



US 20060283145A1

(19) **United States**

(12) **Patent Application Publication**
Weisgerber et al.

(10) **Pub. No.: US 2006/0283145 A1**

(43) **Pub. Date: Dec. 21, 2006**

(54) **BEVERAGE BOTTLING PLANT FOR FILLING BOTTLES WITH A LIQUID BEVERAGE MATERIAL HAVING AN INSPECTION APPARATUS FOR INSPECTING BOTTLES**

Publication Classification

(51) **Int. Cl.**
B65B 1/00 (2006.01)
(52) **U.S. Cl.** *53/167; 53/281*

(76) Inventors: **Martin Weisgerber**, Stolberg (DE);
Carsten Buchwald, Bad Breisig (DE);
Ralph Pohl, Rheinbrohl (DE);
Wolfgang Schorn, Honningen (DE)

(57) **ABSTRACT**

A beverage bottling plant for filling bottles with a liquid beverage material having an inspection apparatus for inspecting bottles. The abstract of the disclosure is submitted herewith as required by 37 C.F.R. §1.72(b). As stated in 37 C.F.R. §1.72(b): A brief abstract of the technical disclosure in the specification must commence on a separate sheet, preferably following the claims, under the heading "Abstract of the Disclosure." The purpose of the abstract is to enable the Patent and Trademark Office and the public generally to determine quickly from a cursory inspection the nature and gist of the technical disclosure. The abstract shall not be used for interpreting the scope of the claims. Therefore, any statements made relating to the abstract are not intended to limit the claims in any manner and should not be interpreted as limiting the claims in any manner.

Correspondence Address:
NILS H. LJUNGMAN & ASSOCIATES
P. O. BOX 130
GREENSBURG, PA 15601-0130 (US)

(21) Appl. No.: **11/405,362**

(22) Filed: **Apr. 17, 2006**

(30) **Foreign Application Priority Data**

Apr. 18, 2005 (DE)..... 10 2005 017 957.6

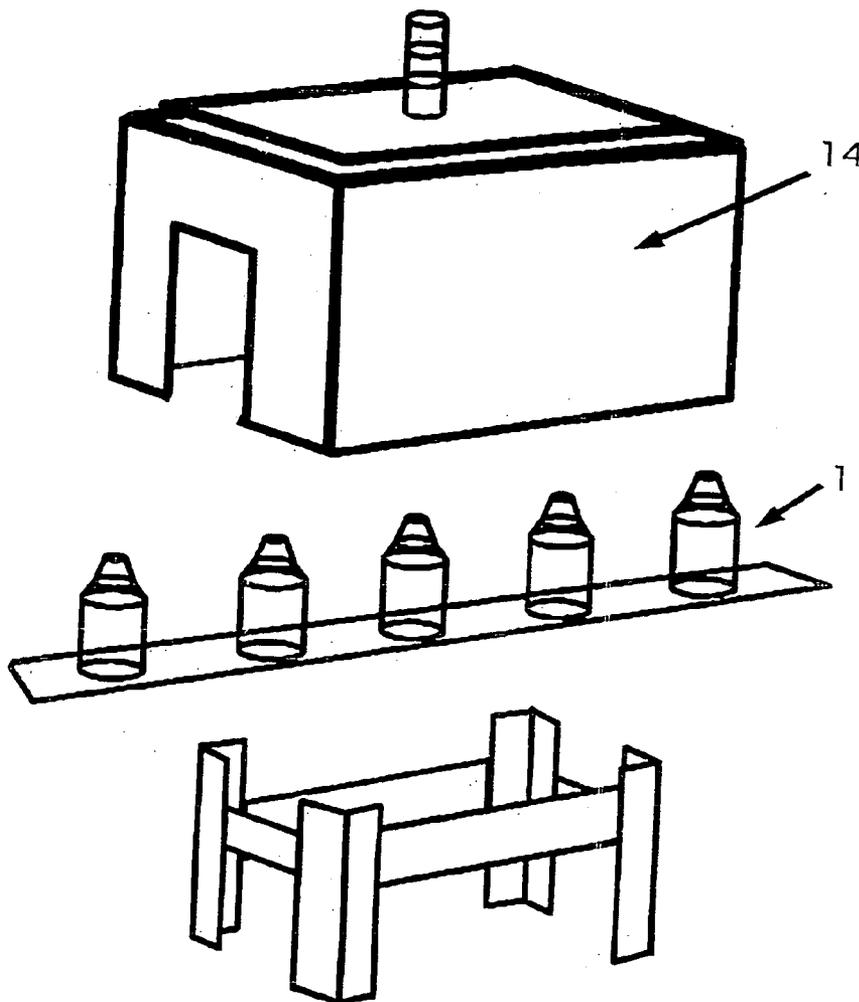


FIG. 1B

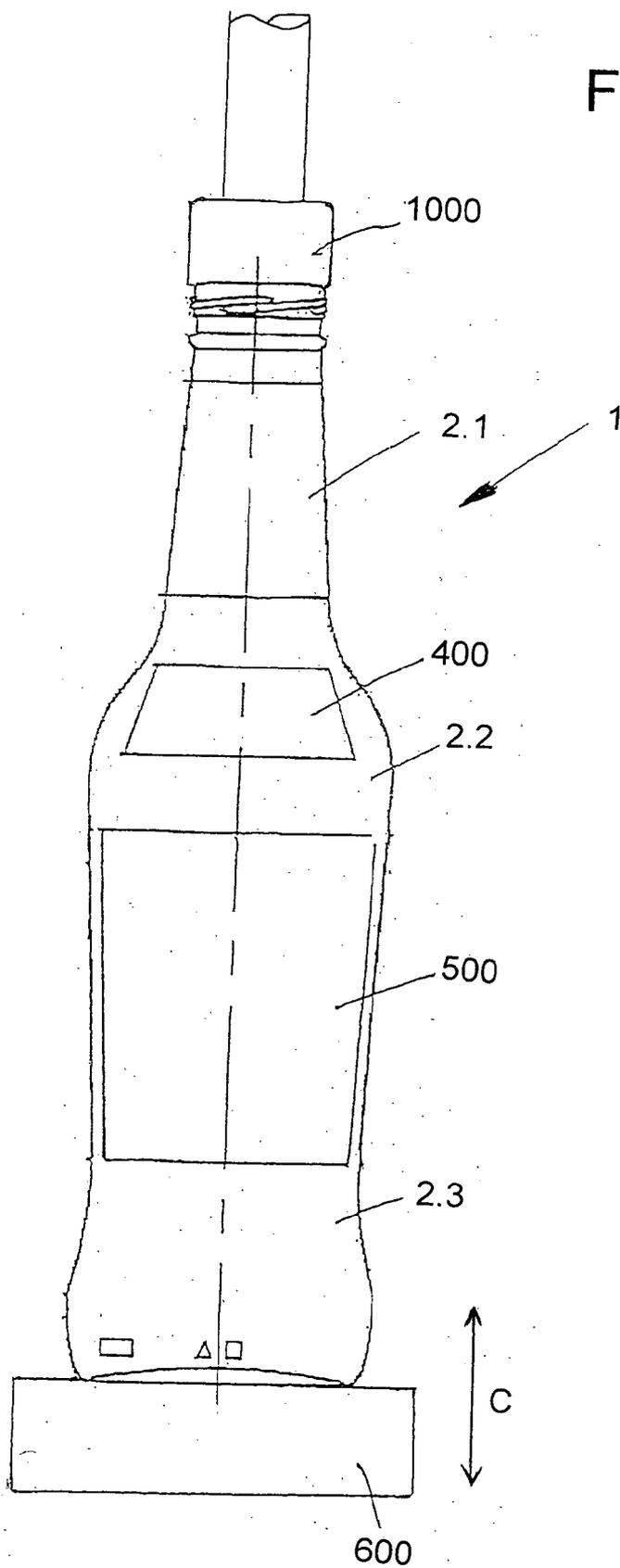
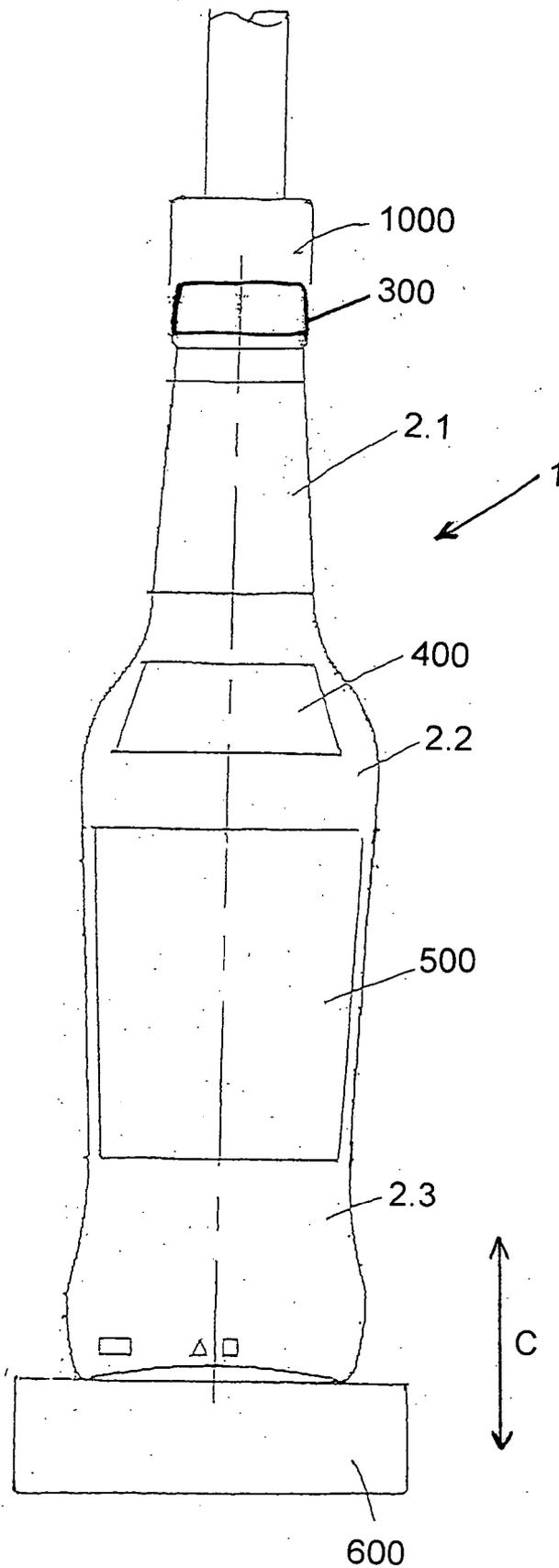


FIG. 1C



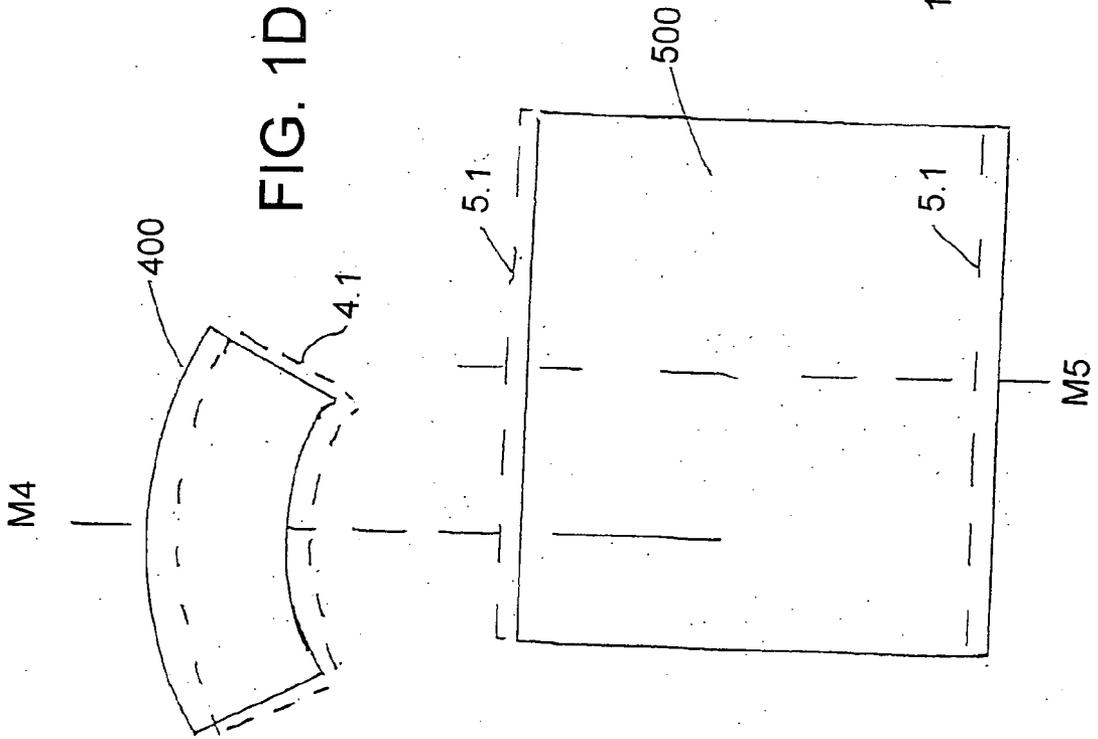
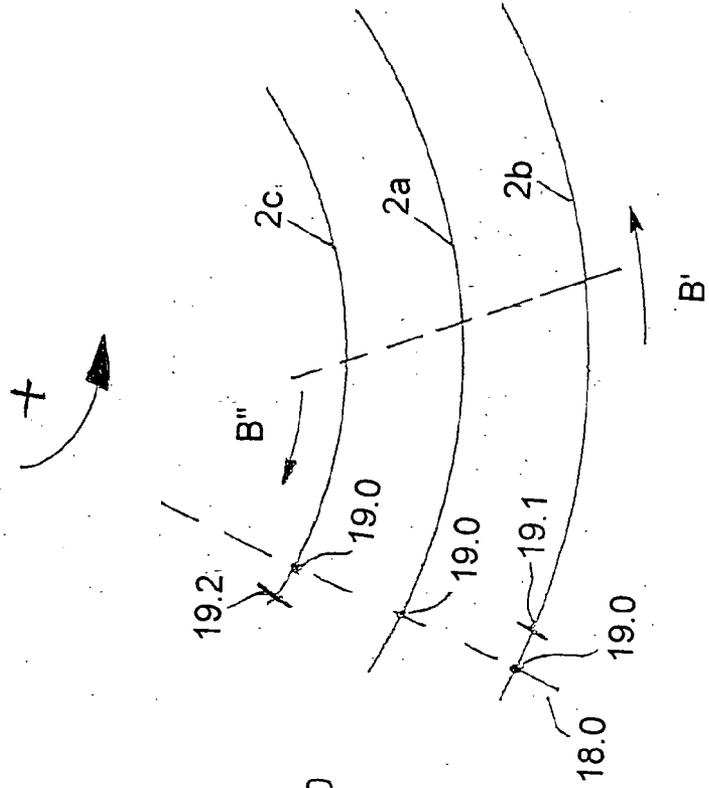


FIG. 1E



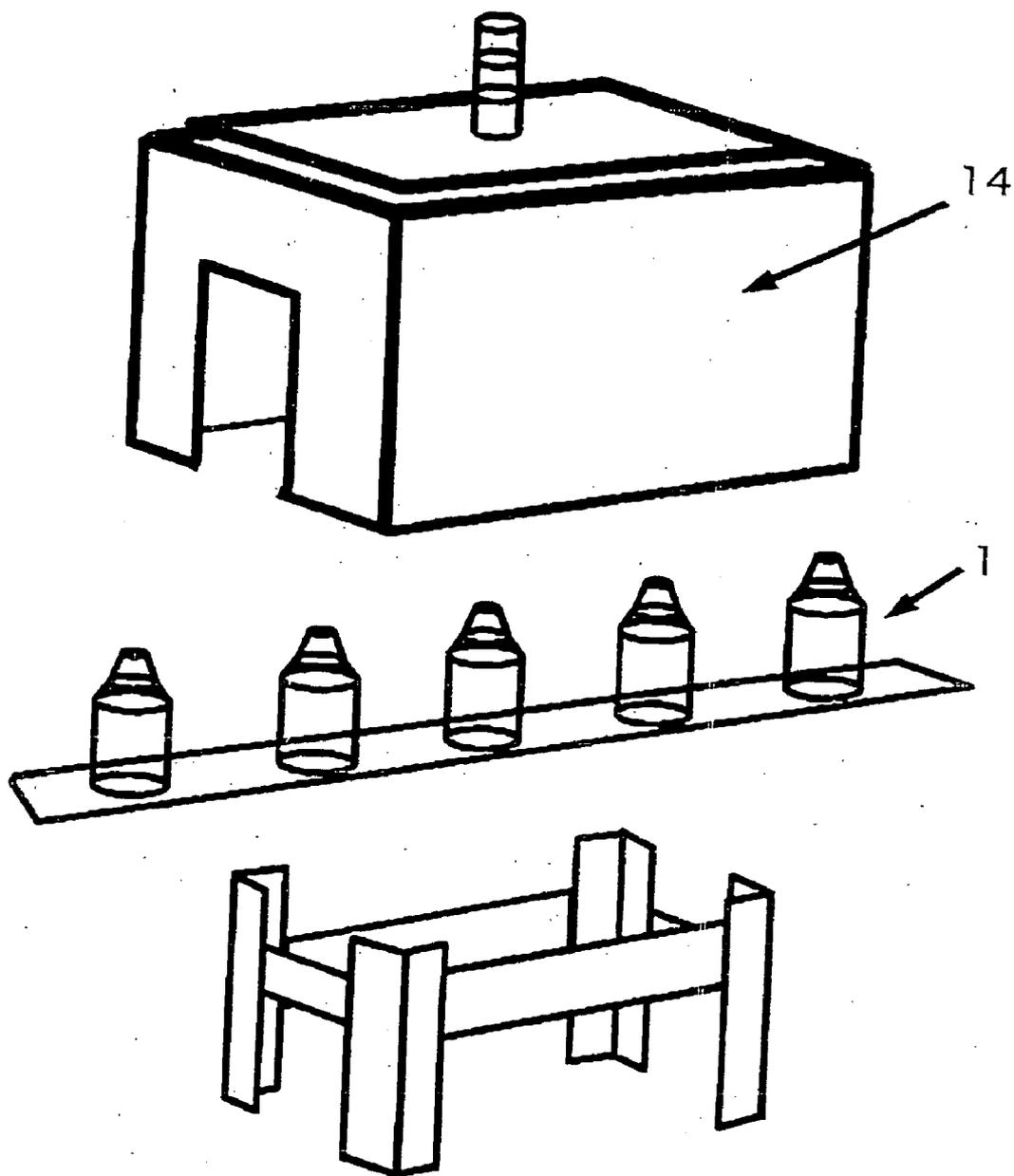


FIG. 1F

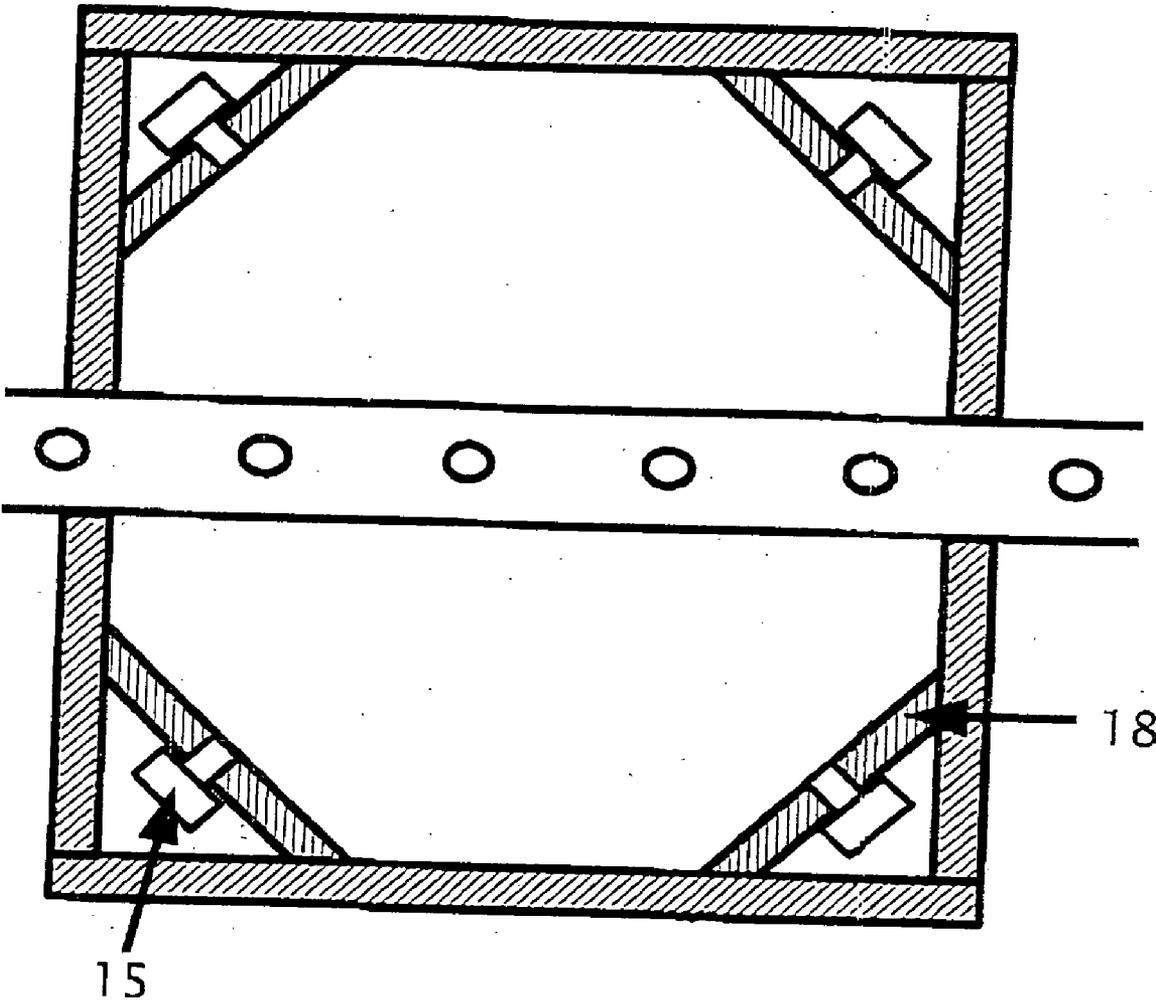


FIG. 2

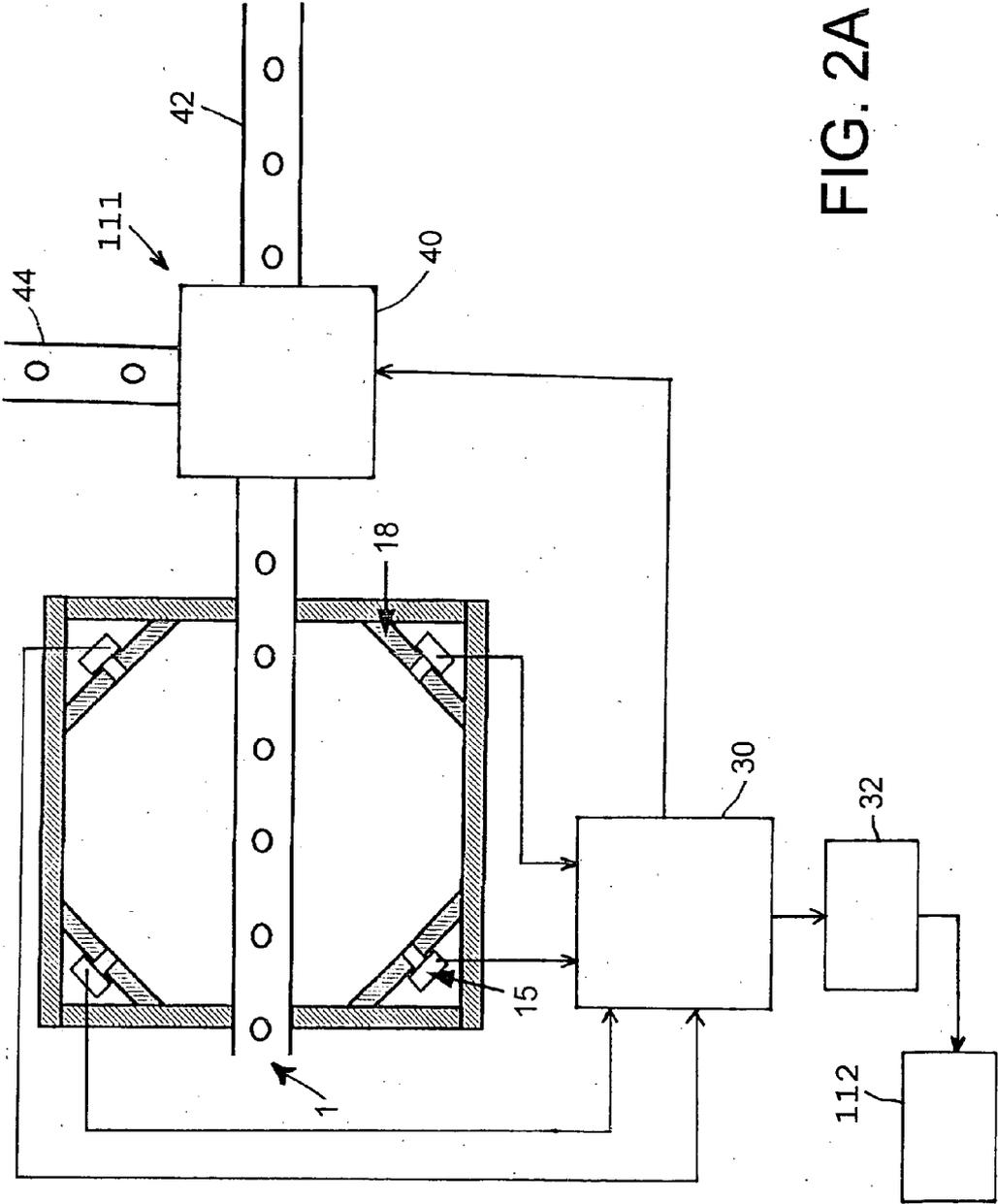


FIG. 2A

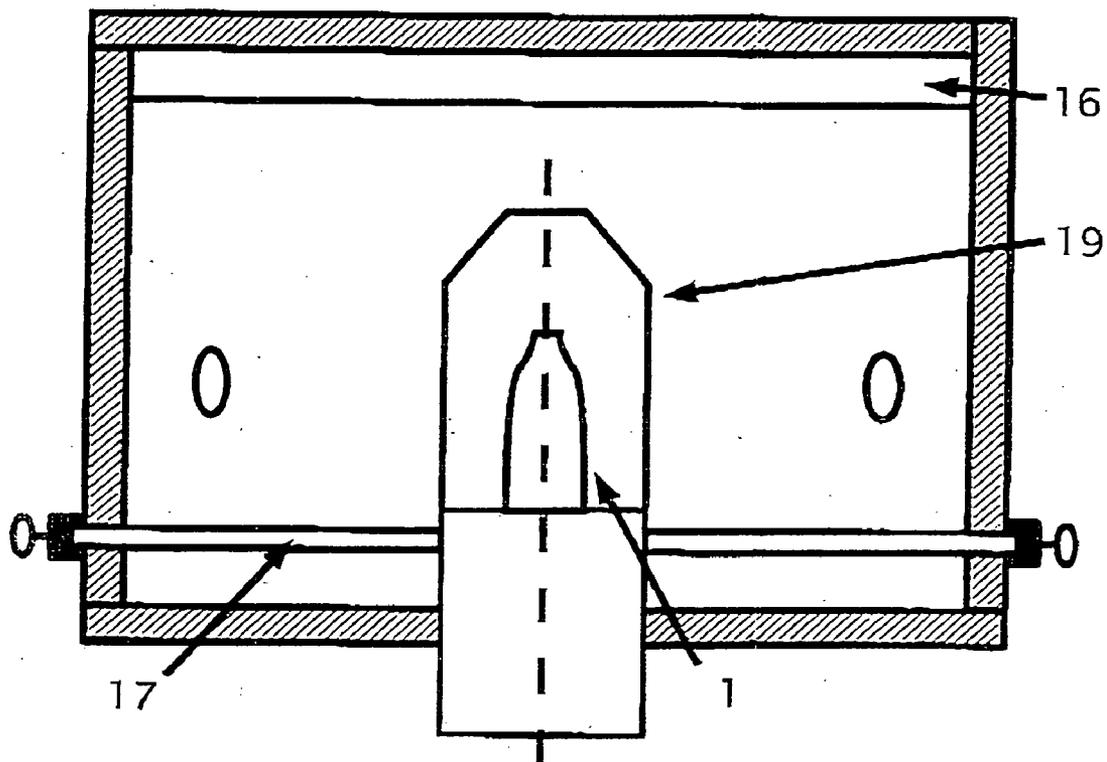


FIG. 3

**BEVERAGE BOTTLING PLANT FOR FILLING
BOTTLES WITH A LIQUID BEVERAGE
MATERIAL HAVING AN INSPECTION
APPARATUS FOR INSPECTING BOTTLES**

BACKGROUND

[0001] 1. Technical Field

[0002] The present application relates to a beverage bottling plant for filling bottles with a liquid beverage material having an inspection apparatus for inspecting bottles.

[0003] 2. Background Information

[0004] A beverage bottling plant for filling bottles with a liquid beverage filling material can possibly comprise a beverage filling machine with a plurality of beverage filling positions, each beverage filling position having a beverage filling device for filling bottles with liquid beverage filling material. The filling devices may have an apparatus designed to introduce a predetermined volume of liquid beverage filling material into the interior of bottles to a substantially predetermined level of liquid beverage filling material. The apparatus designed to introduce a predetermined flow of liquid beverage filling material further comprises an apparatus that is designed to terminate the filling of the beverage bottles upon the liquid beverage filling material reaching the predetermined level in bottles. There may also be provided a conveyer arrangement that is designed to move bottles, for example, from an inspecting machine to the filling machine. Upon filling, a closing station closes the filled bottles. There may further be provided a conveyer arrangement configured to transfer filled bottles from the filling machine to the closing station. Bottles may be labeled in a labeling station, the labeling station having a conveyer arrangement to receive bottles and to output bottles. The closing station and the labeling station may be connected by a corresponding conveyer arrangement.

[0005] Containers and contoured containers, such as bottles and cans etc., for example, that are used for packaging a wide variety of products, for example for the packaging of beverages or other liquids, bulk goods etc., have dimensional variations that result from the tolerances of the manufacturing methods used, which variations can be up to ± 2 mm in the diameter, for example, and up to ± 1 mm in height, for example, depending on the type of container, but also on the respective measurement point or measurement location at which said dimensional tolerances are determined.

[0006] When containers of this type are labeled, said dimensional variations or tolerances can result in the respective label not being in the desired position on the container in question, and in particular when labels are to be applied in different areas of a container, for example on the neck, shoulder or body of a bottle, said labels may not be oriented in the desired relationship with one another, i.e. the vertical axis of symmetry or center axis of the neck, shoulder and body labels no longer lies on the desired line, or the distances between the side edges of a shoulder label and a body label are no longer equal. Variations in the position of the labels caused by variations in the dimensions of the respective container can thus have an adverse effect on the appearance or the visual attractiveness of the respective labeled container, to the point where the high quality requirements of a bottling plant or of the retail consumer are no longer met.

[0007] Embodiments indicate a method and apparatus which makes it possible, since there are tolerances or variations in the dimensions of the contour of the container or of the container itself, to sense the position of one or more labels in the correct position on a given container, and thus to ensure an attractive visual appearance of the individual labeled container in question by removing the bottle with mispositioned labels.

[0008] The present application teaches a method for labeling bottles or similar contoured containers with at least one label, in which method the containers are located on container carriers of a conveyor line and are moved past at least one labeling unit, and thereby at least one label is transferred with one side of the label on the outside surface of the respective container and then fixed in position, starting from said side of the label, on the outside surface of the container, characterized by the fact that by means of at least one first sensor unit on the conveyor line, the contour of the respective container and/or the dimensions of said contour that are critical for the labeling and/or the position of any labels that have previously been applied to the container are detected to define the measured values, and that taking into consideration the variance of the measured values from a specified value, the process of applying the respective label to the container to be labeled is controlled so that the respective label is in the desired position after it has been applied to the container.

[0009] Conventional practice is to produce beverages, e.g. beer, fruit juices, mineral water and/or soft drink beverages on a large scale, i.e. industrially. To be able to offer the consumer a product of good and consistent quality, it has been found to be particularly advantageous to subject the product to numerous tests and inspections not only during the actual production process, but to also subject the finished product to a final inspection.

[0010] An analogous procedure is followed for other products that are bottled in jars or bottles, such as, for example, oils, sauces etc., so that the scope of application of the present application also includes the processing of those products, even if they are not explicitly mentioned below. The scope of protection likewise extends both to inspection machines that employ a linear construction and those that employ a rotary construction.

[0011] The term "finished product" as used here means the finished, closed and labeled container **1** filled with the substance being bottled.

[0012] In the context of a final inspection of this type, the object of the inspection can be, among other things, the fill level, the correct seating of the labels, the surface lettering or the surface quality of the finished product. To be able to carry out these inspection tasks, numerous solutions have been proposed in the past, whereby the machines in question were frequently what are termed linear machines, because as a result of their design they handle the finished product especially gently, and in particular do not damage the container labeling.

[0013] Inspection machines of this type, but also those that employ a rotary construction, are essentially constructed as follows: The containers are transported standing upright on a transport conveyor, e.g. on a conveyor chain. For the inspection of the containers, an inspection station is realized

that forms part of the transport line or surrounds a portion of the transport line. For this purpose, the prior art teaches the realization of a housing which, as an integral component of the inspection station, surrounds the transport line in the inspection area as completely and light-proof as possible, so that as a rule only the inlet and outlet for the containers are not closed by the wall of the housing **14**. However, other inlets and outlets are possible which can further decrease outside originating light.

[0014] The housing **14** and/or the inspection machine will generally include at least one camera **15**, at least one illumination device **16** and a system for the processing and evaluation of the image information recorded.

[0015] On the basis of the evaluated image information and a comparison with the desired values stored in the evaluation system, one or more comparisons between the measured and desired values can be performed to identify defective containers, i.e. containers that do not meet the specified requirements, and are excluded from the rest of the production process, in particular from the packing of the containers **1** in a case or carton for further transport.

[0016] One characteristic that all the configurations of inspection machines of the prior art for optical inspection have in common is that the interior walls of the housing are realized or painted black. The purpose of this measure is to ensure that the surrounding black surfaces absorb any light that is reflected by the surfaces of the container **1** being inspected completely or as completely as possible and thus prevent additional errors and/or problems that might occur during the imaging or its evaluation and may be caused by additional reflections on the surface of the container.

[0017] An additional objective of the black realization of the interior walls of the housing **14** is to prevent problems and disruptions that can be caused by diffused, stray or scattered light that gets into the housing **14** through the container inlet and/or outlet **19**. The purpose of the black walls is to ensure that this diffused or scattered light is absorbed to the maximum extent possible by the interior walls of the housing.

[0018] One essential disadvantage of the realizations of the prior art is that a uniform luminance cannot be achieved inside the housing or on the surface of the container to be inspected. Consequently, the surface of the container has different brightness values. Because these different brightness values are caused only by the type of illumination and/or the geometric "normal contour" of the container being inspected, they make the analysis and the interpretation of the recordings more difficult, because the characteristics that are being looked for and inspected, such as for example the label (edges), container closures or surface defects in the container **1**, also cause fluctuations in brightness.

Object or Objects

[0019] The object is to create a device for the inspection of containers that reliably eliminates or at least minimizes the above mentioned disadvantages of the inspection devices of the prior art. For this purpose, the present application teaches the realization of an inspection device as described herein below. Developments of the present application are also disclosed herein below.

[0020] The above-discussed embodiments of the present invention will be described further hereinbelow. When the word "invention" or "embodiment of the invention" is used in this specification, the word "invention" or "embodiment of the invention" includes "inventions" or "embodiments of the invention", that is the plural of "invention" or "embodiment of the invention". By stating "invention" or "embodiment of the invention", the Applicant does not in any way admit that the present application does not include more than one patentably and non-obviously distinct invention, and maintains that this application may include more than one patentably and non-obviously distinct invention. The Applicant hereby asserts that the disclosure of this application may include more than one invention, and, in the event that there is more than one invention, that these inventions may be patentable and non-obvious one with respect to the other.

BRIEF DESCRIPTION OF THE DRAWINGS

[0021] The present application is explained in greater detail below on the basis of an exemplary embodiment.

[0022] **FIG. 1A** is a schematic illustration of a container filling plant in accordance with one possible embodiment;

[0023] **FIG. 1B** is a simplified illustration showing a side view of a bottle on a turntable of a labeling machine, in which the turntable acts as a container carrier or bottle carrier;

[0024] **FIG. 1C** is similar to **FIG. 1B** and shows further details according to one possible embodiment;

[0025] **FIG. 1D** is a schematic illustration of a shoulder and body label showing their relationship to each other, to explain the embodiments and the control of a labeling machine;

[0026] **FIG. 1E** is a schematic partial illustration of different bottle diameters to explain the embodiments;

[0027] **FIG. 1F** is a simplified illustration of an inspection machine that employs a linear construction, whereby the housing is shown in an elevated position;

[0028] **FIG. 2** is a simplified sectional drawing in an overhead view;

[0029] **FIG. 2A** shows a simplified overhead view of an inspection machine according to one possible embodiment; and

[0030] **FIG. 3** is another simplified section drawing in a side view of an inspection machine that employs a linear construction.

DESCRIPTION OF EMBODIMENT OR EMBODIMENTS

[0031] Developments, advantages and potential applications of the present application are explained in the following description of exemplary embodiments and the drawing. All of the characteristics described and/or illustrated are the object of the present application, individually or in any possible combination, regardless of their placement in the claims or the references between claims. The text of the claims is simultaneously incorporated by reference into the description.

[0032] FIG. 1A shows schematically the main components of one possible embodiment example of a system for filling containers, specifically, a beverage bottling plant for filling bottles B with at least one liquid beverage, in accordance with at least one possible embodiment, in which system or plant could possibly be utilized at least one aspect, or several aspects, of the embodiments disclosed herein.

[0033] FIG. 1A shows a rinsing arrangement or rinsing station 101, to which the containers, namely bottles B, are fed in the direction of travel as indicated by the arrow A1, by a first conveyer arrangement 103, which can be a linear conveyer or a combination of a linear conveyer and a starwheel. Downstream of the rinsing arrangement or rinsing station 101, in the direction of travel as indicated by the arrow A1, the rinsed bottles B are transported to a beverage filling machine 105 by a second conveyer arrangement 104 that is formed, for example, by one or more starwheels that introduce bottles B into the beverage filling machine 105.

[0034] The beverage filling machine 105 shown is of a revolving or rotary design, with a rotor 105', which revolves around a central, vertical machine axis. The rotor 105' is designed to receive and hold the bottles B for filling at a plurality of filling positions 113 located about the periphery of the rotor 105'. At each of the filling positions 113 is located a filling arrangement 114 having at least one filling device, element, apparatus, or valve. The filling arrangements 114 are designed to introduce a predetermined volume or amount of liquid beverage into the interior of the bottles B to a predetermined or desired level.

[0035] The filling arrangements 114 receive the liquid beverage material from a toroidal or annular vessel 117, in which a supply of liquid beverage material is stored under pressure by a gas. The toroidal vessel 117 is a component, for example, of the revolving rotor 105'. The toroidal vessel 117 can be connected by means of a rotary coupling or a coupling that permits rotation. The toroidal vessel 117 is also connected to at least one external reservoir or supply of liquid beverage material by a conduit or supply line. In the embodiment shown in FIG. 1A, there are two external supply reservoirs 123 and 124, each of which is configured to store either the same liquid beverage product or different products. These reservoirs 123, 124 are connected to the toroidal or annular vessel 117 by corresponding supply lines, conduits, or arrangements 121 and 122. The external supply reservoirs 123, 124 could be in the form of simple storage tanks, or in the form of liquid beverage product mixers, in at least one possible embodiment.

[0036] As well as the more typical filling machines having one toroidal vessel, it is possible that in at least one possible embodiment there could be a second toroidal or annular vessel which contains a second product. In this case, each filling arrangement 114 could be connected by separate connections to each of the two toroidal vessels and have two individually-controllable fluid or control valves, so that in each bottle B, the first product or the second product can be filled by means of an appropriate control of the filling product or fluid valves.

[0037] Downstream of the beverage filling machine 105, in the direction of travel of the bottles B, there can be a beverage bottle closing arrangement or closing station 106 which closes or caps the bottles B. The beverage bottle closing arrangement or closing station 106 can be connected

by a third conveyer arrangement 107 to a beverage bottle labeling arrangement or labeling station 108. The third conveyer arrangement may be formed, for example, by a plurality of starwheels, or may also include a linear conveyer device.

[0038] In the illustrated embodiment, the beverage bottle labeling arrangement or labeling station 108 has at least one labeling unit, device, or module, for applying labels to bottles B. In the embodiment shown, the labeling arrangement 108 has three output conveyer arrangement: a first output conveyer arrangement 109, a second output conveyer arrangement 110, and a third output conveyer arrangement 111, all of which convey filled, closed, and labeled bottles B to a bottle inspecting apparatus 20.

[0039] The first output conveyer arrangement 109, in the embodiment shown, is designed to convey bottles B that are filled with a first type of liquid beverage supplied by, for example, the supply reservoir 123. The second output conveyer arrangement 110, in the embodiment shown, is designed to convey bottles B that are filled with a second type of liquid beverage supplied by, for example, the supply reservoir 124. The third output conveyer arrangement 111, in the embodiment shown, is designed to convey incorrectly labeled bottles B. To further explain, the labeling arrangement 108 can comprise at least one beverage bottle inspection or monitoring device that inspects or monitors the location of labels on the bottles B to determine if the labels have been correctly placed or aligned on the bottles B. The third output conveyer arrangement 111 removes any bottles B which have been incorrectly labeled as determined by the inspecting device or devices 14.

[0040] The beverage bottling plant can be controlled by a central control arrangement 112, which could be, for example, computerized control system that monitors and controls the operation of the various stations and mechanisms of the beverage bottling plant.

[0041] The first output conveyer arrangement 109, in the embodiment shown, is designed to convey bottles B that are filled with a first type of liquid beverage supplied by, for example, the supply reservoir 123. The second output conveyer arrangement 110, in the embodiment shown, is designed to convey bottles B that are filled with a second type of liquid beverage supplied by, for example, the supply reservoir 124. The third output conveyer arrangement 111, in the embodiment shown, is designed to convey incorrectly labeled bottles B. To further explain, the labeling arrangement 108 can comprise at least one beverage bottle inspection or monitoring device that inspects or monitors the location of labels on the bottles B to determine if the labels have been correctly placed or aligned on the bottles B. The third output conveyer arrangement 111 removes any bottles B which have been incorrectly labeled as determined by the inspecting device or devices 14.

[0042] The beverage bottling plant can be controlled by a central control arrangement 112, which could be, for example, computerized control system that monitors and controls the operation of the various stations and mechanisms of the beverage bottling plant.

[0043] The labeling machine of FIGS. 1B and 1C, which in the figures is designated 1000 in general, is used to label bottles 1 that are filled with a liquid and are capped on their

bottle mouth with caps **3**, and are each provided with labels **400** and **500**, of which the label **400** is a shoulder label and the label **500** is a body label. For this purpose, the label **400** is applied to the shoulder area **2.2** that is adjacent to the neck **2.1** of the bottle and becomes wider toward the bottom of the bottle, and the label **500** is applied to the body area **2.3** of the bottle **1**, which in the illustrated embodiment is slightly cinched in and is rotationally symmetrical to its axis.

[0044] The bottles **1**, because of the manufacturing methods by which they are produced, have certain dimensional variations which, depending on the type of container or bottle **1**, and on the point at which they are measured, can be up to ± 2.5 mm for the diameter and up to ± 1 mm for the height.

[0045] The objective, after the labeling of each bottle **1**, is for the labels **400** and **500** to be in a defined relationship to the contour of the bottle **1** and also in a defined relationship to each other.

[0046] The manufacturing tolerances of the bottles **1** with reference to the bottle diameter and/or the bottle height can cause the labels **400** and **500** to be applied incorrectly in relation to the contour of the bottle **1** and/or in an incorrect relationship relative to each other. A situation of this type is illustrated schematically and by way of example in **FIG. 1B** by the offset of the axis of symmetry or center axis **M4** of the label **400** and the axis of symmetry or center axis **M5** of the label **500** in the circumferential direction of the bottle, and in **FIG. 1D** by the offset of the labels **400** and **500** in the direction of the axis of the bottle indicated by the broken lines **4.1** and **5.1**.

[0047] As a further explanation of the invention, **FIG. 4** shows Lines **2a-2c**, which represent the path of the peripheral surface of three bottles **2** with different diameters, whereby Line **2a** corresponds, for example, to the specified diameter and the Lines **2b** and **2c** correspond to bottle diameters that differ from said specified diameter.

[0048] The transfer of the labels in the respective labeling units **15** and **16** occurs in the area identified by the line **18**. **19** is the desired position of the center of the label, center axis or axis of symmetry **M4** and **M5**, respectively, on the bottle **2**.

[0049] As shown in **FIG. 1E**, it is apparent that in the event of dimensional variations in the circumference of the bottle (Lines **2b** and **2c**), without a rotational adjustment of the respective bottle **1** or of the bottle carrier or container carrier **600** and/or without an adjustment of the dispensing time, the respective label transferred on the line **18.0** with one side on the periphery of the bottle will not be positioned with its center axis or axis of symmetry on the point **19.0**, but on the periphery of the bottles **2b** on the point **19.1**, and with the bottle diameter **2c** will come to rest on the point **19.2**. To achieve the correct position of the label, with the bottle diameter **2b**, a rotational adjustment of the bottle **1** is necessary as indicated by the arrow **B'**, and with the bottle diameter **2c**, a rotational adjustment of the bottle **1** as indicated by the arrow **B''** in the opposite direction is necessary. Accordingly, an earlier initiation of the dispensing process is necessary in case **2c**, and a delayed initiation of the dispensing process in case **2b**.

[0050] By means of an appropriate control system, which is described in greater detail below, of the labeling machine

20 or of the bottle carrier or container carrier **600** on the periphery of a turntable or rotor **700** which is driven so that it rotates around a vertical machine axis, this incorrect position of the labels **400** and **500**, which is caused by the dimensional variations of the bottles **1** and adversely affects the visual appearance of the labeled bottles **1**, can be minimized.

[0051] To label the bottles **1**, the bottles are fed in the conventional manner by means of a conveyor **8** and an inlet star wheel **9.1** to the turntable or rotor **700**, so that each individual bottle is oriented with its axis in the vertical direction and the bottom of the bottle on a bottle carrier or container carrier **600**, where it is secured against tipping in a suitable manner, for example by means of a spring-mounted pad. The labeled bottles **1** are then removed from the turntable or rotor **700** and the bottle carriers or container carriers **600** by means of an outlet star wheel **9.2** and transported via the conveyor for further processing.

[0052] Downstream on the machine frame of the labeling machine **1000** there is at least one camera **15** of an image processing system, such that by means of said system and/or with the computer **30** located there, the dimensional tolerances and/or actual dimensions of each bottle that moves past the camera **15** are determined, and specifically in the form of variations from corresponding specified values, i.e. the dimensional tolerances of the bottle diameter, e.g. in the shoulder and body area, as well as the dimensional tolerances in the vertical direction. The specified values or the contour or of the diameter and the height for the respective type of bottle or container are stored in the computer **30** of the image processing system.

[0053] The differences between desired locations of the label or labels are determined by comparing the actual dimensions and/or contours and generating a signal indicative of the error between the actual dimensions and/or contours and the specific dimensions and/or contours. This error signal could be used to pick a signal to be transmitted to at least the third output conveyor arrangement **111**, which would remove the bottle.

[0054] Depending on the result of the measurement and/or analysis of the individual bottle **1** by the image processing system, by means of a control device that is actuated by the computer **30**, there is acceptance or rejection of the bottle **1**.

[0055] **FIG. 1C** is similar to **FIG. 1B** and shows a bottle cap **300** on the bottle **1**.

[0056] In an additional embodiment, there is at least one second sensor device or camera **15**. The task of this at least one second camera **15**, in connection with the image processing system that is already present or with a second image processing system that may also be provided, is to analyze the position of the labels that have been previously applied by the labeling units and, taking into consideration the dimensional tolerances of the bottle **2** that have been measured, to check the labeling so that labels are applied in the correct position. The subsequent labels must likewise be applied not only in the correct orientation with respect to the bottle **2**, but also in the correct orientation with respect to the labels already applied, so that, for example, the resulting distances between the vertical side edges of the labels on the shoulder and the back of the bottle are equal.

[0057] The embodiments have been explained above on the basis of the labeling machine for bottles. It goes without

saying that the apparatus and/or the method taught are also suitable for other containers or contoured containers of any type for liquids, bulk goods etc., for example. The invention is also of course not restricted to the labeling of containers with labels on the shoulders and body, but can also be used in the same manner for labeling containers with any type of label, e.g. including labels on the neck and/or back of the container.

[0058] In the illustrated exemplary embodiment, for example, the rotational and/or vertical adjustment of each bottle carrier or container carrier **600** that is necessary is done twice, and specifically once before the bottle reaches the labeling station **15**, and then once again before the bottle reaches the next labeling station **16** in the direction of rotation **A**. After the labels **400** and **500** have been transferred to a bottle **1**, the conventional pressing and brushing of said labels is performed by pressing and brushing elements that are not shown in the illustrations.

[0059] On the machine frame of the labeling machine **1000**, upstream of the bottle outlet formed by the outlet star wheel **9.2**, there is an additional camera **17**, which is also a part of the computer-assisted image processing system and with which an image of the labeled bottles **1** is acquired on their side that is provided with the labels **400** and **500**, so that with the image signal supplied by the camera **17** and the image processing, the result of the labeling achieved can be analyzed, i.e. it can be verified, for example, whether the labels **400** and **500** are in the desired positions relative to each other and in the desired position on the respective bottle **1**. The result of this analysis can also be used to optimize the orientation of bottles **1** that are being labeled for the first time, i.e. to optimize the rotational and vertical adjustment for said bottles **2** and/or to carry out a defined presetting of the bottle carrier or container carrier **600** in the direction of rotation **A** before the bottle reaches the camera **15**.

[0060] In practice it has been found that the surface of a defective container **1** has the most uniform brightness values when the luminance in the housing **14** that surrounds the containers is as uniform as possible. The phrase "uniform luminance" as used in this context means that seen from any point inside the housing, and in any possible direction of viewing or measurement, the same intensity of the illumination or brightness is perceptible or measurable.

[0061] To achieve a luminance that is as uniform as possible, the present application teaches that the interior walls of the surrounding housing are light-colored, often white. The present application also teaches that the interior walls are realized so that the walls reflect and/or radiate the light that strikes them as completely as possible or optimally and as diffusely and simply or unidirectionally as possible.

[0062] Tests have been conducted that have shown that a particularly advantageous imaging of the container can be achieved when the parameters of the interior walls that are relevant for a uniform illumination—namely the reflection and diffusion characteristics—are optimally coordinated with each other.

[0063] The diffusion characteristic of a surface is determined by the parameters scattering power sigma and field angle or angle of half intensity, whereby a scattering power sigma of greater than 0.4 and a field angle of greater than 27 degrees, measured with respect to a line perpendicular to the

surface, have been determined to be particularly advantageous. Scattering power sigma is defined in DIN Standard 5036. Scattering power sigma may also be referred to as spectral reflection factors or as scattered reflection.

[0064] For the reflection characteristic it has been found that a value of greater than 65% is particularly advantageous.

[0065] To reliably achieve the values defined above for these parameters, it is necessary to coat the interior walls of the housing with a suitable material. This material can be, for example, a paint or another coating that contains pigments produced from the oxides of a metal, e.g. titanium.

[0066] The oxides can be a monoxide and/or a dioxide etc. To improve the durability of the above mentioned coating, the coating can be bonded to the interior walls by baking or enameling.

[0067] The angle of half intensity is defined as the angle where the intensity of the light from a surface is half the intensity which is measured directly at 90 degrees to the surface.

[0068] The phrase "interior walls" as used in connection with this application means all surfaces that are inside the housing. These surfaces include, in addition to the side walls, the floor and the ceiling, as well as the surfaces of the of the container conveyor, also including in particular the surface of the conveyor chain. In another possible embodiment all the interior walls may not be completely covered with the reflective coating.

[0069] With regard to all the interior walls and the surfaces facing them, e.g. of the conveyor chain, the present application teaches that their surfaces are also coated in a suitable manner to achieve the desired characteristics.

[0070] During the operation of inspection devices, contamination frequently occurs as the result exploding or falling containers. If such contamination occurs inside the housing, it undesirably distorts the result of the inspection, which means that the contamination must be removed immediately. In this regard, the present application teaches that the floor of the housing **14** is realized at least in parts in the form of a drawer **17** or shutter or flap, so that contamination can be removed quickly and without long shutdowns of the machine.

[0071] Practical tests have also shown that the surfaces of the cameras conventionally used have neither the required characteristics regarding reflection, diffusion or scattering, nor can they be treated so that the desired characteristics can be achieved. Therefore the present application teaches, in the context of an additional realization, that the at least one camera **15** is located inside the housing behind a disc **18** or another suitable element. This arrangement is designed so that the disc is treated over its entire surface as described above except for one location that matches the inlet opening of the camera lens, and that the camera is completely concealed behind said disc except for the inlet opening, as a result of which the uniform luminance in the interior of the housing is influenced or distorted as little as possible.

[0072] Because the time that is available for the inspection of a container is short, in particular in high-capacity inspection machines with capacities of more than 50,000 containers per hour, and time-consuming computer operations for

the elimination of optical imaging errors or distortions must be avoided or minimized to the maximum extent possible. The present application teaches in an embodiment that for a further improvement of the potential applicability of the present application, if more than one camera is used, these cameras are located and oriented so that at the time of the photographing of the container **1**, these cameras are at the same distance from the container. The cameras **15** can then be located, for example, at the corners of a square or also on a circular curve, whereby in both cases (square and circular curve), the container is located exactly at its midpoint at the time the image is taken.

[0073] In FIG. 2A the cameras or other sensors **15** feed data into a computer **30** which analyzes the image or images of the bottles **1** and determines whether the condition of the bottles **1** meets standards within tolerance. If the bottles **1** meet the standards, the rejection and acceptance apparatus **40** of apparatus **111** permits the bottles **1** to exit through the conveyor **42** or rejects the defective bottles to conveyor **44**.

[0074] In the event of a stoppage of bottles traveling through the housing **14**, the computer **30** sends a signal to the emergency stopping device **32** which is able to send a signal to the controller **112** to stop the bottling plant. The computer **30** and the stopping device **32** may be part of the controller **112**.

[0075] The present application relates to an inspection device for the inspection of closed containers such as bottles, jars or similar containers, realized in a linear or rotary design, with at least one camera, at least one illumination device and at least one system for image processing, with a housing which encloses at least a portion of the container conveyor line, at least one illumination device and at least one camera, whereby the present application teaches that the interior surfaces of the housing are light-colored.

[0076] One feature or aspect of an embodiment is believed at the time of the filing of this patent application to possibly reside broadly in an inspection device for the inspection of closed containers such as bottles, jars or similar containers, realized in a linear or rotary design, with at least one camera, at least one illumination device and at least one system for image processing, with a housing which encloses at least a portion of the container conveyor line, at least one illumination device and at least one camera, characterized in that the interior surfaces of the housing are light-colored.

[0077] Another feature or aspect of an embodiment is believed at the time of the filing of this patent application to possibly reside broadly in an inspection device, characterized in that the interior surfaces of the housing are matte.

[0078] Yet another feature or aspect of an embodiment is believed at the time of the filing of this patent application to possibly reside broadly in an inspection device, characterized in that the interior surfaces of the housing are realized so that the light is reflected diffusely.

[0079] Still another feature or aspect of an embodiment is believed at the time of the filing of this patent application to possibly reside broadly in an inspection device, characterized in that the interior surfaces of the housing have a scattering power of at least 0.4.

[0080] A further feature or aspect of an embodiment is believed at the time of the filing of this patent application to

possibly reside broadly in an inspection device, characterized in that the interior surfaces of the housing have a field angle of at least 27 degrees measured with respect to a line perpendicular to the surface.

[0081] Another feature or aspect of an embodiment is believed at the time of the filing of this patent application to possibly reside broadly in an inspection device, characterized in that the interior surfaces of the housing have a reflectance or reflectivity of at least 65%.

[0082] Yet another feature or aspect of an embodiment is believed at the time of the filing of this patent application to possibly reside broadly in an inspection device, characterized in that the at least one camera is located inside the housing, whereby the camera is located so that it is concealed except for the inlet opening of its lens.

[0083] Still another feature or aspect of an embodiment is believed at the time of the filing of this patent application to possibly reside broadly in an inspection device, characterized in that all of the cameras are at the same distance from the container at the time the container is photographed.

[0084] A further feature or aspect of an embodiment is believed at the time of the filing of this patent application to possibly reside broadly in an inspection device, characterized in that the floor surface of the housing is realized at least partly in the form of a drawer and/or in the form of shutters or flaps.

[0085] Another feature or aspect of an embodiment is believed at the time of the filing of this patent application to possibly reside broadly in an inspection device, characterized in that the coating of the interior surfaces of the housing contains at least one metal oxide.

[0086] Yet another feature or aspect of an embodiment is believed at the time of the filing of this patent application to possibly reside broadly in an inspection device, characterized in that the coating of the interior surfaces of the housing is baked or enameled onto the surface.

[0087] Still another feature or aspect of an embodiment is believed at the time of the filing of this patent application to possibly reside broadly in a beverage bottling plant for filling beverage bottles with liquid beverage material, said beverage bottling plant comprising: a plurality of machines comprising at least a rotary beverage bottle filling machine, a rotary beverage bottle closing machine, a bottle labeling machine, and a bottle inspection machine; a first conveyor arrangement being configured and disposed to convey beverage bottles to be filled to said beverage bottle filling machine; said beverage bottle filling machine being configured and disposed to fill beverage bottles with liquid beverage material; said beverage bottle filling machine comprising: a rotor; a rotatable vertical machine column; said rotor being connected to said vertical machine column to permit rotation of said rotor about said vertical machine column; a plurality of beverage bottle filling elements for filling beverage bottles with liquid beverage material being disposed on the periphery of said rotor; each of said plurality of beverage bottle filling elements comprising a container carrier being configured and disposed to receive and hold beverage bottles to be filled; each of said plurality of beverage bottle filling elements being configured and disposed to dispense liquid beverage material into beverage bottles to be filled; at least one liquid reservoir being

configured to hold a supply of liquid beverage material; at least one supply line being configured and disposed to connect said at least one liquid reservoir to said beverage bottle filling machine to supply liquid beverage material to said beverage bottle filling machine; a first filling machine star wheel structure being configured and disposed to move beverage bottles into said beverage bottle filling machine; a second filling machine star wheel structure being configured and disposed to move beverage bottles out of said beverage bottle filling machine; a second conveyor arrangement being configured and disposed to convey filled beverage bottles to said beverage bottle closing machine; said beverage bottle closing machine being configured and disposed to close tops of filled beverage bottles; said beverage bottle closing machine comprising: a rotor; a rotatable vertical machine column; said rotor being connected to said vertical machine column to permit rotation of said rotor about said vertical machine column; a plurality of closing devices being disposed on the periphery of said rotor; each of said plurality of closing devices being configured and disposed to place closures on filled beverage bottles; each of said plurality of closing devices comprising a container carrier being configured and disposed to receive and hold filled beverage bottles; a first closing machine star wheel structure being configured and disposed to move filled beverage bottles into said beverage bottle closing machine; a second closing machine star wheel structure being configured and disposed to move filled, closed beverage bottles out of said beverage bottle closing machine; said bottle labeling machine comprising: a labeling station being configured to label bottles; an input arrangement being configured to transfer bottles to be labeled into said labeling machine; an output arrangement being configured, to transfer labeled bottles out of said labeling machine; a conveyor arrangement being configured and disposed to convey closed, filled, labeled bottles to said bottle inspection machine; said bottle inspection machine being configured to inspect bottles; said bottle inspection machine comprising: a housing; a light source being configured and disposed to illuminate the inner walls of said housing; a conveyor apparatus being configured and disposed to move bottles through said bottle inspection machine; at least one camera being configured to sense at least the position of a label on a bottle; a computer being configured to determine from a set of stored values whether the label on the bottle is acceptable or defective upon receiving signals representing the image of a bottle from said at least one camera; said inner walls of said housing being configured to have a substantial angle of half intensity, substantial spectral reflection factors, and substantial scattered reflection; the optical texture of said inner walls of said housing being configured to provide an optically flat finish to provide a substantially uniform and substantially glare-free light to illuminate the bottles being inspected such that a substantial portion of light impinging upon said inner walls of said housing is reflected for use by said at least one camera to illuminate the bottles being inspected within said housing; the optical texture of said inner walls of said housing being configured to provide light to the bottle and a bottle image to said at least one camera, with substantial definition such that said at least one camera and said computer can distinguish between at least labels on bottles which are defective from at least labels on bottles that are acceptable with substantial accuracy; the optical texture of said inner walls of said housing being configured to mini-

mize a false rejection rate of acceptably labeled bottles; and an apparatus being connected to said computer, and being configured and disposed to remove defective bottles from acceptable bottles from said housing upon receiving a signal from said computer that a bottle is defective.

[0088] A further feature or aspect of an embodiment is believed at the time of the filing of this patent application to possibly reside broadly in an container filling plant for filling containers with liquid material, said container filling plant comprising: a plurality of machines comprising at least a rotary container filling machine, a rotary container closing machine, a container labeling machine, and a container inspection machine; a first conveyor arrangement being configured and disposed to convey containers to be filled to said container filling machine; said container filling machine being configured and disposed to fill containers with liquid material; said container filling machine comprising: a rotor; a rotatable vertical machine column; said rotor being connected to said vertical machine column to permit rotation of said rotor about said vertical machine column; a plurality of container filling elements for filling containers with liquid material being disposed on the periphery of said rotor; each of said plurality of container filling elements comprising a container carrier being configured and disposed to receive and hold containers to be filled; each of said plurality of container filling elements being configured and disposed to dispense liquid material into containers to be filled; at least one liquid reservoir being configured to hold a supply of liquid material; at least one supply line being configured and disposed to connect said at least one liquid reservoir to said container filling machine to supply liquid material to said container filling machine; a first filling machine star wheel structure being configured and disposed to move containers into said container filling machine; a second filling machine star wheel structure being configured and disposed to move containers out of said container filling machine; a second conveyor arrangement being configured and disposed to convey filled containers to said container closing machine; said container closing machine being configured and disposed to close tops of filled containers; said container closing machine comprising: a rotor; a rotatable vertical machine column; said rotor being connected to said vertical machine column to permit rotation of said rotor about said vertical machine column; a plurality of closing devices being disposed on the periphery of said rotor; each of said plurality of closing devices being configured and disposed to place closures on filled containers; each of said plurality of closing devices comprising a container carrier being configured and disposed to receive and hold filled containers; a first closing machine star wheel structure being configured and disposed to move filled containers into said container closing machine; a second closing machine star wheel structure being configured and disposed to move filled, closed containers out of said container closing machine; said container labeling machine comprising: a labeling station being configured to label containers; an input arrangement being configured to transfer containers to be labeled into said labeling machine; an output arrangement being configured to transfer labeled containers out of said labeling machine; a conveyor arrangement being configured and disposed to convey closed, filled, labeled containers to said container inspection machine; said container inspection machine being configured to inspect containers; said container inspection machine comprising: a housing; a light

source being configured and disposed to illuminate the inner walls of said housing; a conveyor apparatus being configured and disposed to move containers through said container inspection machine; at least one optical sensor being configured to sense at least the position of a label on a container; a computer being configured to determine from a set of stored values whether the label on the container is acceptable or defective upon receiving signals representing the image of a container from said at least one optical sensor; said inner walls of said housing being configured to have a substantial angle of half intensity, substantial spectral reflection factors, and substantial scattered reflection; the optical texture of said inner walls of said housing being configured to provide an optically flat finish to provide a substantially uniform and substantially glare-free light to illuminate the containers being inspected such that a substantial portion of light impinging upon said inner walls of said housing is reflected for use by said at least one optical sensor to illuminate the containers being inspected within said housing; the optical texture of said inner walls of said housing being configured to provide light to the container and a container image to said at least one optical sensor, with substantial definition such that said at least one optical sensor and said computer can distinguish between at least labels on containers which are defective from at least labels on containers that are acceptable with substantial accuracy; the optical texture of said inner walls of said housing being configured to minimize a false rejection rate of acceptably labeled containers; and an apparatus being connected to said computer, and being configured and disposed to remove defective containers from acceptable containers from said housing upon receiving a signal from said computer that a container is defective.

[0089] U.S. Patent Application, filed by Applicant on Aug. 20, 2005, having Attorney Docket No. NHL-HOL-119, and German Application No. 10 2004 040 634.0, filed on Aug. 21, 2004, are both incorporated by reference as if set forth in their entirety herein.

[0090] The components disclosed in the various publications, disclosed or incorporated by reference herein, may possibly be used in possible embodiments of the present invention, as well as equivalents thereof.

[0091] Some examples of bottling systems, which may be used or adapted for use in at least one possible embodiment of the present may be found in the following U.S. Patents assigned to the Assignee herein, namely: U.S. Pat. Nos. 4,911,285; 4,944,830; 4,950,350; 4,976,803; 4,981,547; 5,004,518; 5,017,261; 5,062,917; 5,062,918; 5,075,123; 5,078,826; 5,087,317; 5,110,402; 5,129,984; 5,167,755; 5,174,851; 5,185,053; 5,217,538; 5,227,005; 5,413,153; 5,558,138; 5,634,500; 5,713,403; 6,276,113; 6,213,169; 6,189,578; 6,192,946; 6,374,575; 6,365,054; 6,619,016; 6,474,368; 6,494,238; 6,470,922; and 6,463,964.

[0092] The purpose of the statements about the technical field is generally to enable the Patent and Trademark Office and the public to determine quickly, from a cursory inspection, the nature of this patent application. The description of the technical field is believed, at the time of the filing of this patent application, to adequately describe the technical field of this patent application. However, the description of the technical field may not be completely applicable to the claims as originally filed in this patent application, as

amended during prosecution of this patent application, and as ultimately allowed in any patent issuing from this patent application. Therefore, any statements made relating to the technical field are not intended to limit the claims in any manner and should not be interpreted as limiting the claims in any manner.

[0093] Some examples of optical scanners which may possibly be utilized or adapted for use in at least one possible embodiment may possibly be found in the following U.S. Patents: U.S. Pat. No. 6,719,204, entitled "Mathieu-Gaussian beam for optical scanners;" U.S. Pat. No. 6,603,108, entitled "Image sensing modules for portable optical scanners;" U.S. Pat. No. 6,209,788, entitled "Optical scanners;" and U.S. Pat. No. 6,164,540, entitled "Optical scanners."

[0094] An example of an optical fiber conductor using an image scope which may possibly be utilized or adapted for use in at least one possible embodiment may possibly be found in U.S. Pat. No. 4,783,135, entitled "Optical fiber conductor and image scope using same."

[0095] The appended drawings in their entirety, including all dimensions, proportions and/or shapes in at least one embodiment of the invention, are accurate and are hereby included by reference into this specification.

[0096] Some examples of cameras or the like optical monitoring apparatus that may possibly be utilized or possibly adapted for use in at least one possible embodiment of the present application may possibly be found in the following U.S. patents: U.S. Pat. No. 5,233,186 issued to Ringlien on Aug. 3, 1993; U.S. Pat. No. 5,243,400 issued to Ringlien on Sep. 7, 1993; U.S. Pat. No. 5,369,713 issued to Schwartz et al. on Nov. 29, 1994; U.S. Pat. No. 5,442,446 issued to Gerber et al. on Aug. 15, 1995; U.S. Pat. No. 5,661,295 issued to Buchmann et al. on Aug. 26, 1997; and U.S. Pat. No. 5,898,169 issued to Nodbryhn on Apr. 27, 1999.

[0097] The background information is believed, at the time of the filing of this patent application, to adequately provide background information for this patent application. However, the background information may not be completely applicable to the claims as originally filed in this patent application, as amended during prosecution of this patent application, and as ultimately allowed in any patent issuing from this patent application. Therefore, any statements made relating to the background information are not intended to limit the claims in any manner and should not be interpreted as limiting the claims in any manner.

[0098] Some examples of optical fiber wave guides which may possibly be utilized or adapted for use in at least one possible embodiment may possibly be found in the following U.S. Patents: U.S. Pat. No. 6,953,457, entitled "Phototherapeutic wave guide apparatus;" U.S. Pat. No. 6,423,055, entitled "Phototherapeutic wave guide apparatus;" and U.S. Pat. No. 6,294,775, entitled "Miniature image acquisition system using a scanning resonant waveguide."

[0099] All, or substantially all, of the components and methods of the various embodiments may be used with at least one embodiment or all of the embodiments, if more than one embodiment is described herein.

[0100] Some examples of labeling machines which may possibly be utilized in at least one possible embodiment may

possibly be found in the following U.S. patents: U.S. Pat. No. 6,634,400, entitled "Labeling machine;" U.S. Pat. No. 6,561,246, entitled "Labeling machine capable of precise attachment of a label to different sizes of containers;" U.S. Pat. No. 6,550,512, entitled "Labeling machine capable of preventing erroneous attachment of labels on containers;" U.S. Pat. No. 6,543,514, entitled "In-line continuous feed sleeve labeling machine and method;" U.S. Pat. No. 6,378,587, entitled "Cylindrical container labeling machine;" U.S. Pat. No. 6,328,086, entitled "Labeling machine;" U.S. Pat. No. 6,315,021, entitled "Labeling machine;" U.S. Pat. No. 6,263,940, entitled "In-line continuous feed sleeve labeling machine and method;" U.S. Pat. No. 6,199,614, entitled "High speed labeling machine having a constant tension driving system;" U.S. Pat. No. 6,167,935, entitled "Labeling machine;" U.S. Pat. No. 6,066,223, entitled "Labeling machine and method;" U.S. Pat. No. 6,050,319, entitled "Non-round container labeling machine and method;" and U.S. Pat. No. 6,045,616, entitled "Adhesive station and labeling machine."

[0101] The purpose of the statements about the object or objects is generally to enable the Patent and Trademark Office and the public to determine quickly, from a cursory inspection, the nature of this patent application. The description of the object or objects is believed, at the time of the filing of this patent application, to adequately describe the object or objects of this patent application. However, the description of the object or objects may not be completely applicable to the claims as originally filed in this patent application, as amended during prosecution of this patent application, and as ultimately allowed in any patent issuing from this patent application. Therefore, any statements made relating to the object or objects are not intended to limit the claims in any manner and should not be interpreted as limiting the claims in any manner.

[0102] All of the patents, patent applications and publications recited herein, and in the Declaration attached hereto, are hereby incorporated by reference as if set forth in their entirety herein.

[0103] Some examples of starwheels which may possibly be utilized or adapted for use in at least one possible embodiment may possibly be found in the following U.S. Patents: U.S. Pat. No. 5,613,593, entitled "Container handling starwheel;" U.S. Pat. No. 5,029,695, entitled "Improved starwheel;" U.S. Pat. No. 4,124,112, entitled "Odd-shaped container indexing starwheel;" and U.S. Pat. No. 4,084,686, entitled "Starwheel control in a system for conveying containers."

[0104] The summary is believed, at the time of the filing of this patent application, to adequately summarize this patent application. However, portions or all of the information contained in the summary may not be completely applicable to the claims as originally filed in this patent application, as amended during prosecution of this patent application, and as ultimately allowed in any patent issuing from this patent application. Therefore, any statements made relating to the summary are not intended to limit the claims in any manner and should not be interpreted as limiting the claims in any manner.

[0105] It will be understood that the examples of patents, published patent applications, and other documents which are included in this application and which are referred to in paragraphs which state "Some examples of . . . which may possibly be used in at least one possible embodiment of the

present application . . ." may possibly not be used or useable in any one or more embodiments of the application.

[0106] The sentence immediately above relates to patents, published patent applications and other documents either incorporated by reference or not incorporated by reference.

[0107] The corresponding foreign patent publication applications, namely, Federal Republic of Germany Patent Application No. 10 2005 017 957.6, filed on Apr. 18, 2005, having inventors Dr. Martin Weisgerber, Carsten Buchwald, Ralph Pohl, and Wolfgang Schorn, and DE-OS 10 2005 017 957.6 and DE-PS 10 2005 017 957.6, are hereby incorporated by reference as if set forth in their entirety herein for the purpose of correcting and explaining any possible misinterpretations of the English translation thereof. In addition, the published equivalents of the above corresponding foreign and international patent publication applications, and other equivalents or corresponding applications, if any, in corresponding cases in the Federal Republic of Germany and elsewhere, and the references and documents cited in any of the documents cited herein, such as the patents, patent applications and publications, are hereby incorporated by reference as if set forth in their entirety herein.

[0108] All of the references and documents, cited in any of the documents cited herein, are hereby incorporated by reference as if set forth in their entirety herein. All of the documents cited herein, referred to in the immediately preceding sentence, include all of the patents, patent applications and publications cited anywhere in the present application.

[0109] The description of the embodiment or embodiments is believed, at the time of the filing of this patent application, to adequately describe the embodiment or embodiments of this patent application. However, portions of the description of the embodiment or embodiments may not be completely applicable to the claims as originally filed in this patent application, as amended during prosecution of this patent application, and as ultimately allowed in any patent issuing from this patent application. Therefore, any statements made relating to the embodiment or embodiments are not intended to limit the claims in any manner and should not be interpreted as limiting the claims in any manner.

[0110] The details in the patents, patent applications and publications may be considered to be incorporable, at applicant's option, into the claims during prosecution as further limitations in the claims to patentably distinguish any amended claims from any applied prior art.

[0111] The purpose of the title of this patent application is generally to enable the Patent and Trademark Office and the public to determine quickly, from a cursory inspection, the nature of this patent application. The title is believed, at the time of the filing of this patent application, to adequately reflect the general nature of this patent application. However, the title may not be completely applicable to the technical field, the object or objects, the summary, the description of the embodiment or embodiments, and the claims as originally filed in this patent application, as amended during prosecution of this patent application, and as ultimately allowed in any patent issuing from this patent application. Therefore, the title is not intended to limit the claims in any manner and should not be interpreted as limiting the claims in any manner.

[0112] The abstract of the disclosure is submitted herewith as required by 37 C.F.R. §1.72(b). As stated in 37 C.F.R. §1.72(b):

[0113] A brief abstract of the technical disclosure in the specification must commence on a separate sheet, preferably following the claims, under the heading "Abstract of the Disclosure." The purpose of the abstract is to enable the Patent and Trademark Office and the public generally to determine quickly from a cursory inspection the nature and gist of the technical disclosure. The abstract shall not be used for interpreting the scope of the claims.

Therefore, any statements made relating to the abstract are not intended to limit the claims in any manner and should not be interpreted as limiting the claims in any manner.

[0114] The embodiments of the invention described herein above in the context of the preferred embodiments are not to be taken as limiting the embodiments of the invention to all of the provided details thereof, since modifications and variations thereof may be made without departing from the spirit and scope of the embodiments of the invention.

What is claimed is:

1. A beverage bottling plant for filling beverage bottles with liquid beverage material, said beverage bottling plant comprising:

- a plurality of machines comprising at least a rotary beverage bottle filling machine, a rotary beverage bottle closing machine, a bottle labeling machine, and a bottle inspection machine;
- a first conveyor arrangement being configured and disposed to convey beverage bottles to be filled to said beverage bottle filling machine;
- said beverage bottle filling machine being configured and disposed to fill beverage bottles with liquid beverage material;
- said beverage bottle filling machine comprising:
 - a rotor;
 - a rotatable vertical machine column;
 - said rotor being connected to said vertical machine column to permit rotation of said rotor about said vertical machine column;
 - a plurality of beverage bottle filling elements for filling beverage bottles with liquid beverage material being disposed on the periphery of said rotor;
 - each of said plurality of beverage bottle filling elements comprising a container carrier being configured and disposed to receive and hold beverage bottles to be filled;
 - each of said plurality of beverage bottle filling elements being configured and disposed to dispense liquid beverage material into beverage bottles to be filled;
 - at least one liquid reservoir being configured to hold a supply of liquid beverage material;
 - at least one supply line being configured and disposed to connect said at least one liquid reservoir to said beverage bottle filling machine to supply liquid beverage material to said beverage bottle filling machine;

- a first filling machine star wheel structure being configured and disposed to move beverage bottles into said beverage bottle filling machine;
- a second filling machine star wheel structure being configured and disposed to move beverage bottles out of said beverage bottle filling machine;
- a second conveyor arrangement being configured and disposed to convey filled beverage bottles to said beverage bottle closing machine;
- said beverage bottle closing machine being configured and disposed to close tops of filled beverage bottles;
- said beverage bottle closing machine comprising:
 - a rotor;
 - a rotatable vertical machine column;
 - said rotor being connected to said vertical machine column to permit rotation of said rotor about said vertical machine column;
 - a plurality of closing devices being disposed on the periphery of said rotor;
 - each of said plurality of closing devices being configured and disposed to place closures on filled beverage bottles;
 - each of said plurality of closing devices comprising a container carrier being configured and disposed to receive and hold filled beverage bottles;
 - a first closing machine star wheel structure being configured and disposed to move filled beverage bottles into said beverage bottle closing machine;
 - a second closing machine star wheel structure being configured and disposed to move filled, closed beverage bottles out of said beverage bottle closing machine;
- said bottle labeling machine comprising:
 - a labeling station being configured to label bottles;
 - an input arrangement being configured to transfer bottles to be labeled into said labeling machine;
 - an output arrangement being configured to transfer labeled bottles out of said labeling machine;
- a conveyor arrangement being configured and disposed to convey closed, filled, labeled bottles to said bottle inspection machine;
- said bottle inspection machine being configured to inspect bottles;
- said bottle inspection machine comprising:
 - a housing;
 - a light source being configured and disposed to illuminate the inner walls of said housing;
 - a conveyor apparatus being configured and disposed to move bottles through said bottle inspection machine;
 - at least one camera being configured to sense at least the position of a label on a bottle;

a computer being configured to determine from a set of stored values whether the label on the bottle is acceptable or defective upon receiving signals representing the image of a bottle from said at least one camera;

said inner walls of said housing being configured to have a substantial angle of half intensity, substantial spectral reflection factors, and substantial scattered reflection;

the optical texture of said inner walls of said housing being configured to provide an optically flat finish to provide a substantially uniform and substantially glare-free light to illuminate the bottles being inspected such that a substantial portion of light impinging upon said inner walls of said housing is reflected for use by said at least one camera to illuminate the bottles being inspected within said housing;

the optical texture of said inner walls of said housing being configured to provide light to the bottle and a bottle image to said at least one camera, with substantial definition such that said at least one camera and said computer can distinguish between at least labels on bottles which are defective from at least labels on bottles that are acceptable with substantial accuracy;

the optical texture of said inner walls of said housing being configured to minimize a false rejection rate of acceptably labeled bottles; and

an apparatus being connected to said computer, and being configured and disposed to remove defective bottles from acceptable bottles from said housing upon receiving a signal from said computer that a bottle is defective.

2. The beverage bottling plant according to claim 1, wherein said inner walls of said housing are matte.

3. The beverage bottling plant according to claim 2, wherein said inner walls of said housing are realized so that the light is reflected diffusely.

4. The beverage bottling plant according to claim 3, wherein said inner walls of said housing have a scattering power of at least 0.4.

5. The beverage bottling plant according to claim 4, wherein:

said inner walls of said housing have a field angle of at least 27 degrees measured with respect to a line perpendicular to the surface;

said inner walls of said housing have a reflectance or reflectivity of at least 65%; and

said at least one camera is located inside said housing, whereby said at least one camera is located so that it is concealed except for the inlet opening of its lens.

6. The beverage bottling plant according to claim 5, wherein:

said inspection machine comprises a plurality of cameras, and wherein said plurality of cameras are at the same distance from the bottle at the time the container is photographed; and

the floor surface of said housing is realized at least partly in the form of a drawer and/or in the form of shutters or flaps.

7. The beverage bottling plant according to claim 6, wherein:

said optical texture of said inner walls of said housing contains at least one metal oxide; and

said optical texture of said inner walls of said housing is baked or enameled onto the surface.

8. A container filling plant for filling containers with liquid material, said container filling plant comprising:

a plurality of machines comprising at least a rotary container filling machine, a rotary container closing machine, a container labeling machine, and a container inspection machine;

a first conveyor arrangement being configured and disposed to convey containers to be filled to said container filling machine;

said container filling machine being configured and disposed to fill containers with liquid material;

said container filling machine comprising:

a rotor;

a rotatable vertical machine column;

said rotor being connected to said vertical machine column to permit rotation of said rotor about said vertical machine column;

a plurality of container filling elements for filling containers with liquid material being disposed on the periphery of said rotor;

each of said plurality of container filling elements comprising a container carrier being configured and disposed to receive and hold containers to be filled;

each of said plurality of container filling elements being configured and disposed to dispense liquid material into containers to be filled;

at least one liquid reservoir being configured to hold a supply of liquid material;

at least one supply line being configured and disposed to connect said at least one liquid reservoir to said container filling machine to supply liquid material to said container filling machine;

a first filling machine star wheel structure being configured and disposed to move containers into said container filling machine;

a second filling machine star wheel structure being configured and disposed to move containers out of said container filling machine;

a second conveyor arrangement being configured and disposed to convey filled containers to said container closing machine;

said container closing machine being configured and disposed to close tops of filled containers;

said container closing machine comprising:

a rotor;

a rotatable vertical machine column;

said rotor being connected to said vertical machine column to permit rotation of said rotor about said vertical machine column;

- a plurality of closing devices being disposed on the periphery of said rotor;
 - each of said plurality of closing devices being configured and disposed to place closures on filled containers;
 - each of said plurality of closing devices comprising a container carrier being configured and disposed to receive and hold filled containers;
 - a first closing machine star wheel structure being configured and disposed to move filled containers into said container closing machine;
 - a second closing machine star wheel structure being configured and disposed to move filled, closed containers out of said container closing machine;
 - said container labeling machine comprising:
 - a labeling station being configured to label containers;
 - an input arrangement being configured to transfer containers to be labeled into said labeling machine;
 - an output arrangement being configured to transfer labeled containers out of said labeling machine;
 - a conveyor arrangement being configured and disposed to convey closed, filled, labeled containers to said container inspection machine;
 - said container inspection machine being configured to inspect containers;
 - said container inspection machine comprising:
 - a housing;
 - a light source being configured and disposed to illuminate the inner walls of said housing;
 - a conveyor apparatus being configured and disposed to move containers through said container inspection machine;
 - at least one optical sensor being configured to sense at least the position of a label on a container;
 - a computer being configured to determine from a set of stored values whether the label on the container is acceptable or defective upon receiving signals representing the image of a container from said at least one optical sensor;
 - said inner walls of said housing being configured to have a substantial angle of half intensity, substantial spectral reflection factors, and substantial scattered reflection;
 - the optical texture of said inner walls of said housing being configured to provide an optically flat finish to provide a substantially uniform and substantially glare-free light to illuminate the containers being inspected such that a substantial portion of light impinging upon said inner walls of said housing is reflected for use by said at least one optical sensor to illuminate the containers being inspected within said housing;
 - the optical texture of said inner walls of said housing being configured to provide light to the container and a container image to said at least one optical sensor,
 - with substantial definition such that said at least one optical sensor and said computer can distinguish between at least labels on containers which are defective from at least labels on containers that are acceptable with substantial accuracy;
 - the optical texture of said inner walls of said housing being configured to minimize a false rejection rate of acceptably labeled containers; and
 - an apparatus being connected to said computer, and being configured and disposed to remove defective containers from acceptable containers from said housing upon receiving a signal from said computer that a container is defective.
- 9.** The container filling plant according to claim 8, wherein said inner walls of said housing are matte.
- 10.** The container filling plant according to claim 9, wherein said inner walls of said housing are realized so that the light is reflected diffusely.
- 11.** The container filling plant according to claim 10, wherein said inner walls of said housing have a scattering power of at least 0.4.
- 12.** The container filling plant according to claim 11, wherein:
- said inner walls of said housing have a field angle of at least 27 degrees measured with respect to a line perpendicular to the surface;
 - said inner walls of said housing have a reflectance or reflectivity of at least 65%; and
 - said at least one camera is located inside said housing, whereby said at least one camera is located so that it is concealed except for the inlet opening of its lens.
- 13.** The container filling plant according to claim 12, wherein:
- said inspection machine comprises a plurality of cameras, and wherein said plurality of cameras are at the same distance from the bottle at the time the container is photographed; and
 - the floor surface of said housing is realized at least partly in the form of a drawer and/or in the form of shutters or flaps.
- 14.** The container filling plant according to claim 13, wherein:
- said optical texture of said inner walls of said housing contains at least one metal oxide; and
 - said optical texture of said inner walls of said housing is baked or enameled onto the surface.
- 15.** An inspection device for the inspection of closed containers such as bottles, jars or similar containers, realized in a linear or rotary design, with at least one camera, at least one illumination device and at least one system for image processing, with a housing which encloses at least a portion of the container conveyor line, at least one illumination device and at least one camera, wherein the interior surfaces of the housing are light-colored.
- 16.** The inspection device according to claim 15, wherein the interior surfaces of the housing are matte.
- 17.** The inspection device according to claim 16, wherein:
- the interior surfaces of the housing are realized so that the light is reflected diffusely; and

the interior surfaces of the housing have a scattering power of at least 0.4.

18. The inspection device according to claim 17, wherein:

the interior surfaces of the housing have a field angle of at least 27 degrees measured with respect to a line perpendicular to the surface;

the interior surfaces of the housing have a reflectance or reflectivity of at least 65%.

19. The inspection device according to claim 18, wherein:

the at least one camera is located inside the housing, whereby the camera is located so that it is concealed except for the inlet opening of its lens; and

all of the cameras are a the same distance from the container at the time the container is photographed.

20. The inspection device according to claim 19, wherein:

the floor surface of the housing is realized at least partly in the form of a drawer and/or in the form of shutters or flaps;

the coating of the interior surfaces of the housing contains at least one metal oxide; and

the coating of the interior surfaces of the housing is baked or enameled onto the surface.

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