(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
28 November 2024 (28.11.2024)

WIPO | PCT

(10) International Publication Number
WO 2024/242566 A1

(51) International Patent Classification:
G01M 3/36 (2006.01)

(21) International Application Number:
PCT/NL2024/050266

(22) International Filing Date:
24 May 2024 (24.05.2024)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
2034905 24 May 2023 (24.05.2023) NL

(71) Applicant: **OXIPACK HOLDING B.V.** [NL/NL]; Wilgenkade 17, 3992 LL Houten (NL).

(72) Inventor: **SMIT, Arjan Tonnis**; c/o Wilgenkade 17, 3992 LL Houten (NL).

(74) Agent: **WITMANS, H.A.**; V.O., P.O. Box 87930, 2508 DH Den Haag (NL).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CV, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IQ, IR, IS, IT, JM, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, MG, MK, MN, MU, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, WS, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, CV, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SC, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ,

(54) **Title:** A SYSTEM AND METHOD FOR TESTING LEAK TIGHTNESS OF A FILM PACKAGE

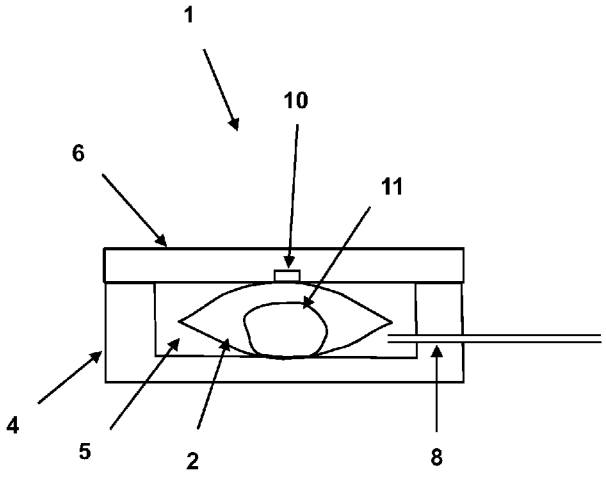

FIG 1B

(57) **Abstract:** A system and method for testing leak tightness of a film package containing a solid sticky product. A film wall of the film package at least partially sticks to the product. The method comprises providing a receptacle and a lid for closing the receptacle. The lid and receptacle enclose a chamber for holding the film package, wherein the chamber is larger than an outer shape of the film package. The method comprises placing the film package inside the chamber. The method further comprises closing the chamber. The method further comprises at least partially unsticking the film wall from the product by reducing a gas pressure inside the chamber to a first pressure, such that gas inside the film package is expanded and moved between the film wall and the product. The method comprises determining the leak tightness of the film package.

WO 2024/242566 A1

[Continued on next page]

RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, ME, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report (Art. 21(3))*

Title: A system and method for testing leak tightness of a film package

FIELD OF THE INVENTION

The present invention relates to the field of determining pressure inside a film package. In particular, the invention relates to the field of determining leak tightness of a film package. More in particular, the invention relates to a system and method for testing leak tightness of a film package containing a solid sticky product.

BACKGROUND

It is known to package products in a package. Such packages may e.g. store the product under vacuum or under a protective atmosphere. Leak tightness detection systems are advantageous to determine whether such package is leak tight. The package not being leak tight may present a problem in terms of reduced shelf life of the product, product escaping from the package or the like. It is also known that different types of packages require different methods for testing leak tightness.

SUMMARY

It is an object to provide a method for testing leak tightness of a film package containing a solid sticky product, and/or a leak detection system for testing leak tightness of a film package containing a solid sticky product. More in general, it is an object to provide an improved leak detection system and/or method for testing leak tightness of a film package.

Thereto, according to a first aspect is provided a method for testing leak tightness of a film package containing a solid sticky product. A wall of the film package at least partially sticks to the product. The solid sticky product can be at least partially non-porous. It will be appreciated that at least a part of the solid sticky product is a whole without significant gaps in

between. Nevertheless, the solid sticky product can also comprise at least one further part with one or more holes formed therein. The film package can comprise at least one gas bubble inside. A pressure in the film package can be atmospheric or subatmospheric. The film package can e.g. have been sealed at a subatmospheric pressure. The method comprises providing a receptacle and a lid for closing the receptacle. The receptacle can be closed airtight. The lid and receptacle enclose a chamber for holding the film package, wherein, at least at atmospheric pressure, the chamber is larger than an outer shape of the film package. The method comprises placing the film package inside the chamber. The film package can be placed in the chamber manually, e.g. by hand, or automatically, e.g. using a transporting system, such as a conveyor, robot, or the like. The film package can comprise a plurality of film packages. The method comprises closing the chamber with the film package inside. The chamber can be closed by moving the lid to a position wherein the lid covers the open end of the receptacle such that the lid closes the receptacle. The method comprises at least partially unsticking the film wall from the product by reducing a gas pressure inside the chamber to a first pressure, such that gas inside the film package is expanded and moved between the film wall and the product. The gas pressure is reduced to the first pressure outside the package and inside the chamber. It will be appreciated that the ratio between the volume of product and the at least one gas bubble can be 10:1 or larger, such as 1000:1 or larger. The ratio between the volume of product and the at least one gas bubble can be higher than 10:1 for preserving shelf life of the product. Additionally, the ratio between the volume of product and the at least one gas bubble can be lower than 1000:1 for allowing, upon reducing the gas pressure inside the chamber, a sufficient amount of gas to move between the film wall and the product such that the film wall at least partially unsticks from the product. The method further comprises determining the leak tightness of the film package. The leak tightness can be determined by a sensor. The sensor can be configured for

detecting a size of the at least one gas bubble. Preferably, the above steps of the method are performed in the described order.

Optionally, the product comprises fat and/or oil. The fat and/or oil percentage of the product can comprise more than one percent, preferably more than five percent. The product can be a greasy product. The composition of the product can contribute to the product exceeding a minimum stickiness level required for it to temporally adhere to the film wall of the film package.

Optionally, the first pressure is below atmospheric pressure, preferably lower than 100 mbara. The first pressure can e.g. be approximately 50 mbara. Preferably, the first pressure is chosen to be lower than a pressure inside the film package. Preferably, the first pressure is chosen to be lower than a pressure at which the film package was sealed. The pressure difference between the inside of the film package and the chamber results in a relatively higher pressure inside the film package with respect to the pressure in the chamber, i.e. outside the film package.

Optionally, the gas pressure inside the chamber is reduced to a first pressure such that the film package abuts against at least two walls of the chamber, such as two opposite walls. As, at atmospheric pressure, the chamber is larger than the outer shape of the film package, the package can expand inside the chamber when the pressure inside the chamber is reduced. The film package may abut against the two walls by bulging due to the reduced pressure. The pressure difference between the film package and the chamber can cause a volume of gas in the film package to increase, such that the film package expands. The volume increase of the film package and/or the higher pressure inside the package than around the package in the chamber can generate a force and/or pressure acting on at least two walls of the chamber.

Optionally, the step of determining the leak tightness of the film package further comprises determining a force and/or pressure that the film package applies to at least one of the at least two walls of the chamber.

Alternatively or additionally, the step of determining the leak tightness of the film package further comprises determining one or more dimensions of the at least one gas bubble.

Optionally, the leak tightness of the film package is determined by measuring the force and/or pressure applied to at least one wall of the chamber over time. During measurement of the applied force and/or pressure, the pressure in the chamber can be maintained constant. When the force and/or pressure on the wall of the chamber is substantially constant over a predetermined period of time, the film package is determined to be leak tight. In case the force and/or pressure on the wall of the chamber decreases over time, e.g. between two consecutive measurements, the film package is determined to contain a leak. Alternatively, or additionally, data representative of the force and/or pressure in view of a package under consideration can be compared with data representative of the force and/or pressure in view of one or more different packages, such as a package known to be leak tight, for determining leak tightness of the package under consideration. Alternatively or additionally, the leak tightness of the film package is determined by measuring one or more dimensions of the at least one gas bubble over time.

Optionally, the method further comprises providing a buffer vessel for containing gas at a subatmospheric pressure and connectable to the chamber by a fluid channel comprising a valve. The step of reducing a gas pressure inside the chamber can comprise opening the valve for establishing fluid connection between the buffer vessel and the chamber. The buffer vessel can be connected to suction means and/or a gas outlet. The buffer vessel can contain a similar and/or a different type of gas compared to the gas inside the chamber.

Optionally, the gas pressure inside the chamber is reduced to the first pressure in less than 1 second, preferably in less than 100 milliseconds, more preferably in less than 10 milliseconds. A relatively large volume of the

buffer vessel compared to the volume of the chamber results in a relatively fast pressure reduction time.

Optionally, the ratio between the volume of the buffer vessel and the volume of the chamber is larger than 10:1, preferably larger than 100:1. The buffer vessel can comprise a similar or different shape compared to the shape of the chamber.

Optionally, the film package is a flexible film package. The material of the film package can be at least partially made of a flexible material, such as plastic.

Optionally, the product comprises cheese or meat, such as sausage. The product can be at least partially non-porous. The product can comprise a combination of cheese and meat. The cheese may have a part with one or more holes therein. The ratio between the volume of cheese and/or meat and the at least one gas bubble can be between 10:1 and 1000:1, or larger.

Optionally, the product comprises a food product. The food product can be a monolithic piece such as a single piece of cheese or a sausage. The food product can be a plurality of monolithic pieces. Preferably the film package comprises twenty or less, more preferably twelve or less, even more preferably six or less, monolithic pieces of the food product, such as slices of cheese, cold cuts, cuts of meat, or sausages.

Optionally an adhesiveness of the product is larger than 100 g·s, e.g. larger than about 150 g·s. Adhesiveness herein refers to the work needed to overcome attractive force between the product and other surfaces, in particular the film package film. For instance, Yuanrong Zheng et al. (Texture Profile Analysis of Sliced Cheese in relation to Chemical Composition and Storage Temperature, Journal of Chemistry, Vol. 2016) reported that for example Emmental cheese can have an adhesiveness of about 160 g·s, Gouda cheese can have an adhesiveness of about 200 g·s, and Cheddar can have an adhesiveness of about 500 g·s at 25 °C. Meat products, such as sausages or cold cuts can have similar adhesiveness. The adhesiveness of the product

makes that work needs to be performed to separate the film package from the product. This sets this situation apart from situations in which the film package does not (or hardly) adhere to the product, making it much easier for air to move between the product and the package film, causing the packaged product to behave markedly different when exposed to underpressure.

According to a second aspect is provided a leak detection apparatus for testing leak tightness of a film package containing a solid sticky product. It will be appreciated that the film package can comprise at least one gas bubble inside. A wall of the film package at least partially sticks to the product. The apparatus comprises a receptacle for receiving the film package. The apparatus further comprises a lid for closing the receptacle, wherein the lid and receptacle enclose a chamber for holding the film package. The chamber and the film package are relatively shaped and/or sized such that at atmospheric pressure in the chamber the chamber is larger than an outer shape of the film package. The apparatus comprises a suction port for removing from inside the chamber gas surrounding the package for at least partially unsticking the film wall from the product. The suction port can be arranged such that the chamber gas can be moved out of the chamber. The apparatus comprises a leak tightness sensor for determining leak tightness of the package. The leak tightness sensor can be positioned inside the chamber, i.e. in the receptacle and/or in the lid. The leak tightness sensor can also be integrated in the receptacle and/or in the lid.

Optionally, the product comprises fat and/or oil.

Optionally, the suction port is connected to a suction system configured for reducing a gas pressure inside the chamber to a first pressure. The suction system can be arranged to reduce the amount of gas inside the chamber, such that the gas pressure in the chamber is reduced to a first pressure.

Optionally, the apparatus is configured such that at the first pressure the film package abuts against at least two walls of the chamber.

The chamber and the film package can be relatively shaped and/or sized such that at subatmospheric pressure in the chamber the film package abuts against at least two walls of the chamber.

Optionally, the first pressure is below atmospheric pressure, preferably lower than 100 mbara.

Optionally, the apparatus is configured for reducing the gas pressure inside the chamber to the first pressure in less than 1 second, preferably in less than 100 milliseconds, more preferably in less than 10 milliseconds.

Optionally, the leak tightness sensor comprises a force and/or pressure sensor for determining a force and/or pressure that the film package applies to at least one of the at least two walls at subatmospheric pressure in the chamber. Alternatively, the leak tightness sensor can comprise a movable part that is urged to move when the force and/or pressure of the film package is applied thereto for determining the amount of bulging of the film package. Alternatively or additionally, the leak tightness sensor comprises a sensor that is configured for determining one or more dimensions of the at least one gas bubble, such as a laser or other type of distance measurement sensor.

Optionally, the suction system includes a pump. The pump can be configured for removing gas from inside the chamber that is surrounding the film package.

Optionally, the suction system includes a vacuum source. The vacuum source can be configured for reducing the gas pressure in the chamber to the first pressure.

Optionally, the suction system includes a buffer vessel for containing gas at a subatmospheric pressure and connectable to the chamber by a fluid channel comprising a valve. Upon opening the valve, a fluid connection between the buffer vessel and the chamber is established and gas inside the chamber is removed. Removing gas from the chamber reduces the gas pressure inside the chamber and outside the film package to the first

pressure. The pressure reduction outside the film package causes gas inside the film package to expand and move between the film wall and the product to at least partially unstick the film wall from the solid sticky product.

Optionally, the ratio between the volume of the buffer vessel and the volume of the chamber is larger than 10:1, preferably larger than 100:1.

Optionally, the film package is a flexible film package.

Optionally, the chamber is configured for holding a film package comprising a different shape for a different type of product. The accuracy of determining the leak tightness is similar for film packages having a different volume.

According to a third aspect is provided a leak detection system for testing leak tightness of a film package containing a solid sticky product. The leak detection system comprises a leak detection apparatus as described and a film package containing a solid sticky product. A film wall of the film package at least partially sticks to the solid sticky product.

It will be appreciated that any of the aspects, features and options described in view of the method for testing leak tightness apply equally to the leak detection system and apparatus, and vice versa. It will also be clear that any one or more of the above aspects, features and options can be combined.

BRIEF DESCRIPTION OF THE DRAWINGS

Embodiments of the present invention will now be described in detail with reference to the accompanying drawings in which:

Figures 1A and 1B show illustrations of a schematic representation of an example of a side view of a leak detection system for testing leak tightness of a film package;

Figure 2 shows an illustration of a schematic representation of a flow chart of an example of a method for testing leak tightness of a film package containing a solid and/or liquid substance and a gas;

Figure 3 shows an illustration of a schematic representation of an example of a side view of a leak detection system including additional features for testing leak tightness of a film package;

Figure 4 shows an illustration of a schematic representation of an example of a leak detection apparatus for testing leak tightness of a film package;

Figure 5 shows an illustration of a schematic representation of an example of a leak detection apparatus for testing leak tightness of a film package, wherein the suction system includes a buffer vessel.

DETAILED DESCRIPTION

Figures 1A and 1B show an example of a side view of a leak detection system 1 for testing leak tightness of a film package 2. The leak detection system 1 comprises a film package 2, a receptacle 4 and a lid 6. In this example the lid 6 is in the closed position such that the lid 6 and the receptacle 4 enclose a chamber 5 holding the film package 2. The leak detection system 1 further comprises a suction port 8 and a force and/or pressure sensor 10. The film package 2 contains a solid sticky product 11. It will be appreciated that the film package 2 in this example comprises at least one gas bubble inside. In this example, the ratio between the volume of product 11 and the at least one gas bubble is between 10:1 and 1000:1. However, larger ratios are also possible. At atmospheric pressure, a part of the film wall of the film package 2 sticks to the solid sticky product 11 as shown in Figure 1A. The distribution of the volume of the product 11 is in this example relatively close-packed and dense with respect to the overall volume of the package 2, as shown schematically in Figure 1A. The product 11 can e.g. be a monolithic product, such as a block of cheese, or a small ($\leq$20, e.g. $\leq$12, or $\leq$6) number of monolithic parts of product, such as cold cuts, slices of cheese, cuts of meat, or sausages. The close-packed and dense distribution of volume of the product ensures, at atmospheric pressure in the chamber, that

gas inside the package 2 cannot easily propagate between the film wall and the product 11. The lack of propagation of gas between the film wall and the product 11 causes a part of the film wall of the film package 2 to stick to the solid sticky product 11. The receptacle 4 is arranged for receiving the film package 2. Dimensions of the chamber 5 relative to the package 2 can be chosen as follows. As schematically shown in Figure 1A, at atmospheric pressure in the chamber, the chamber 5 is larger than an outer shape of the film package 2. As schematically shown in Figure 1B, at subatmospheric pressure in the chamber 5, the film package 2 abuts against at least two, here opposite, walls of the chamber. As, at atmospheric pressure, the chamber 5 is larger than the outer shape of the film package 2, the package 2 can expand inside the chamber 5 when the pressure inside the chamber is reduced. Upon expanding of gas inside the film package 2 at subatmospheric pressure in the chamber 5, gas is moved between the film wall of the film package 2 and the solid sticky product 11 such that at least part of the film wall of the film package 2 unsticks from the solid sticky product 11, as schematically shown in Figure 1B. It will be appreciated that substantially the entire film wall can unstick from the solid sticky product 11. It will be appreciated that in this example at least a part of the solid sticky product 11 is a whole without significant gaps in between. Nevertheless, the solid sticky product 11 can also comprise at least one further part with one or more holes formed therein. Here, the receptacle 4 and lid 6 have the shape of a rectangular box. It will be appreciated that the receptacle 4 and lid 6 can have a different shape and/or size, such as a triangular, hexagonal or cylindrical box. The film package 2 can have a different shape than the chamber 5. The chamber 5 is configured for holding a film package 2 comprising a different shape for a different type of product. The suction port 8 can be used for removing gas from the inside of the chamber 5 outside the film package 2. In this example the suction port 8 is located in a wall of the receptacle 4. The suction port 8 is here connected to a duct that extends from the suction port 8 for transporting the gas away from

the chamber 5. The force and/or pressure sensor 10 is in this example arranged for determining a force and/or pressure that the film package 2 exerts to the force and/or pressure sensor or wall of the chamber at subatmospheric pressure in the chamber. In this example the force and/or pressure sensor 10 is located on the lid 6 on the side facing the chamber 5. However, the sensor 10 can be positioned on any wall of the receptacle 4. The sensor 10 can be integrated in the receptacle 4 or the lid 6, or it can be a separate component. Alternatively or additionally, the sensor 10 can be configured for determining one or more dimensions of the at least one gas bubble.

Figure 2 shows an example of a flow chart of a method 100 for testing leak tightness of a film package 2 containing a solid sticky product 11. In this example, the ratio between the volume of product 11 and the at least one gas bubble is between 10:1 and 1000:1. However, larger ratios are also possible. The method can be performed using a system as described in view of Figures 1A and 1B. Optional steps are shown in dashed boxes. In a first step 102 the receptacle 4 and the lid 6 are provided. The film package 2 is placed inside the chamber 5 in step 104. In step 106, the chamber 5 is closed. The lid 6 can be secured to the receptacle 4 once closed if desired. In this example, the film package 2 will rest on the bottom wall of the chamber 5 and abut the top wall, or at least exert a force and/or pressure to the top wall. It will be appreciated that the film package 2 can exert a force and/or pressure on the bottom wall instead when the force and/or pressure sensor 10 is located on the bottom wall. A buffer vessel 26 that is connectable to the chamber 5 by a fluid channel comprising a valve can be provided in step 108. In step 110, the method 100 further comprises at least partially unsticking the film wall from the product 11 by reducing a gas pressure inside the chamber. Step 110 can comprise opening the valve for establishing fluid connection between the buffer vessel 26 and the chamber 5. The gas pressure inside the chamber 5 can be reduced to a first pressure in step 110, such that the film package 2 abuts against at

least two walls of the chamber. Here, gas present in the film package 2 expands as the pressure inside the chamber 5 is reduced. This expansion causes the film package 2 to abut against two, here opposite, walls of the chamber 5 as shown in Figure 1B. The pressure reduction in the chamber 5 allows the gas present inside the package 2 to expand and start propagating between the film wall and the product 11. The propagation of the gas between the film wall and the product 11 gradually unsticks at least part of the film wall of the film package 2 from the product 11. The gradual unsticking can e.g. proceed from the outer edge of the contact surface between the product 11 and the film wall as the gas in the package 2 propagates between the product 11 and the film wall towards the center of said contact surface until the film wall at least partially unsticks from the product 11. In step 112, the leak tightness of the film package 2 is determined. The leak tightness can be determined by measuring a force and/or pressure that the film package 2 exerts to at least one of the at least two walls of the chamber, here to the force and/or pressure sensor 10. The film package 2 can be a flexible film package. The ratio between the volume of the buffer vessel 26 and the volume of the chamber can be larger than 10:1, preferably larger than 100:1. The first pressure is optionally below atmospheric pressure, preferably lower than 100 mbara.

In this example, the leak tightness is determined by measuring the force and/or pressure applied by the package to at least one wall of the chamber over time. During measurement of the applied force and/or pressure, the pressure in the chamber is maintained constant in this example. Then, when the force and/or pressure on the wall of the chamber is substantially constant over time, the film package 2 is determined to be leak tight. In case the force and/or pressure on the wall of the chamber decreases between two consecutive measurements, the film package 2 is determined to contain a leak. It will be appreciated that it is also possible to determine leak tightness while the pressure in the chamber varies. In such case slightly more complex

data processing is required to determine whether or not the package 2 is leak tight.

Figure 3 shows an example of a side view of a leak detection system 1 including additional features for testing leak tightness of a film package 2 containing a solid sticky product 11. Here, the lid 6 is in the open position such that the film package 2 can be received in the receptacle 4. In this example, the suction port 8 is located in the bottom wall of the receptacle 4. It will be appreciated that the suction port 8 can also be positioned in the lid 6 or a side wall. Here, the system 1 comprises a moisture detection system 12, a display 14, a control unit 16 and a suction system 18. In this example the moisture detection system 12 is located on a wall of the receptacle 4. The suction system 18 is connected to the suction port 8, in order to provide fluid communication between the inside and the outside of the chamber 5. The moisture detection system 12 can be positioned integral with the receptacle 4 and/or the lid 6, or it can be a separate component. The display 14 is arranged for visualizing data representative of the leak tightness and/or the determined force and/or pressure. The display 14 can be located close to or remote from the receptacle 4 and the lid 6. Data representative of the determined force and/or pressure over time can be visualized on the display 14, e.g. using tables, graphs and/or diagrams. The control unit 16 is in this example in communication with the force and/or pressure sensor 10, the moisture detection sensor 12 and the suction system 18. The control unit 16 can be arranged for determining the force and/or pressure at a first moment and at a second moment spaced in time. Even though lines are shown between these communicating components in Figure 3, it will be appreciated that the control unit 16 can be in wireless communication with sensors 10 and 12, the display 14 and the suction system 18. The suction system 18 can comprise a vacuum source or pump 24. The control unit 16 can be in communication with the suction port 8 and/or the suction system 18. The film package 2 optionally includes a plurality of film packages.

Figure 4 shows an example of a leak detection apparatus 20 for testing leak tightness of a film package 2 containing a solid sticky product 11. The leak detection apparatus 20 comprises a receptacle 4, a lid 6, a suction port 8, suction system 18 and a force and/or pressure sensor 10 as described. The lid 6 of the leak detection apparatus 20 is here in the open position, such that the receptacle 4 is arranged for receiving the film package 2.

Figure 5 shows an example of a leak detection apparatus 20 for testing leak tightness of a film package 2 containing a solid sticky product 11. The leak detection apparatus 20 comprises a receptacle 4, a lid 6, a suction port 8, suction system 18 and a force and/or pressure sensor 10 as described. The lid 6 of the leak detection apparatus 20 is here in the open position, such that the receptacle 4 is arranged for receiving the film package 2. In this example, the suction system 18 includes a buffer vessel 26 that is connected to the chamber 5 by a fluid channel 28 and a valve 30. The buffer vessel 26 can contain gas at a subatmospheric pressure when the valve 30 is closed. Opening the valve 30 establishes fluid communication between the buffer vessel 26 and the chamber 5, such that gas from inside the chamber 5 is moved to the buffer vessel 26. The pressure reduction inside the chamber 5 causes gas in the film package 2 to expand and move between the film wall and the product 11 to at least partially unstick the film wall from the product. The ratio between the volume of the buffer vessel 26 and the volume of the chamber 5 can be larger than 10:1, preferably larger than 100:1.

Herein, the invention is described with reference to specific examples of embodiments of the invention. It will, however, be evident that various modifications and changes may be made therein, without departing from the essence of the invention. For the purpose of clarity and a concise description features are described herein as part of the same or separate embodiments, however, alternative embodiments having combinations of all or some of the features described in these separate embodiments are also envisaged.

However, other modifications, variations, and alternatives are also possible. The specifications, drawings and examples are, accordingly, to be regarded in an illustrative sense rather than in a restrictive sense.

For the purpose of clarity and a concise description features are described herein as part of the same or separate embodiments, however, it will be appreciated that the scope of the invention may include embodiments having combinations of all or some of the features described.

In the claims, any reference signs placed between parentheses shall not be construed as limiting the claim. The word 'comprising' does not exclude the presence of other features or steps than those listed in a claim. Furthermore, the words 'a' and 'an' shall not be construed as limited to 'only one', but instead are used to mean 'at least one', and do not exclude a plurality. The mere fact that certain measures are recited in mutually different claims does not indicate that a combination of these measures cannot be used to an advantage.

Claims

1. A method for testing leak tightness of a film package containing a solid sticky product, wherein a film wall of the film package at least partially sticks to the product, comprising:
   - providing a receptacle and a lid for closing the receptacle, wherein the lid and receptacle enclose a chamber for holding the film package, wherein the chamber is larger than an outer shape of the film package;
   - placing the film package inside the chamber,
   - closing the chamber;
   - at least partially unsticking the film wall from the product by reducing a gas pressure inside the chamber to a first pressure, such that gas inside the film package is expanded and moved between the film wall and the product; and
   - determining the leak tightness of the film package.

2. Method according to claim 1, wherein the product comprises fat and/or oil.

3. Method according to claim 1 or 2, wherein the first pressure is below atmospheric pressure, preferably lower than 100 mbara.

4. Method according to claim 1, 2 or 3, wherein the gas pressure inside the chamber is reduced to a first pressure such that the film package abuts against at least two walls of the chamber.

5. Method according to any of claims 1-4, wherein the step of determining the leak tightness of the film package further comprises determining a force and/or pressure that the film

package applies to at least one of the at least two walls of the chamber.

6. Method according to claim 5, wherein the leak tightness is determined by measuring the force and/or pressure applied to at least one wall of the chamber over time.

7. Method according to any of claims 1-6, wherein the method further comprises providing a buffer vessel for containing gas at a subatmospheric pressure and connectable to the chamber by a fluid channel comprising a valve, and wherein the step of reducing a gas pressure inside the chamber comprises opening the valve for establishing fluid connection between the buffer vessel and the chamber.

8. Method according to any of claims 1-7, wherein the gas pressure inside the chamber is reduced to the first pressure in less than 1 second, preferably in less than 100 milliseconds, more preferably in less than 10 milliseconds.

9. Method according to claim 7 or 8, as far as dependent on claim 7, wherein the ratio between the volume of the buffer vessel and the volume of the chamber is larger than 10:1, preferably larger than 100:1.

10. Method according to any of the preceding claims, wherein the film package is a flexible film package.

11. Method according to any of the preceding claims, wherein the product comprises cheese or meat, such as sausage.

12. A leak detection apparatus for testing leak tightness of a film package containing a solid sticky product, wherein a film wall of the film package at least partially sticks to the product, comprising:

- a receptacle for receiving the film package;
- a lid for closing the receptacle, wherein the lid and receptacle enclose a chamber for holding the film package;
- wherein the chamber and the film package are relatively shaped and/or sized such that at atmospheric pressure in the chamber the chamber is larger than an outer shape of the film package;
- a suction port for removing, from inside the chamber, gas surrounding the package for at least partially unsticking the film wall from the product; and
- a leak tightness sensor for determining leak tightness of the package.

13. Leak detection apparatus according to claim 12, wherein the product comprises fat and/or oil.

14. Leak detection apparatus according to claim 12 or 13, wherein the suction port is connected to a suction system configured for reducing a gas pressure inside the chamber to a first pressure.

15. Leak detection apparatus according to claim 14, wherein the apparatus is configured such that at the first pressure the film package abuts against at least two walls of the chamber.

16. Leak detection apparatus according to claim 14 or 15, wherein the first pressure is below atmospheric pressure, preferably lower than 100 mbara.

17. Leak detection apparatus according to any of claims 14, 15 or 16, wherein the apparatus is configured for reducing the gas pressure inside the chamber to the first pressure in less than 1 second, preferably in less than 100 milliseconds, more preferably in less than 10 milliseconds.

18. Leak detection apparatus according to any of claims 15-17, as far as dependent on claim 14, wherein the leak tightness sensor comprises a force and/or pressure sensor for determining a force and/or pressure that the film package applies to at least one of the at least two walls of the chamber.

19. Leak detection apparatus according to any of claims 14-18, wherein the suction system includes a pump.

20. Leak detection apparatus according to any of claims 14-18, wherein the suction system includes a vacuum source.

21. Leak detection apparatus according to any of claims 14-20, wherein the suction system includes a buffer vessel for containing gas at a subatmospheric pressure and connectable to the chamber by a fluid channel comprising a valve, such that when the valve is opened a fluid connection between the buffer vessel and the chamber is established and gas inside the chamber is removed.

22. Leak detection apparatus according to claim 21, wherein the ratio between the volume of the buffer vessel and the volume of the chamber is larger than 10:1, preferably larger than 100:1.

23. Leak detection apparatus according to any of claims 12-22, wherein the film package is a flexible film package.

24. Leak detection apparatus according to any of claims 12-23, wherein the chamber is configured for holding a film package comprising a different shape for a different type of product.

25. A leak detection system for testing leak tightness of a film package, comprising a leak detection apparatus according to any of claims 12-24 and a film package containing a solid sticky product, wherein a film wall of the film package at least partially sticks to the product.

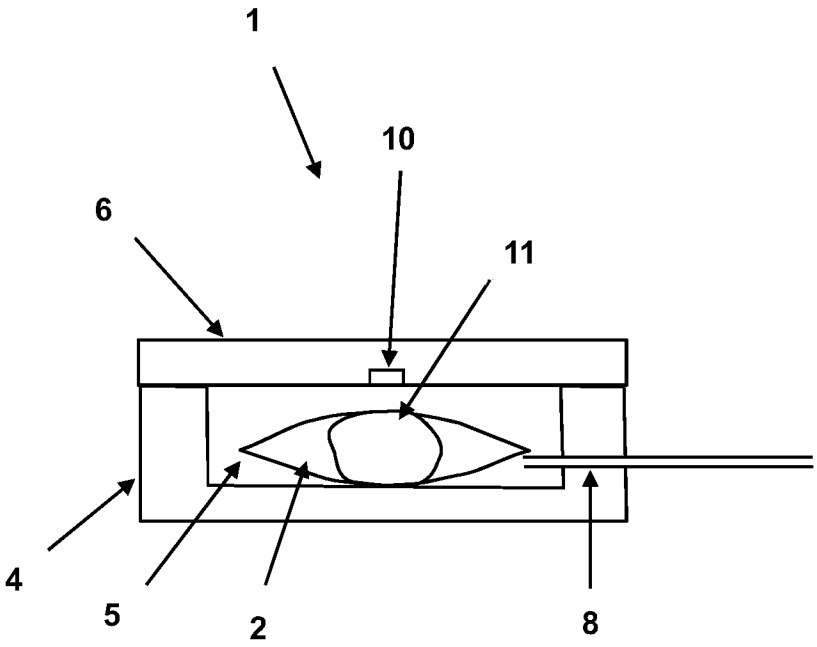

FIG 1A

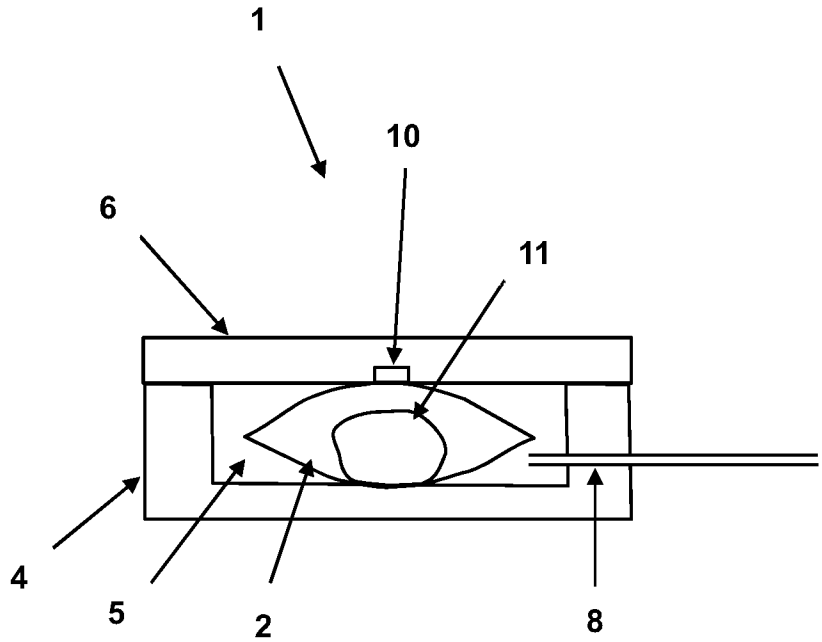

FIG 1B

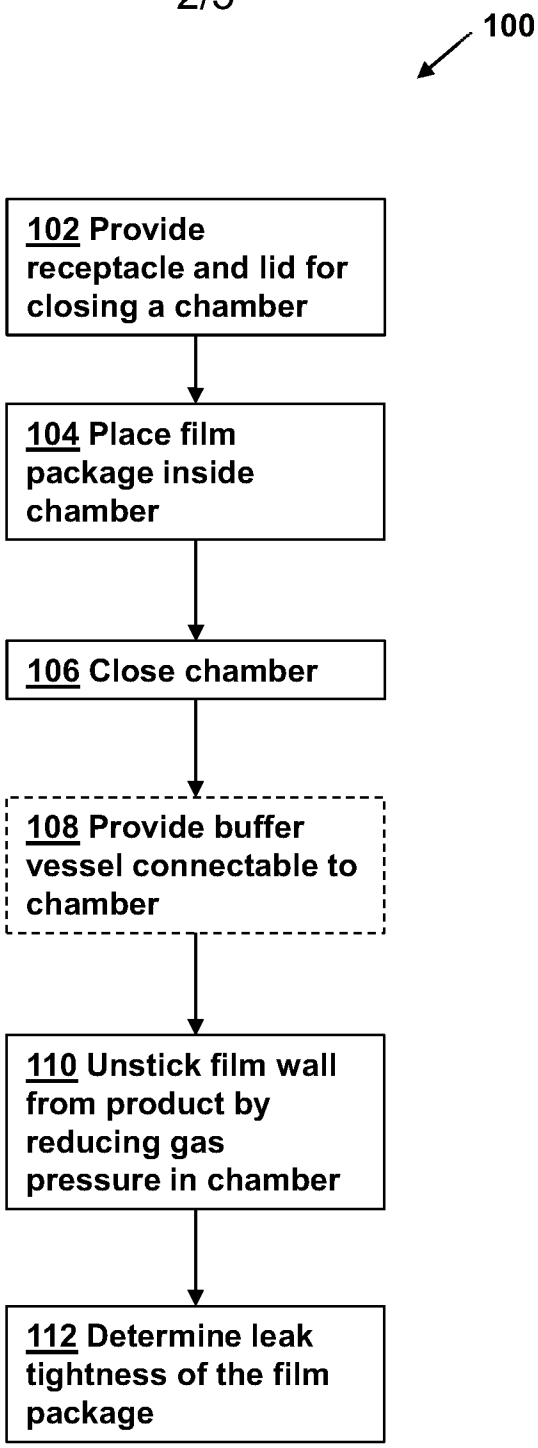
100
102 Provide receptacle and lid for closing a chamber
104 Place film package inside chamber
106 Close chamber
108 Provide buffer vessel connectable to chamber
110 Unstick film wall from product by reducing gas pressure in chamber
112 Determine leak tightness of the film package

FIG 2

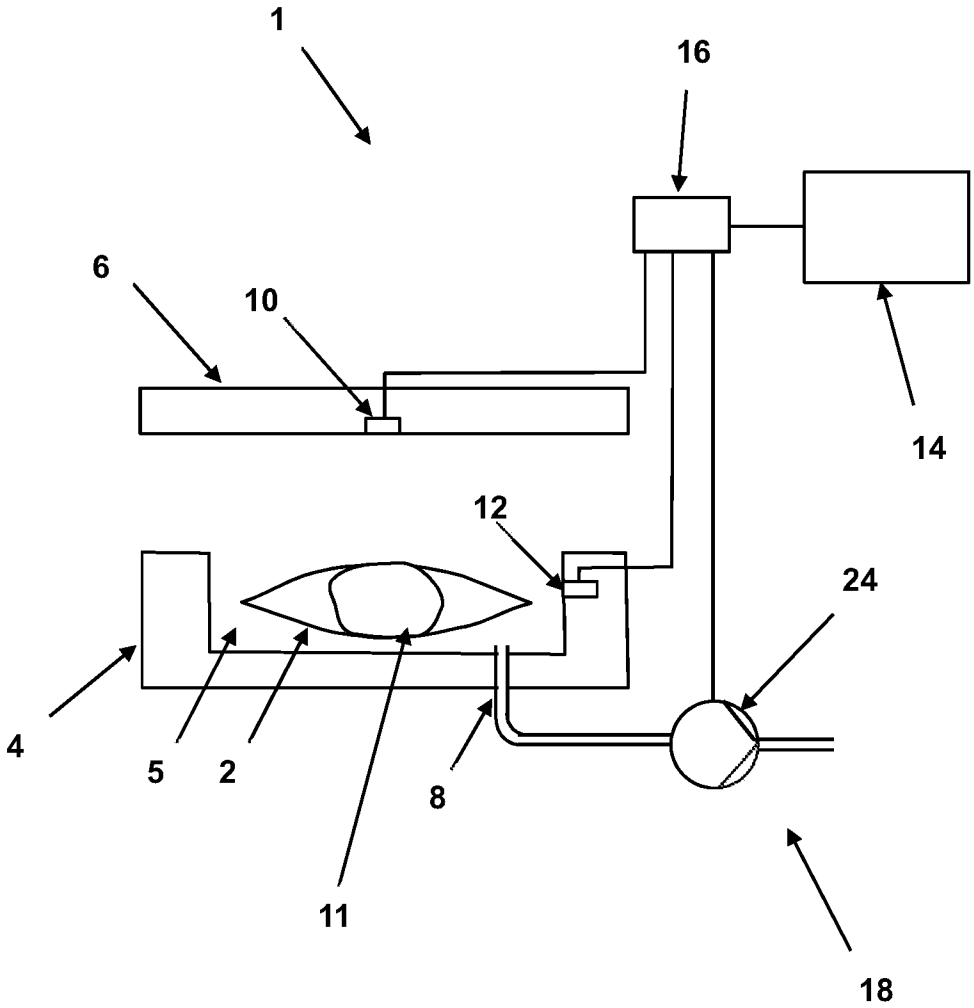

FIG 3

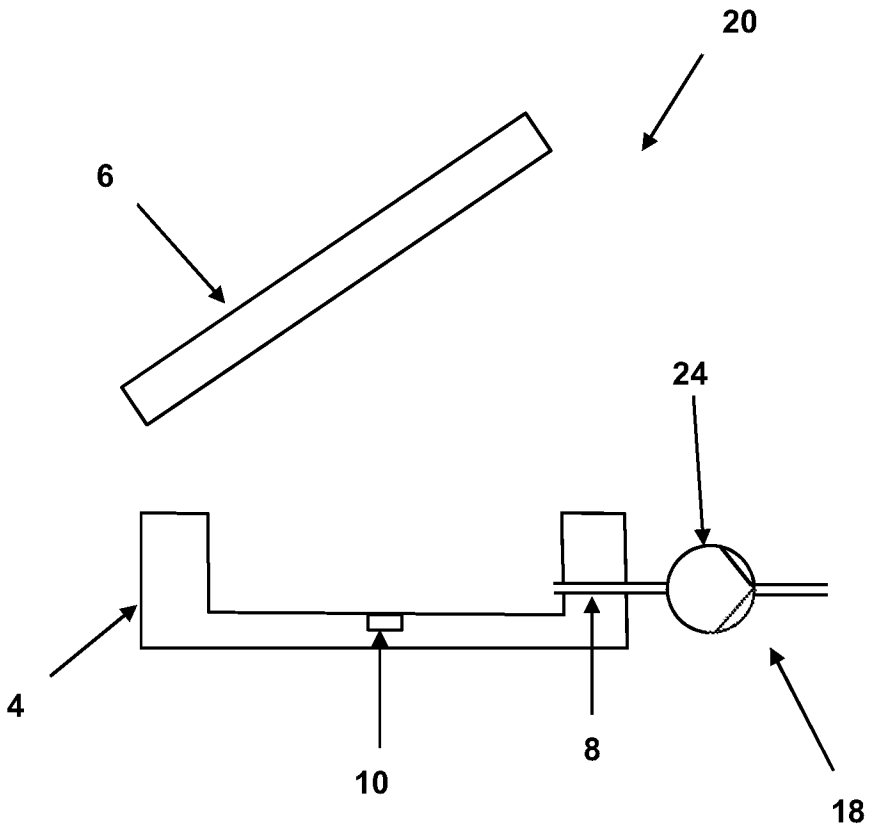

FIG 4

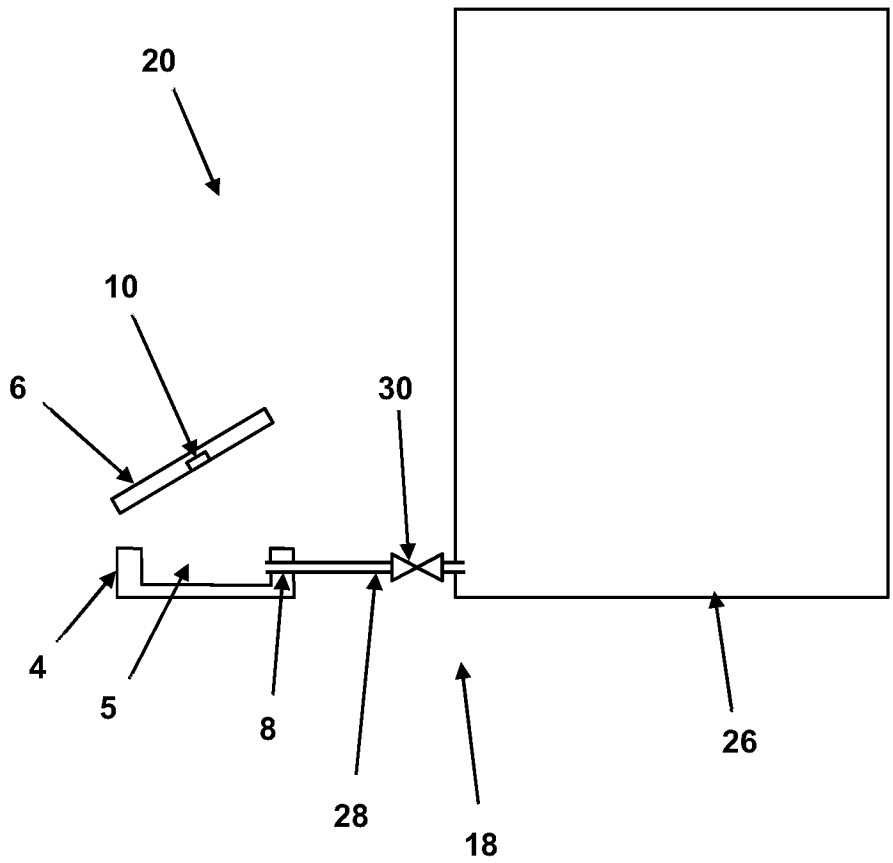

FIG 5

INTERNATIONAL SEARCH REPORT

International application No
PCT/NL2024/050266

A. CLASSIFICATION OF SUBJECT MATTER
INV. G01M3/36
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
G01M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2017/192035 A1 (OXIPACK HOLDING B V [NL]) 9 November 2017 (2017-11-09) page 1, line 27 - page 2, line 29; figures 2a, 3a-3d page 4, lines 1-12 page 11, line 17 - page 12, line 27 page 14, line 20 - page 15, line 3; claims 1,2,5,6	1-22
X	US 5 226 316 A (MALLY TIMOTHY G [US] ET AL) 13 July 1993 (1993-07-13)	12-25
A	claims 1,11; figure 12	1-11

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance;; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance;; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
14 June 2024	25/06/2024

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Cilissen, Marcel

1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/NL2024/050266

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2017192035 A1	09-11-2017	NONE	
US 5226316 A	13-07-1993	AT E152516 T1	15-05-1997
		CA 2092028 A1	21-09-1993
		DE 69310254 T2	02-10-1997
		EP 0561645 A1	22-09-1993
		ES 2101226 T3	01-07-1997
		US 5226316 A	13-07-1993