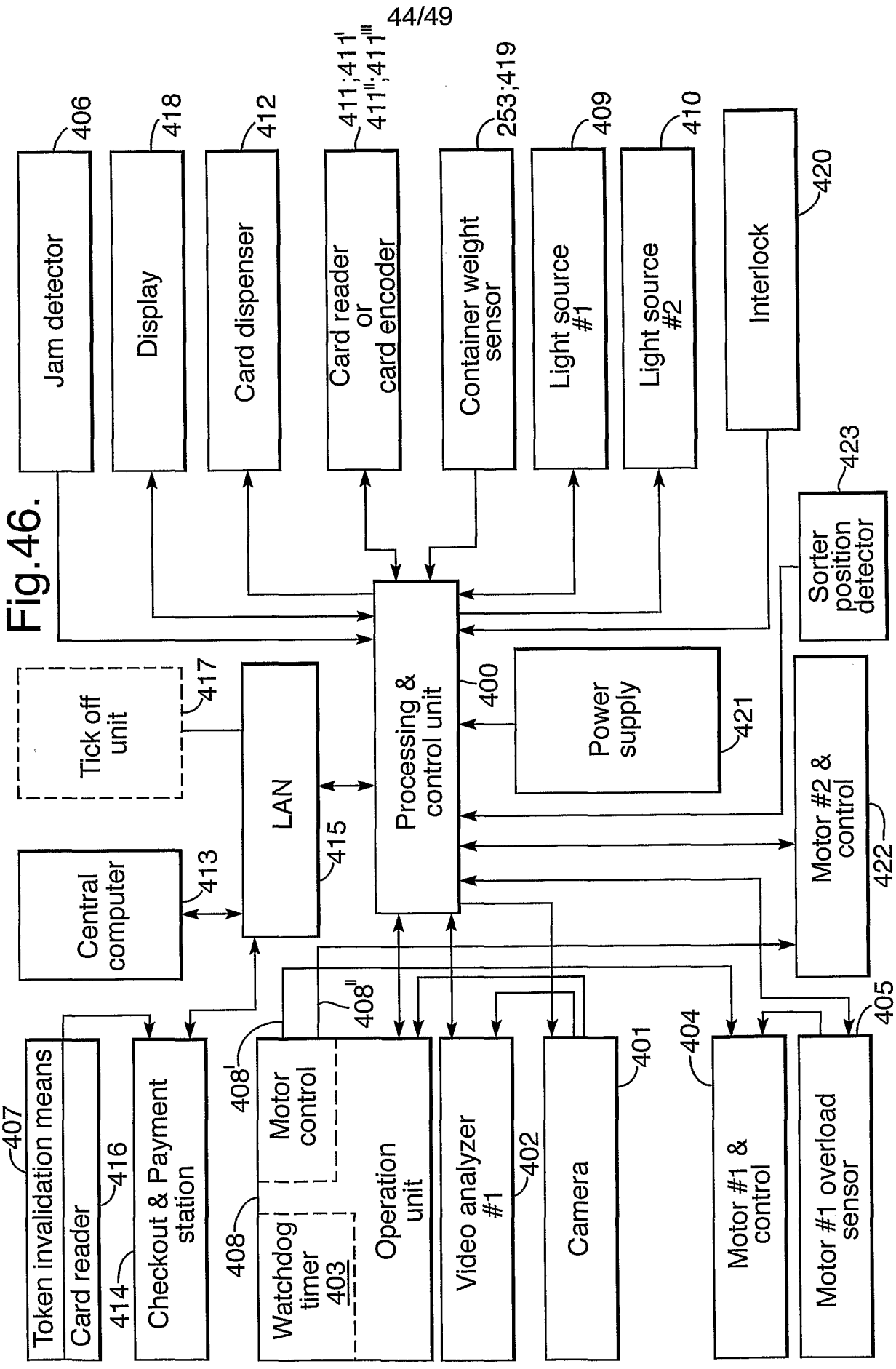


Fig.45.




Jam detector
406
Display
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Card dispenser
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Card reader or card encoder
411;411'
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Container weight sensor
253;419
Light source #1
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Light source #2
410
Interlock
420
Sorter position detector
423
Tick off unit
417
LAN
415
Processing & control unit
400
Power supply
421
Motor #2 & control
422
Central computer
413
Token invalidation means
407
Card reader
416
Checkout & Payment station
414
Motor control
408'
Watchdog timer 403
408
Operation unit
408''
Video analyzer #1
402
Camera
401
Motor #1 & control
404
Motor #1 overload sensor
405

Fig.46.

Fig.47.

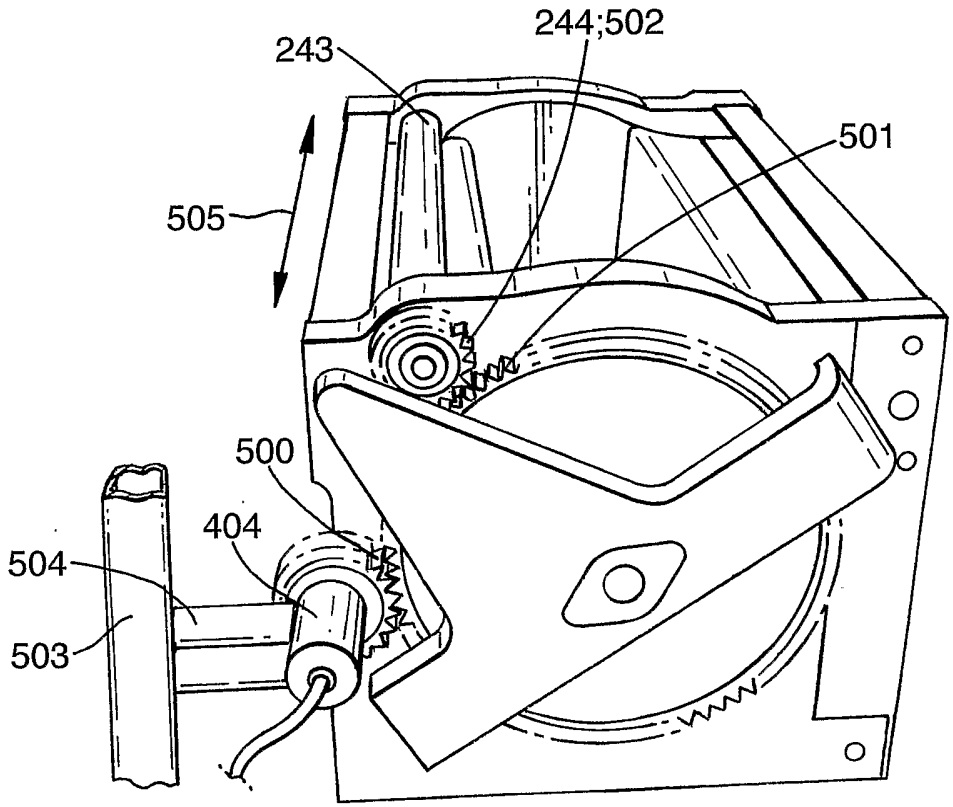


Fig.48a.

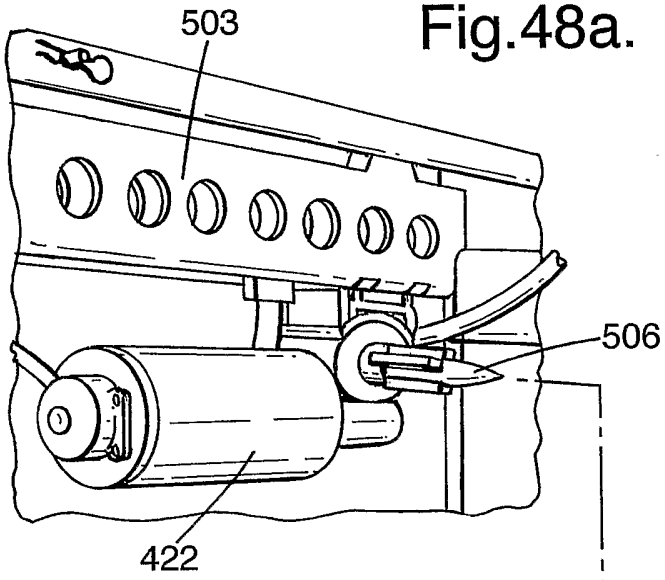


Fig.48b.

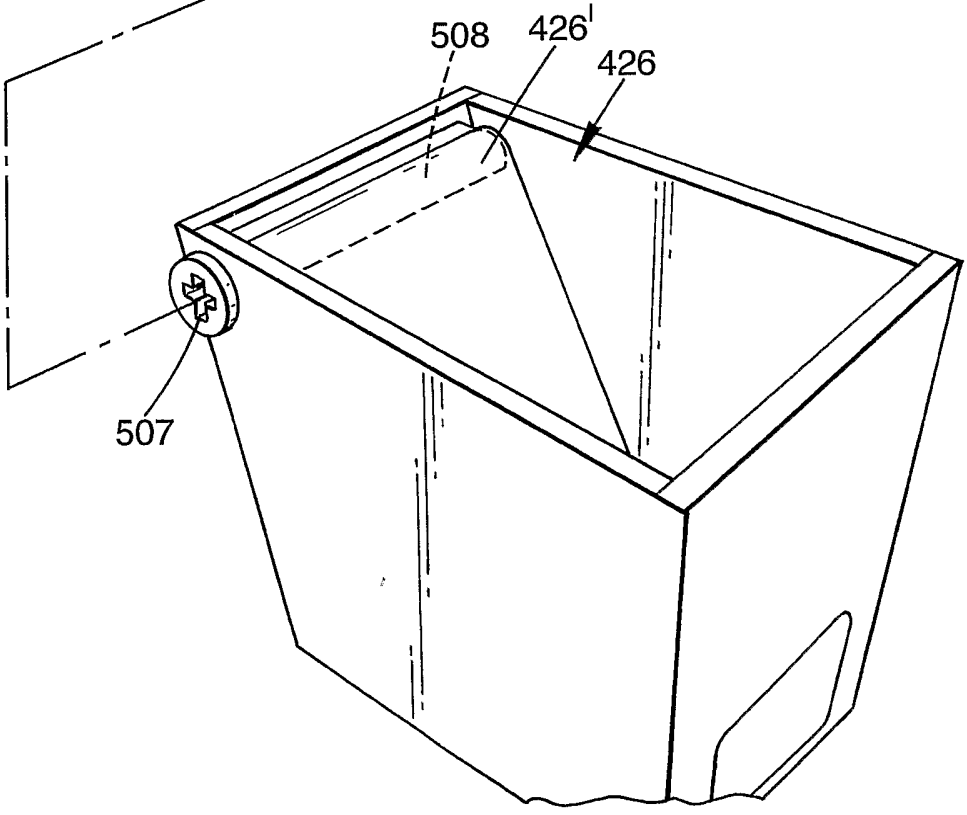


Fig.49a.

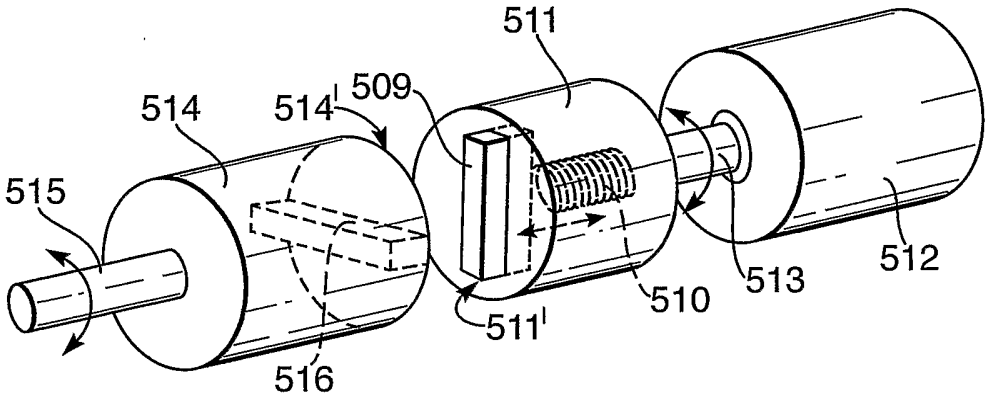


Fig.49b.

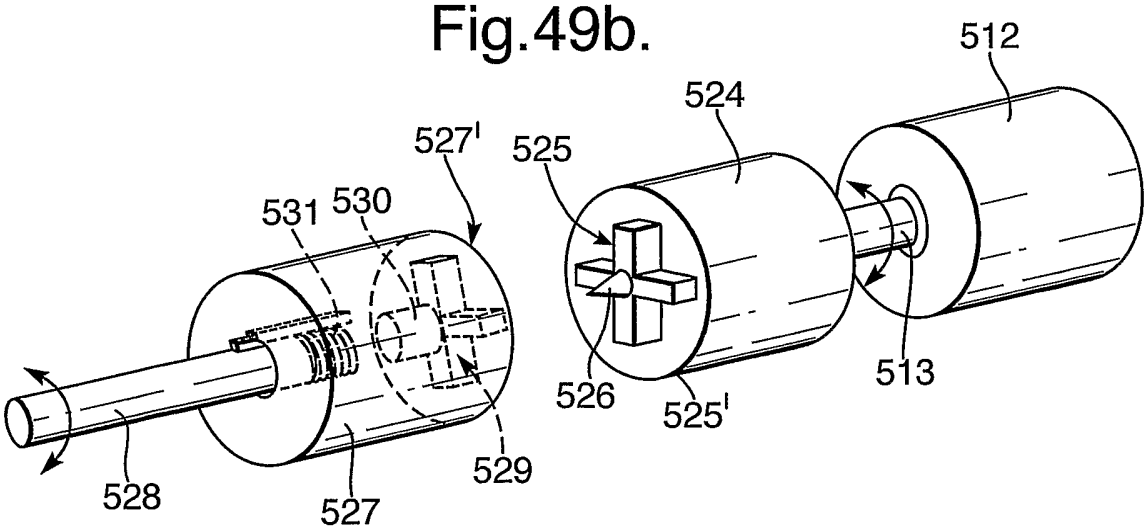


Fig.50a.

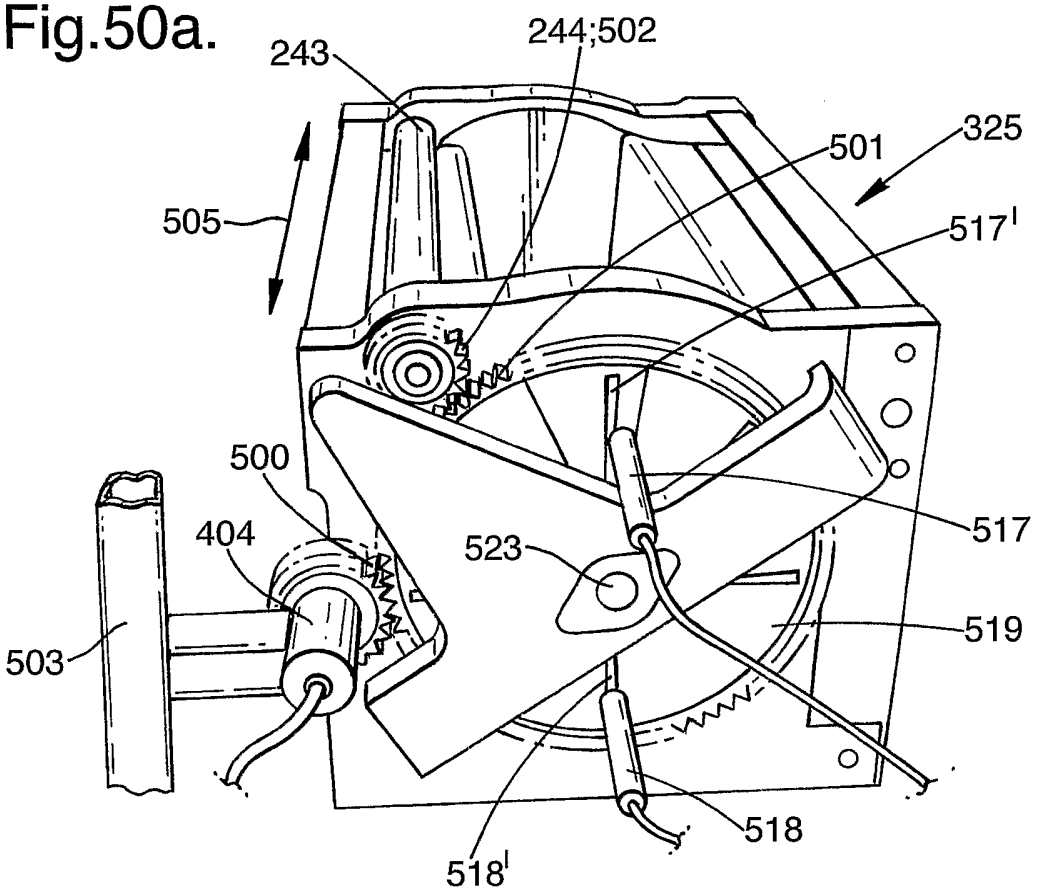
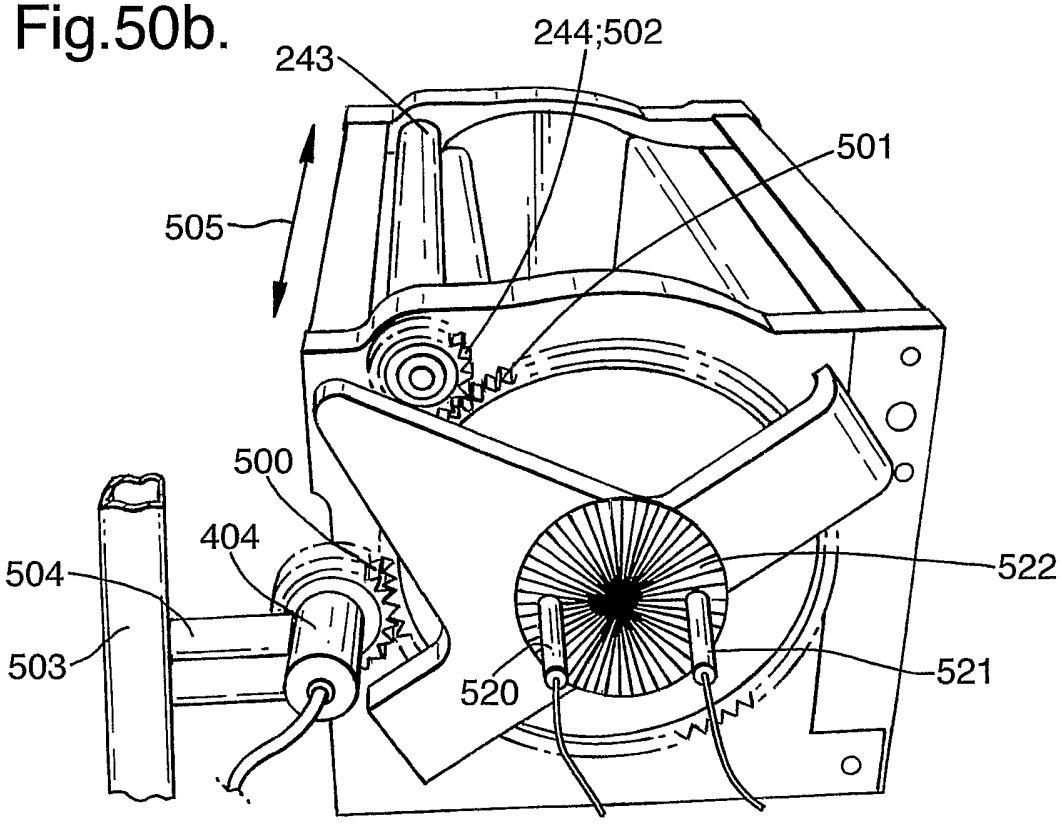


Fig.50b.



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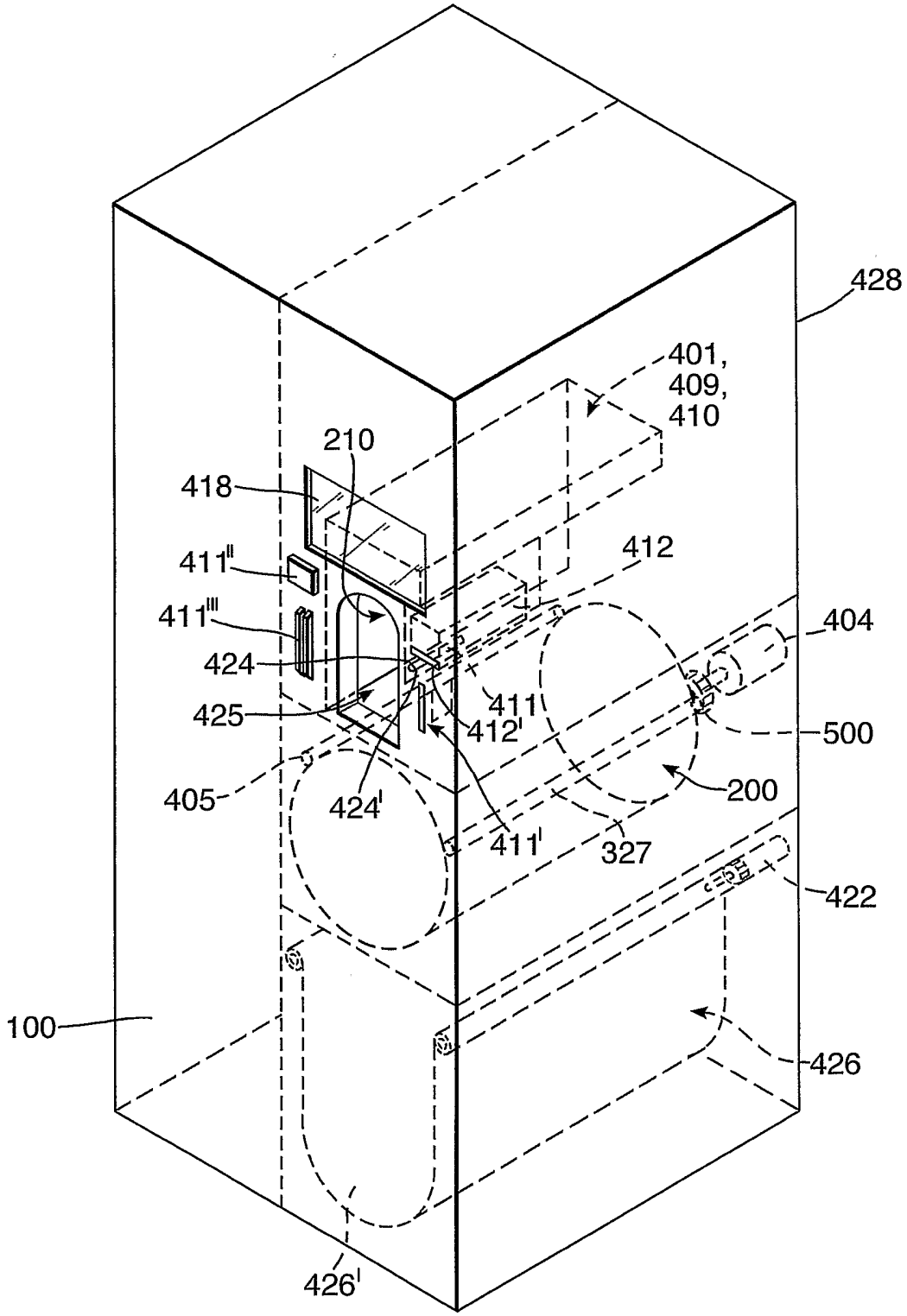
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