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Method for monitoring a container treatment installation

Abstract

The invention relates to a method for monitoring a container treatment installation which has a filling apparatus for filling containers and a closure apparatus for closing containers. The method involves filling a container with a filling material using the filling apparatus and measuring a concentration of a gas in the filling material of the filled container using a measuring device, wherein the filled container is removed in order to measure the concentration upstream of the closure apparatus or the concentration is measured upstream of the closure apparatus. Advantageously, the method allows the low-oxygen filling by the filling apparatus to be able to be monitored in a selective manner.

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Background/Summary

CROSS-REFERENCE TO RELATED APPLICATIONS

(1) This application claims the benefit under 35 U.S.C. § 119(a) of German Patent Application No. DE 10 2021 129 056.2 filed Nov. 9, 2021 entitled METHOD FOR MONITORING A CONTAINER TREATMENT INSTALLATION, and whose entire disclosure is incorporated by reference herein.

TECHNICAL FIELD

(2) The invention relates to a method for monitoring a container treatment installation which has a filling apparatus and a closure apparatus.

TECHNICAL BACKGROUND

(3) Methods and filling apparatuses for filling oxygen-sensitive liquid, such as, for example, beer, in bottles or cans are known per se. For example, oxygen-sensitive products can be filled in a filling process in which the containers are successively evacuated, purged, evacuated, pretensioned, filled and have the pressure reduced. Additional evacuation operations are optionally also possible.

(4) EP 2 629 093 A1 discloses a method and an apparatus for determining the CO2 content in a liquid which is intended to be checked, in particular in a drink.

(5) DE 102 13 076 A1 discloses a method for determining the contained quantities of gases dissolved in a liquid, preferably in a drink, wherein after complete filling of a measurement chamber, which is provided at least with a pressure measurement sensor, with the liquid whose gas content is intended to be checked ("test liquid") and after fluid-tight closure of the measurement chamber, the volume thereof—starting from a standard volume—is increased by a predetermined factor and the equilibrium pressure which has been produced afterwards in the measurement chamber is established and—based on the pressure measurement value obtained in this manner—the gas content of the fluid to be checked is calculated.

(6) A benefit of the invention is to provide an improved monitoring method by means of which it can be established how successful the filling of oxygen-sensitive products has actually been in order where applicable to identify potential for optimisation or sources of error.

SUMMARY OF INVENTION

(7) Benefits are achieved by the features of the independent claim **1**. Advantageous developments are set out in the dependent claims and the description.

(8) One aspect of the present disclosure relates to a method for monitoring a container treatment installation which has a filling apparatus (for example, a filling carousel) for filling containers, preferably cans, and a closure apparatus (for example, closure carousel) for closing containers, preferably cans. The closure apparatus is arranged downstream of the filling apparatus (with respect to the container) (for example, connected by means of a transport apparatus between the filling apparatus and the closure apparatus). The method involves filling a container with a (for example, liquid or pasty) filling material using the filling apparatus. The method further involves measuring a concentration of a gas in the filling material of the filled container using a measuring device, wherein the filled container is removed in order to measure the concentration upstream of the closure apparatus or the concentration is measured upstream of the closure apparatus.

(9) Advantageously, the method enables the low-oxygen filling by the filling apparatus to be able to be monitored in a selective manner. The method is particularly suitable for containers which are in the form of cans but can also be used with all other types of containers. Additional disruptive

factors or “sources of concern” for the containers, such as the closure apparatus which can move and handle the containers at enormous speed and can consequently also shake them so that, for example carbon dioxide escapes from the filling material in the container or oxygen is absorbed by the filling material in the container, consequently cannot falsify the measurement result. If, for example, the measurement takes place only after the closure apparatus, the influence of the closure apparatus would significantly influence the concentration of the gas in the filling material of the container so that ultimately hardly any reliable statement relating to the quality of the filling by the filling apparatus could be made. Causes for problems during filling can consequently be more quickly identified and overcome using the method according to the present disclosure. As a result of the selective analysis of the filling apparatus, for example, assembly operations lasting months in order to optimise the filling apparatus can be saved if, for example, the closure apparatus is actually responsible for an excessively high concentration of oxygen or an excessively low concentration of carbon dioxide in the filling material in the containers. Consequently, the potential for a discussion relating to the quality of the filling apparatus between the manufacturer and client of the filling apparatus can also be reduced.

(10) In one embodiment, the gas is carbon dioxide or oxygen.

(11) Preferably, the expression “concentration of a gas in the filling material” may relate to an indication which indicates a mass (for example, in g) or a volume (for example, in l or cm3) of the gas per mass (for example, in g) or volume (for example, in l) of the liquid or pasty filling material. In the context of the present disclosure, this term is also intended to be understood to refer to a gas content of the gas in the filling material.

(12) In another embodiment, the filled container is manually removed in order to establish the concentration upstream of the closure apparatus (for example, without shaking the filled container).

(13) In another embodiment, the method involves covering, preferably manually covering, the filled container with a lid, preferably in a substantially gas-tight manner, prior to measuring the concentration of the gas. As a result of the lid, the container can be safely transported to the measuring device, even if the container has not yet even been closed as a result of the removal of the container upstream of the closure apparatus. A change of the atmosphere in the upper space of the filled container can also be prevented, which has an influence on the gas exchange between the upper space and filling material in the container.

(14) In another embodiment, the filled container is covered with the lid in the stationary state without the concentration of the gas in the filling material being significantly changed and/or without shaking the filled container. Advantageously, additional disruptive factors or sources of concern which can influence the gas concentration in the container can consequently be excluded.

(15) In one embodiment, the filled container is covered with the lid directly downstream of the filling apparatus and/or upstream of the closure apparatus. Consequently, the container can advantageously be covered with the lid where applicable before or directly during the removal.

(16) In another embodiment, the lid is identical to those lids with which the closure apparatus closes the containers, preferably bottles. Alternatively, the lid may, for example, be an adapter lid which preferably differs from those lids with which the closure apparatus closes the containers, preferably cans. Advantageously, the technique can consequently be used both with bottles, for example, PET bottles or glass bottles, which use, for example, a screw closure, and with cans with a corresponding adapter lid.

(17) In another embodiment, the adapter lid has a, preferably penetrable, opening through which the filling material is conveyed to the measuring device and/or to which the measuring device is or can be connected.

(18) In one variant, the adapter lid has a seal, preferably an O-ring, for sealing with respect to the filled container (for example, with respect to an outer cover or inner cover of the container), preferably on a circumferential collar portion of the adapter lid.

(19) In another variant, the measurement of the concentration of the gas involves perforating the lid

with a perforation apparatus and/or introducing a line portion, to which the measuring device is or can be connected, into the filling material in the filled container.
(20) It is possible for the line portion to be a portion of the perforation apparatus, for example, the portion by means of which the lid is perforated (for example, in the region of the opening of the lid).
(21) In another variant, the measurement of the concentration of the gas involves pressing out and/or drawing out the filling material from the filled container in the direction towards the measuring device.
(22) In one embodiment, a conveying gas, preferably carbon dioxide or nitrogen, is introduced into the filled container, preferably into an upper space of the filled container, so that the filling material is pressed out of the filled container in the direction towards the measuring device. Advantageously, it is made possible to convey the filling material to the measuring device in a simple manner without the filling material becoming contaminated by oxygen in the conveying gas.
(23) In one embodiment, a purge gas, for example, carbon dioxide or nitrogen, is introduced into a line between the filled container and the measuring device in order to purge the line before the filling material is directed through the line to the measuring device. Advantageously, therefore, it is possible to prevent the filling material from becoming contaminated by oxygen in the line on the way to the measuring device, whereby the measurement result could be falsified.
(24) In another embodiment, the method further involves adapting an operation and/or a configuration (for example, construction, assembly and/or control) of the filling apparatus depending on the measured concentration. Advantageously, therefore, based on the measured concentration, which has not been influenced by disruptive factors located downstream of the filling apparatus, it is possible to identify in a very selective manner whether the operation or the configuration of the filling apparatus should be adapted (for example, optimised) in order to obtain the desired concentration of the gas in the filling material in the container directly downstream of the filling apparatus in an operationally reliable manner.
(25) In another embodiment, the method further involves measuring another concentration of the gas in the filling material before the filling material is poured into the container and/or in a filling material supply line to the filling apparatus, wherein the filling material in order to measure the additional concentration of the gas is preferably drawn from a delivery valve of the filling material supply line. Optionally, the method may further involve establishing a concentration change of the gas via the filling apparatus depending on the measured concentration and the measured additional concentration. Advantageously, therefore, a change of the concentration of the gas which is actually brought about by the handling in the filling apparatus can be derived in order where applicable to identify potential for optimisation in the filling apparatus or to identify that the filling apparatus has already been adjusted as desired or in an optimum manner.
(26) In another embodiment, the adaptation of the operation and/or the configuration (for example, construction, assembly and/or control) of the filling apparatus is further carried out in accordance with the measured additional concentration. Preferably, the adaptation can be carried out (for example, only) under the condition that the concentration change of the gas via the filling apparatus is greater than or less than a predetermined limit value.
(27) Preferably, a container treatment installation may be configured to produce, clean, coat, check, fill, close, label, print and/or package containers for liquid media, preferably drinks or liquid foods.
(28) For example, the containers may be in the form of bottles, cans, canisters, cartons, flasks, etcetera.
(29) The above-described preferred embodiments and features of the invention can be freely combined with each other.

Description

BRIEF DESCRIPTION OF THE FIGURES

(1) Further details and advantages of the invention are described below with reference to the appended drawings, in which:

(2) FIG. **1** shows a schematic view of a container treatment installation;

(3) FIG. **2** shows a schematic structure for measuring a concentration of a gas in a filling material of a container, wherein the container and an adapter lid are illustrated in section; and

(4) FIG. **3** shows a bar chart for indicating concentrations of carbon dioxide in the filling medium as measured by way of example at different positions of a container treatment installation.

DETAILED DESCRIPTION OF EXEMPLARY EMBODIMENTS

(5) FIG. **1** shows a container treatment installation **10**. The container treatment installation **10** has a filling apparatus **12** for filling containers and a closure apparatus **14** for closing containers. The closure apparatus **14** is arranged downstream of the filling apparatus **12** (with respect to the containers).

(6) In a particularly preferred manner, the container treatment installation is constructed for handling cans, such as drinks cans (for example, 0.33 l or 0.5 l cans). Accordingly, the filling apparatus **12** is preferably configured for filling cans and the closure apparatus **14** is preferably configured for closing cans.

(7) However, it is in principle also possible to apply the techniques of the present disclosure to container treatment installations which can handle a different type of container. Such containers may, for example, be in the form of bottles, canisters, cartons, flasks, etcetera.

(8) The filling apparatus **12** is preferably in the form of a filling carousel. The closure apparatus **14** is preferably in the form of a closure carousel. However, other construction types for the filling apparatus **12** and/or the closure apparatus **14** are also conceivable, for example, an embodiment as a linear filler or as a linear closure member.

(9) The filling apparatus **12** can fill the containers with a filling material, for example, a drink or a food. The filling material is preferably a liquid or pasty medium. In a particularly preferred manner, the filling material is oxygen-sensitive, such as, for example, beer.

(10) The filling apparatus **12** may have a plurality of filling valves for simultaneously filling a plurality of containers. For example, the filling valves may be arranged around a circumference of the filling apparatus **12** which is in the form of a filling carousel.

(11) The filling apparatus **12** may have a product or filling material supply line **16**. Via the filling material supply line **16**, the filling material can be supplied to the filling apparatus **12** (and consequently to the filling valves of the filling apparatus **12**). It is possible for the filling material supply line **16** to have, for example, a delivery valve **18**, for example, a product tap. At the delivery valve **18**, the filling material can be drawn, for example, for checks, for example, manually or automatically.

(12) The filling apparatus **12** may have a container supply line **20**. Via the container supply line **20**, containers can be supplied to the filling apparatus **12** for filling. The container supply line **20** may, for example, have one or more container conveyors. The container conveyor(s) may, for example, have at least one transport star-like member (for example, filling apparatus inlet star-like member) and/or linear conveyor.

(13) A transport apparatus **22** of the container treatment installation **10** may be arranged downstream of the filling apparatus **12**. The transport apparatus **22** can connect the filling apparatus **12** and the closure apparatus **14** to each other. The transport apparatus **22** can be configured to transport containers from the filling apparatus **12** to the closure apparatus **14**. The transport apparatus **22** may have one or more container conveyors. The container conveyor(s) may, for example, have at least one transport star-like member (for example, filling apparatus outlet star-like member and/or closure apparatus inlet star-like member) and/or linear conveyor.

(14) The closure apparatus **14** may close the containers. Preferably, the closure apparatus **14** can

close the containers which are in the form of cans with a can lid. The can lid can be securely connected to the container, for example, by means of mechanical shaping of the can lid and/or the container. The can lid itself may in turn have a closure which can be opened, as known, for example, with drinks cans.

(15) However, it is also possible for the closure apparatus **14** to be configured to close another type of container, that is to say, not cans. Accordingly, the closure apparatus **14** may close the containers, for example, with a lid, a cork, a crown cap or a screw closure. The closure apparatus **14** may have a plurality of closure stations for simultaneously closing a plurality of containers. For example, the closure stations may be arranged around a circumference of the closure apparatus **14** which is in the form of a closure carousel.

(16) The containers which are closed by the closure apparatus **14** can leave the closure apparatus **14** via a container outlet **24**. The container outlet **24** may transport the closed containers, for example, to at least one additional handling apparatus of the container treatment installation. The container outlet **24** may have one or more container conveyors. The container conveyor(s) may, for example, have at least one transport star-like member (for example, filling apparatus outlet star-like member and/or closure apparatus inlet star-like member) and/or linear conveyor.

(17) It is possible for the container treatment installation **10** in addition to the filling apparatus **12** and the closure apparatus **14** to have additional handling apparatuses for handing containers (not illustrated). For example, the container treatment installation **10** may additionally have a handling apparatus for producing, checking, coating, cleaning labelling, printing and/or packing containers.

(18) FIG. **2** shows an exemplary measurement structure **26** for measuring a concentration of a gas in the filling medium of a container **28**.

(19) The measurement structure **26** has the container **28**, an adapter lid **30** and a measuring device **32**. The container **28** is preferably in the form of an incomplete can in which the conventional can closure is missing, as illustrated.

(20) The adapter lid **30** is preferably constructed to close the container **28** which is in the form of an incomplete can and in which the conventional can closure/lid is missing. In place of a conventional closure/lid, the container **28** can consequently be closed by means of the adapter lid **30**.

(21) Preferably, the adapter lid **30** has an opening **34**. For example, the opening **34** may be arranged centrally in the adapter lid **30**. The opening **34** may preferably connect an upper side of the adapter lid **30** to a lower side of the adapter lid **30**. The opening **34** may be in the form of a through-hole through the adapter lid **30**.

(22) It is possible for the opening **34** to be a part or a portion of a securing connection for the preferably gas-tight, releasable connection of the measuring device **32**. The securing connection may, for example, have a securing portion, such as, for example, a thread, a bayonet closure, a plug element, a plug element receiving member, a locking element or a locking element receiving member for connecting the measuring device **32**.

(23) The adapter lid **30** may preferably be configured in a disc-like manner and may have a circumferential collar portion or flange **36**. In order to close the container **28**, the collar portion **36** may completely circumferentially engage around or surround an outer cover of the container **28**. A seal **38**, such as, for example, an O-ring may further be arranged on the collar portion **36**. The seal **38** may seal between the adapter lid **30** or the collar portion **36** thereof and the container **28** or the outer cover thereof in a gas-tight manner.

(24) A connection between the adapter lid **30** and the container **28** may be releasable. Preferably, the adapter lid **30** may be pushed or placed onto the unclosed container **28**.

(25) The measuring device **32** may be releasably connected to the adapter lid **30** (or another lid) in order to measure a concentration of a gas, preferably carbon dioxide (CO_2) or oxygen. The measuring device **32** may be connected to the adapter lid **30** and consequently to the container **28** by means of a line **40**.

(26) The measuring device **32** may use any known technique in order to measure a concentration of the gas. The measuring device **32** may additionally output the measured concentration, for example, via an indicator unit or in the form of a corresponding electrical (for example, analogue or digital) signal which indicates the measured concentration.
(27) The measuring device **32** may be connected to the adapter lid **30** (or another lid), preferably to the opening **34** thereof, by means of a seal **44**. For example, the seal **44** may be in the form of a truncated wedge or truncated cone for inserting into the opening **34**.
(28) Preferably, a line portion **42** which is connected to the measuring device **32** protrudes through the opening **34** directly into the filling medium in the container **28**. Via this line portion **42**, at least a portion of the filling medium in the container **28** can be directed to the measuring device **32**. In this portion of the filling medium from the container **28**, the measuring device **32** can measure the concentration of the gas.
(29) It is possible for the measurement structure **26** to further have a perforation apparatus **46** and/or a gas source **48**.
(30) The perforation apparatus **46** may be constructed to perforate the adapter lid **30** (or another lid) in the region of the where applicable closed opening **34** or to be guided through the opening **34** in order to be introduced with the line portion **42** in the filling medium in the container **28**.
(31) The gas source **48** may be connected to a line system which connects the measuring device **32** and the opening **34** of the adapter lid **30** to each other. The gas source **48** may, for example, provide nitrogen or carbon dioxide. By means of the gas source **48**, gas can be directed into the line system. The gas may, for example, be used as purge gas in order to purge the line system. Alternatively or additionally, the gas can be used as conveying gas for pressing out the filling medium in the container **28** through the line portion **42** in the direction towards the measuring device **32**. To this end, the gas may, for example, be supplied to an upper space of the container **28**.
(32) Even if the particularly preferred embodiment is described herein with the container **28** which is in the form of a can and the adapter lid **30**, it should be noted that in embodiments in which the containers **28** are, for example, not cans (for example, glass or PET bottles), in place of the adapter lid **30** another lid can be used to close the container **28** for connecting the measuring device **32**. The lid may preferably be of the same type as the one used by the closure apparatus **14** to close the containers **28**, for example, a screw closure.
(33) A method for monitoring a container treatment installation is described below. The method is described by way of example with reference to FIGS. **1** to **3**.
(34) The method involves filling a container **28** with a filling material by means of the filling apparatus **12**. For example, the container may be filled with the filling medium by the filling apparatus **12** as one of several containers **28**. During filling, the container **28** may be positioned below a filling valve of the filling apparatus **12**. During filling, the container **28** may be pressed onto the filling valve, or there may be a gap between the container **28** and the filling valve. The filling apparatus **12** may receive the filling medium via the filling material supply line **16**. The filling apparatus **12** may receive the container **28** which is intended to be filled via the container supply line **20**.
(35) It is possible for the container **28**, prior to being filled with the filling medium, to be evacuated at least once, purged at least once with a production gas (for example, inert gas, such as carbon dioxide) and/or pretensioned with a production gas (for example, inert gas, such as carbon dioxide). The evacuation, purging and/or pretensioning can be carried out by means of the filling apparatus **12**.
(36) The method further involves measuring a concentration of a gas in the filling medium of the filled container **28** by means of the measuring device **32**. To this end, the filling material can be directed out of the container **28** to the measuring device **32**.
(37) The container **28** which is filled with the filling medium by means of the filling apparatus **12** is removed in order to measure the concentration upstream of the closure apparatus **14**, for example,

directly downstream of the filling apparatus **10** and/or a position on the transport apparatus **22**. During removal, the transport apparatus **22** for transporting containers **28** may be moving or stationary.
(38) Alternatively, the concentration of the gas in the filling medium of the filled container **28** is measured upstream of the closure apparatus **14** without the filled container **28** being removed from a position on the transport apparatus **22** to this end. In this instance, the concentration of the gas in the filling medium may be measured, for example, directly at the transport apparatus **22**.
(39) The removal of the filled container **28** can preferably be carried out manually/by hand. However, it is also possible for the filled container **28** to be directed, for example, automatically out of a container flow and consequently removed.
(40) The method may further involve covering, preferably manually covering, the filled container **28** with a (for example, adapter) lid **30** prior to measuring the concentration of the gas. The lid **30** may preferably cover the container **28** in a gas-tight manner. The lid **30** may, for example, be configured in the same manner as the adapter lid **30** (see FIG. **2**), particularly when the container **28** is a can.
(41) The covering with the lid **30** is preferably carried out when the container **28** is stationary, for example, when the container **28** is retained or supported by the transport apparatus **22** and the transport apparatus **22** is stationary. Preferably, the filled container **28** can be covered with the lid **30** directly downstream of the filling apparatus **12**.
(42) However, the container may, for example, also be removed from the transport apparatus **22**, placed elsewhere and then covered with the lid **30**. Alternatively, the lid **30** may also be covered with the lid **30** during a movement of the container **28**, wherein there is preferably brought about no shaking of the container **28** and consequently no significant change of the concentration of the gas in the filling material in the container **28**.
(43) The measurement or establishment of the concentration of the gas by means of the measuring device **32** may involve connecting the measuring device **32** to the lid **30**, for example, the opening **34** of the lid **30**. In this instance, for example, the perforation apparatus **46** can be used in order to perforate the lid **30**. The line portion **42** may be introduced in the filling material in the container **28** and direct the filling material to the measuring device **32**.
(44) It is possible for the filling material to be drawn from the container **28** to the measuring device **32**, for example, with a pump (not illustrated). Alternatively or additionally, the filling material can be pressed out of the container **28** by supplying a (for example, conveying) gas into the upper space of the container **28** from the container **28** via the line portion **42** in the direction towards the measuring device **32**. The gas can be directed from the gas source **48** to the container **28**. It is also possible for the gas from the gas source **48** to purge the line between the container **28** and the measuring device **32**.
(45) The method may further involve adapting an operation and/or a configuration of the filling apparatus **12** in accordance with the measured concentration.
(46) For example, an oxygen concentration which is above a predetermined limit value can be measured. The operation and/or the configuration of the filling apparatus **12** can be adapted in order to reduce the oxygen concentration in the filling material in containers **28** which are subsequently filled.
(47) On the other hand, for example, it is possible to measure a carbon dioxide concentration which is below a predetermined limit value. The operation and/or the configuration of the filling apparatus **12** can be adapted in order to increase the carbon dioxide concentration in the filling material in containers **28** which are subsequently filled.
(48) The method may further involve measuring an (additional) concentration of the gas in the filling material and the adaptation of the operation and/or the configuration of the filling apparatus **12** may further be dependent on the measured additional concentration.
(49) This (additional) concentration of the gas can be measured in the filling material before the

filling material is poured from the filling apparatus **12** into the containers **28**. For example, filling material can be drawn at the delivery valve **18** in the filling material supply line **16** and examined for the (additional) concentration, for example, using the measuring device **32**.
(50) From the measured concentration of the filling material in the container **28** and the measured (additional) concentration of the filling material prior to filling, a concentration change of the gas in the filling material can be derived or established by means of the filling apparatus **12**. The concentration may have increased, decreased or remained substantially the same.
(51) If, for example, an increase of the oxygen concentration which exceeds a predetermined limit value has been established via the filling apparatus **12**, the operation and/or the configuration of the filling apparatus **12** can be adapted in order to obtain a low oxygen concentration in the filling material in the containers **28** in containers **28** which are subsequently filled.
(52) If, for example, a decrease of the carbon dioxide concentration which exceeds a predetermined limit value has been established via the filling apparatus **12**, the operation and/or the configuration of the filling apparatus **12** can be adapted in order to obtain a higher carbon dioxide concentration in the filling material in the containers **28** in containers **28** which are subsequently filled.
(53) The method consequently enables a very precise examination of the extent to which the filling apparatus **12** is responsible for an increase or decrease of the gas in order to be able to react in a correspondingly selective manner. Therefore, the method is advantageous over other methods, as described below with reference to FIG. **3**.
(54) FIG. **3** shows a bar chart having four bars **50**, **52**, **54**, **56**, which indicate the actually measured carbon dioxide concentrations in a container treatment installation for containers **28** which are in the form of cans.
(55) The bar **50** indicates a carbon dioxide concentration in the filling material which has been measured at the delivery valve **18**. The bar **52** indicates a carbon dioxide concentration in the filling material of filled, closed containers **28** which was measured downstream of the closure apparatus **14**. The bar **54** indicates a carbon dioxide concentration in the filling material of filled containers **28** which was measured after the filled container **28** was powerfully agitated. As a result of the agitation, the carbon dioxide concentration in the filling material in the filled container **28** is substantially reduced. The bar **56** indicates a carbon dioxide concentration in the filling material of filled containers **28** which was measured according to the present monitoring method upstream of the closure apparatus **14**, for example, after corresponding removal of the container **28**.
(56) When bars **50** and **52** are compared, a decrease of the carbon dioxide concentration is apparent. When the bars **50** and **56** are compared, in contrast, an increase of the carbon dioxide concentration is evident. The can which has been removed after the closure apparatus **14** for measurement has approximately 0.1 g/l CO_2 less in the filling material than the can which has been removed between the filling apparatus **12** and the closure apparatus **14** for measurement (see bars **52** vs. **56**).
(57) That is to say, only the comparison of the bars **50** and **56** can provide reliable information relating to how the concentration of carbon dioxide via the filling apparatus **12** has changed or what carbon dioxide content there is in the filling material in the container **28** directly after filling. If only the bars **50** and **52** were taken into consideration, there would potentially be incorrect estimates or incorrect diagnoses. It would not be taken into account that, as a result of the movements and disturbances of the containers **28** in the closure apparatus **14**, the containers **28** are shaken and consequently a carbon dioxide concentration in the filling material in the containers **28** can decrease. The quality of the (low-oxygen) filling of the filling apparatus **12** would consequently be underestimated. Only by taking into account the column **56** can a conclusion be selectively drawn relating to the actual absorption or discharge of CO_2 during the filling. This, as explained, can be measured in the cans by means of the measurement structure **26** which is described with reference to FIG. **2** using the adapter lid **30** for the container which is in the form of a can before the container **28** has been closed by the closure apparatus **14**.

(58) FIG. **3** relates by way of example to the measurement of carbon dioxide concentrations. However, the technique can, for example, also be used for the measurement of oxygen concentrations.
(59) The invention is not limited to the preferred embodiments described above. Instead, a large number of variants and modifications which also make use of the notion of the invention and are therefore included within the protective scope are possible. In particular, the invention also claims protection for the subject-matter and the features of the dependent claims regardless of the claims referred to. In particular, the individual features of the independent claim **1** are in each case disclosed independently of each other. In addition, the features of the subordinate claims are disclosed independently of all the features of the independent claim **1** and are, for example, disclosed independently of the features of the independent claim **1**.
LIST OF REFERENCE NUMERALS
(60) **10** Container treatment installation **12** Filling apparatus **14** Closure apparatus **16** Filling material supply line **18** Delivery valve **20** Container supply line **22** Transport apparatus **24** Container outlet **26** Measurement structure **28** Container **30** Adapter lid **32** Measuring device **34** Opening **36** Collar portion **38** Seal **40** Line **42** Line portion **44** Seal **46** Perforation apparatus **48** Gas source **50**-**56** Bars to indicate the carbon dioxide concentration

Claims

1. A method for monitoring a container treatment installation which has a filling apparatus for filling containers and a closure apparatus for closing containers, wherein the closure apparatus is arranged downstream of the filling apparatus, the method comprising: filling a container with a filling material using the filling apparatus; measuring a concentration of a gas in the filling material of the filled container using a measuring device, wherein the filled container is removed in order to measure the concentration upstream of the closure apparatus or the concentration is measured upstream of the closure apparatus.
2. The method according to claim 1, wherein: the gas is carbon dioxide or oxygen.
3. The method according to claim 1, wherein: the filled container is manually removed in order to establish the concentration upstream of the closure apparatus.
4. The method according to claim 1, further comprising: covering the filled container with a lid prior to measuring the concentration of the gas.
5. The method according to claim 4, wherein at least one of: the filled container is covered with the lid in a stationary state without the concentration of the gas in the filling material being significantly changed; the filled container is covered with the lid in a stationary state without shaking the filled container; and the filled container is covered with the lid in a substantially gas-tight manner.
6. The method according to claim 5, wherein at least one of: the measurement of the concentration of the gas involves perforating the lid with a perforation apparatus; and the measurement of the concentration of the gas involves introducing a line portion, to which the measuring device is connected or connectable, into the filling material in the filled container.
7. The method according to claim 4, wherein at least one of: the filled container is covered with the lid directly downstream of the filling apparatus; and the filled container is covered with the lid upstream of the closure apparatus.
8. The method according to claim 4, wherein: the lid is identical to those lids with which the closure apparatus closes the containers, or the lid is an adapter lid which differs from those lids with which the closure apparatus closes the containers.
9. The method according to claim 8, wherein: the adapter lid has an opening through which the filling material is conveyed to the measuring device or to which the measuring device is connectable.

10. The method according to claim 9, wherein: the opening is penetrable.
11. The method according to claim 8, wherein: the adapter lid has a seal for sealing with respect to the filled container.
12. The method according to claim 11, wherein at least one of: the seal is an O-ring; and the adapter lid has the seal on a circumferential collar portion of the adapter lid.
13. The method according to claim 1, wherein at least one of: the measurement of the concentration of the gas involves pressing out the filling material from the filled container in the direction towards the measuring device; and the measurement of the concentration of the gas involves drawing the filling material from the filled container in the direction towards the measuring device.
14. The method according to claim 1, wherein at least one of: a conveying gas is introduced into the filled container so that the filling material is pressed out of the filled container in a direction towards the measuring device; and a purge gas is introduced into a line between the filled container and the measuring device in order to purge the line before the filling material is directed through the line to the measuring device.
15. The method according to claim 1, further comprising at least one of: adapting an operation of the filling apparatus depending on the measured concentration; and adapting a configuration of the filling apparatus depending on the measured concentration.
16. The method according to claim 1, further comprising at least one of: measuring an additional concentration of the gas in the filling material before the filling material is poured into the container, and measuring an additional concentration of the gas in the filling material in a filling material supply line to the filling apparatus.
17. The method according to claim 16, wherein: the filling material in order to measure the additional concentration of the gas is drawn from a delivery valve of the filling material supply line.
18. The method according to claim 16, further comprising: establishing a concentration change of the gas via the filling apparatus depending on the measured concentration and the measured additional concentration.
19. The method according to claim 16, wherein at least one of: the adaptation of the operation of the filling apparatus is further carried out in accordance with the measured additional concentration, and the adaptation of the configuration of the filling apparatus is further carried out in accordance with the measured additional concentration.
20. The method of claim 19, wherein: the adaptation is carried out under the condition that the concentration change of the gas via the filling apparatus is greater than or less than a predetermined limit value.