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(71) Applicant: **Universal Pack S.r.l.**
47842 San Giovanni in Marignano (RN) (IT)

(72) Inventor: **Donati, Pietro**
47842 San Giovanni in Marignano (RN) (IT)

(74) Representative: **Petraz, Gilberto Luigi et al**
GLP S.r.l.
Viale Europa Unita, 171
33100 Udine (IT)

(54) METHOD AND MACHINE FOR PACKAGING A PRODUCT INTO FLEXIBLE PACKAGES IN A STERILE ENVIRONMENT

(57) A machine (10) for packaging a product (P) into flexible packages (B) comprises one or more units (30) for shaping and filling the packages (B); each shaping and filling unit (30) extends along a longitudinal axis (A) and comprises at least one nozzle (11), feeding means (19) configured to make advance along the longitudinal axis (A) a tubular casing (20) of the material with which to make the packages (B) and having an internal surface (22) facing toward the nozzle (11), longitudinal welding means (27) configured to form at least a first longitudinal weld (29) that joins together at least two sides of the tubular casing (20) and preliminary sterilization means (31), disposed in proximity to said longitudinal welding means (27) for delivering a sterilizing agent (S2).

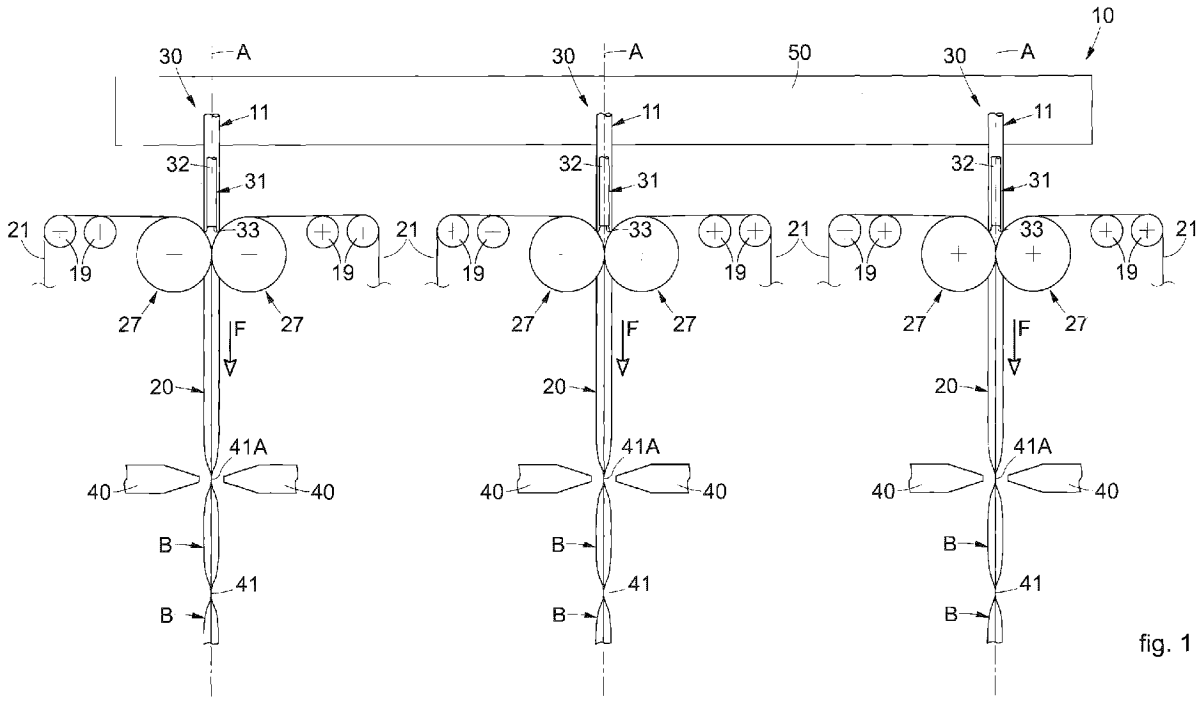

fig. 1

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Description

FIELD OF THE INVENTION

[0001] The present invention concerns a method and a machine for packaging a product into flexible packages in a sterile environment, such as sachets, pouches or bags, preferably of the single-dose type. The machine and the method according to the present invention are suitable for packaging, by way of example and without limitation to the generality, products in the liquid, semi-liquid or pasty state, such as oil, milk, sauces, creams, ointments, or solid products, for example in powder or in granules.

BACKGROUND OF THE INVENTION

[0002] Machines are known for packaging a product into flexible packages in a sterile environment which generally comprise a nozzle around which one or more sheets of plastic material - typically two - are fed, along a feeding direction, which will be joined to form the flexible packages.

[0003] An example of a machine under discussion is described in International Patent Application WO2022/024155 in the name of the Applicant.

[0004] The nozzle comprises a duct for delivery the product to be packaged, a further duct for the delivery of a sterilizing gas, and another duct for the delivery of a purging gas able to prevent the product from coming into contact with the sterilizing gas used to sterilize the inside of the flexible packages.

[0005] Upstream of the outlet holes of the aforementioned ducts there is disposed a longitudinal welding device having the function of longitudinally welding the sheets made of plastic material and defining a tubular casing that wraps the nozzle, while downstream of the outlet holes of the ducts there is disposed a transverse welding device having the function of transversely welding the tubular casing and defining the flexible packages.

[0006] Normally, the longitudinal weld is performed in a continuous manner while feeding the sheets around the nozzle, so as to ensure that the tubular casing, that is the precursor of the flexible packages, delimits the environment that is to be sterilized.

[0007] The transverse weld is performed intermittently so that, between one welding cycle and another, the tubular casing is advanced by a predetermined stretch along the feeding direction, said stretch being related to the length of the package.

[0008] A drawback of the known delivery units consists in the fact that the area covered by the longitudinal welds is not decontaminated and, therefore, any defects in the realization of such welds expose parts that are not decontaminated toward the inside of the package, i.e. directly in contact with the product.

[0009] There is therefore a need to perfect a machine and method for packaging a product into flexible packages in a sterile environment, that can overcome at least one of the disadvantages of the state of the art.

[0010] To do this, it is necessary to solve the technical problem of avoiding that parts that have not been decontaminated are in direct contact with the product contained inside the packages.

[0011] In particular, one purpose of the present invention is to realize a machine and method for packaging a product in a sterile environment that guarantees the perfect sterilization of the package even in the presence of defects in the longitudinal welds.

[0012] Another purpose of the present invention is to make a machine, and to develop a method, for packaging a product in a sterile environment that is simple both structurally and functionally, and inexpensive to make and implement.

[0013] The Applicant has devised, tested and embodied the present invention to overcome the shortcomings of the state of the art and to obtain these and other purposes and advantages.

SUMMARY OF THE INVENTION

[0014] The present invention is set forth and characterized in the independent claim/s. The dependent claims describe other characteristics of the present invention or variants to the main inventive idea.

[0015] In accordance with the above purposes, and to resolve the technical problem disclosed above in a new and original way, also achieving considerable advantages compared to the state of the prior art, according to the present invention there is provided a machine for packaging a product into flexible packages in a sterile environment, and that comprises one or more units for shaping and filling such packages.

[0016] Each of said shaping and filling units extends along a longitudinal axis and comprises:

- at least one nozzle provided with a first duct configured to deliver said product and a second duct configured to deliver a sterilizing agent,
- feeding means configured to make one or more sheets advance along a direction of advance parallel to said longitudinal axis, said one or more sheets defining a tubular casing around said nozzle, having an internal surface facing toward said nozzle,
- longitudinal welding means configured to form at least a first longitudinal weld that joins said sheets.

[0017] In accordance with one aspect of the present invention said machine comprises means of preliminary sterilization on portions of said internal surface which define, or are adjacent to, said longitudinal welds. Said preliminary sterilization means comprise at least one duct disposed in proximity to said longitudinal welding means.

[0018] In accordance with another aspect of the present invention, said at least one duct of said preliminary sterilization means is disposed upstream of said lon-

gitudinal welding means with respect to said direction of advance.

[0019] In accordance with another aspect of the present invention, said preliminary sterilizing agent is hydrogen peroxide. In accordance with embodiment variants, the preliminary sterilizing agent may also comprise further compounds, or mixtures of compounds, other than hydrogen peroxide, however having suitable chemical-physical characteristics to achieve the desired decontaminating effect.

[0020] In accordance with another aspect of the present invention, said at least one duct of said preliminary sterilization means comprises a delivery end disposed in proximity to said longitudinal welding means and upstream thereof with respect to said direction of advance.

[0021] In accordance with another aspect of the present invention, said delivery aperture is disposed directly above the point where said longitudinal welding means bring two portions of said one or more sheets in contact with each other to form said longitudinal weld.

[0022] In accordance with another aspect of the present invention, said preliminary sterilization means are configured to deliver said preliminary sterilizing agent at a temperature and at a pressure such as to guarantee both the delivery thereof in the form of vapor, and the subsequent condensation thereof on said portions of said one or more sheets that will form said longitudinal weld.

[0023] In accordance with another aspect of the present invention, a method for packaging a product into flexible packages in a sterile environment comprises at least:

- a feeding step in which a tubular casing, made of a material suitable to produce said packages, having an internal surface facing toward said nozzle, is made to advance with respect to the nozzle and along the longitudinal axis;
- a longitudinal welding step in which said tubular casing is welded along at least one longitudinal side thereof defining at least a first longitudinal weld;
- a sterilization step of said tubular casing in which a second duct comprised in said nozzle delivers a sterilizing agent inside said tubular casing;
  a preliminary sterilization step in which pre-sterilization means delivers a pre-sterilizing agent onto portions of said internal surface which define, or are adjacent to, said longitudinal welds.

[0024] In accordance with another aspect of the present invention, said preliminary sterilization step occurs prior to said longitudinal welding step and said sterilization step of said tubular casing.

[0025] In accordance with another aspect of the present invention, in said preliminary sterilization step it is provided to deliver preliminary sterilizing agent in the form of hydrogen peroxide in the form of vapor.

[0026] In accordance with another aspect of the present invention, said preliminary sterilization step is followed by a condensation step of the preliminary sterilizing agent. In this case, said longitudinal welding step is further configured to cause the prior sterilizing agent to evaporate again.

[0027] In this embodiment, the heat generated by the longitudinal welding means to make the longitudinal welds is also exploited to cause the evaporation of the preliminary sterilizing agent that has been condensed in the condensation step.

[0028] This allows to avoid that the preliminary sterilizing agent remains in the package shaped and filled with the product and which over time could cause the deterioration of the product or degrade, at least in part, the organoleptic characteristics.

[0029] In other embodiments, all falling within the scope of the present invention, the preliminary sterilizing agent is delivered in gaseous form, or at most in the form of saturated vapor.

[0030] In accordance with another aspect of the present invention, the method also comprises:

- a transverse welding step in which transverse welding means perform a transverse weld adapted to close a respective one of said packages at a lower part,
- a filling step in which a first duct comprised in said nozzle delivers said product into said tubular casing; said filling step occurs after said sterilization step and said transverse welding step.

DESCRIPTION OF THE DRAWINGS

[0031] These and other aspects, characteristics and advantages of the present invention will become apparent from the following description of some embodiments, given as a non-restrictive example with reference to the attached drawings wherein:

- fig. 1 is a schematic representation of a machine for packaging a product into flexible packages in a sterile environment, in accordance with an embodiment of the present invention;
- figure 2 is a schematic front view of a shaping and filling unit comprised in the machine of fig. 1;
- figure 3 is a schematic side view of the shaping and filling unit of fig. 2;
- figure 4 is a schematic cross-section of the shaping and filling unit of fig. 2, taken according to section plane IV-IV.

[0032] We must clarify that in the present description the phraseology and terminology used, as well as the figures in the attached drawings also as described, have the sole function of better illustrating and explaining the present invention, their function being to provide a non-limiting example of the invention itself, since the scope of protection is defined by the claims.

[0033] To facilitate comprehension, the same reference numbers have been used, where possible, to identify identical common elements in the drawings. It is understood that elements and characteristics of one embodiment can be conveniently combined or incorporated into other embodiments without further clarifications.

DESCRIPTION OF SOME EMBODIMENTS OF THE PRESENT INVENTION

[0034] With reference to figure 1, a machine 10 according to the present invention, for packaging a product P into flexible packages B, comprises one or more units for shaping and filling the packages B, each unit being indicated as a whole with the reference number 30. The flexible packages B can be configured as sachets, pouches, bags or single-dose sticks.

[0035] In the example provided in fig. 1, the machine 10 comprises three units 30 for shaping and filling the packages B, all preferably connected to the fixed structure of the machine 10, schematically indicated in fig. 1 with the reference number 50.

[0036] Each unit 30 for shaping and filling the packages B develops along a substantially vertical longitudinal axis A and comprises at least one nozzle 11.

[0037] The person skilled in the art readily understands that the longitudinal axis A may have a different orientation than depicted herein, for example more inclined than a vertical plane. Furthermore, the longitudinal axis A may have a development also different from the straight one, for example it may be defined by a combination of straight and/or curved stretches.

[0038] In the example provided herein the longitudinal axis A may also coincide with the longitudinal axis of symmetry of the nozzle 11, but it is evident that the present invention is not limited thereto. In other configurations, not depicted, the longitudinal axis A along which each shaping and filling unit 30 develops may not be the axis of the nozzle 11.

[0039] The nozzle 11 comprises a first duct 12 able to deliver the product P with which the flexible packages B are filled and a second duct 13 able to deliver a sterilizing agent S.

[0040] By way of example only, the product P is preferably a liquid, semi-liquid or pasty product comprising oil, milk, sauces, creams, pomades, ointments but the present invention is not limited thereto. The product P may also be a solid product, for example in powder or in granules. Further, by way of example only, the sterilizing agent S may be a gaseous mixture of hydrogen peroxide and air, preferably in non-condensing form.

[0041] The person skilled in the art understands, however, that the product P to be packaged and the sterilizing agent S can be of any other type other than those listed above without thereby departing from the scope of the present invention.

[0042] The nozzle 11 may also comprise a third duct 14 configured to deliver at least one sterile gas G such as, for example, sterile air, as will be described in detail below.

[0043] Each duct 12, 13, 14 is connected to a respective feeding circuit of known type and which will not be described in detail.

[0044] Furthermore, each duct 12, 13, 14 has a respective delivery outlet 15, 16, 17. In particular, as visible in fig. 2, the first duct 12 has its own delivery outlet 15 from which, in use, the product P is delivered, the second duct 13 has a respective delivery outlet 16 from which, in use, the sterilizing agent is delivered and the third duct 14 has a corresponding delivery outlet 17 from which, in use, the sterile gas G is delivered.

[0045] In the example provided in fig. 1, the ducts 12, 13, 14 are positioned substantially vertical, parallel to the longitudinal axis A of the nozzle 11, and the delivery outlets 15, 16, 17 of each duct 12, 13, 14 face downwards.

[0046] Furthermore, the delivery outlet 16 of the second duct 13 is disposed upstream of the delivery outlet 15 of the first duct 12 and the delivery outlet 17 of the third duct 14 is positioned downstream of the delivery outlet 16 of the second duct 13 and upstream of the delivery outlet 15 of the first duct 12.

[0047] As is clear from figure 2, the outlets 15, 16, 17 are disposed at different vertical heights, therefore the expressions "upstream" and "downstream" must be understood with reference to the longitudinal axis A, disposed vertically, as well as to the direction of advance in which the packages B move.

[0048] In the embodiments depicted herein the delivery outlets 15, 16, 17 are positioned at the end of the respective duct 12, 13, 14. However, it is clear that in other embodiments the delivery outlets 15, 16, 17 can be positioned at other portions of the respective duct 12, 13, 14, for example comprising one or more holes made at the lateral surface thereof.

[0049] The person skilled in the art understands that the mutual arrangement between the ducts 12, 13, 14 can be of any type, and can also vary depending on the final shape and size of the packages B to be made.

[0050] For example, in the embodiment depicted in figure 2, the ducts 12, 13, 14 of the nozzle 11 are disposed side by side and parallel.

[0051] Alternatively, in another embodiment not depicted, the second duct 13 partially contains the first duct 12 and also the third duct 14. In this case the first, second and third ducts 12, 13, 14 are disposed concentric with each other and with respect to the longitudinal axis A.

[0052] In further possible embodiments, not depicted, two ducts of the nozzle 11 can be disposed concentrically and a third one can be disposed side by side and parallel to them.

[0053] Each nozzle 11 of the machine 10 is associated with feeding means 19 configured to feed at least one sheet 21, for example unwound from a respective reel, around the nozzle 11.

[0054] According to one embodiment, the material of the sheet 21 can be formed by one or more layers of a

laminar material usually used in the food or pharmaceutical packaging sector, having properties suitable to guarantee hygiene, food compatibility and tightness of the packages B.

[0055] Specifically, the feeding means 19 are configured to make advance the at least one sheet 21 around the nozzle 11 in a direction of advance, indicated by arrows F in figures 1-3, parallel to the longitudinal axis A.

[0056] Starting from the at least one sheet 21, the machine 10 according to the present invention forms a tubular casing 20, in the manner that will be explained in greater detail in the following. The tubular casing 20 has an internal surface 22 (fig. 4) facing toward the nozzle 11, defining the walls of the semi-closed chamber in which the product P will be contained, and an external surface 23 (fig. 2), opposite the internal surface 22.

[0057] In the example provided herein, the feeding means 19 are configured as rollers that unwind the one or more sheets 21 in such a way as to form the tubular casing 20 around the nozzle 11.

[0058] It should be noted that the conformation and the position of the feeding means 19 depends on the shape to be given to the tubular casing 20 and the number of sheets 21 that are used to make the packages B.

[0059] In the example provided herein the tubular casing 20 is formed by two sheets 21 of material coming from opposite parts with respect to the nozzle 11 so that the latter is interposed between the two sheets 21 (figures 1, 3 and 4).

[0060] The person skilled in the art understands, however, that the number of sheets 21 and their mutual arrangement may also be very different from that described without thereby departing from the scope of the present invention. For example, the tubular casing 20 may be defined by a single sheet 21 folded on itself.

[0061] Each nozzle 11 is also associated with longitudinal welding means 27 configured to longitudinally weld the two sheets 21 so as to join them along longitudinal welds 29, substantially continuous, which, by joining the sheets 21, allow the tubular casing 20 to be formed. This allows the tubular casing 20 to be formed and stabilized around the nozzle 11 to make the sterilizing action of the sterilizing agent S on the internal surface 22 of the tubular casing 20 more effective thanks to the fact of creating a semi-closed chamber around the nozzle 11, as will be explained in greater detail below.

[0062] Also in this case the conformation and the position of the longitudinal welding means 27 depend on the final shape to be given to the tubular casing 20 and on the number of sheets 21 that are used to make the packages B.

[0063] For example, in the example provided herein, in which the tubular casing 20 is defined by two sheets 21 facing each other, the longitudinal welding means 27 comprise two pairs of welding rollers configured to weld together the opposite sides of the two sheets 21 which, two by two overlap each other, at the sides of the nozzle 11. In this case the longitudinal welding means 27 make two longitudinal welds 29 (figures 2 and 4).

[0064] Or, in the case not depicted, where the tubular casing 20 is defined by a single sheet 21 folded on itself, the longitudinal welding means 27 comprise a single pair of welding rollers configured to weld together the sides of the same sheet 21 that overlap the side of the nozzle 11. In this case the longitudinal welding means 27 make only a single longitudinal weld 29.

[0065] Preferably, the longitudinal welding means 27 are disposed upstream of the delivery end 16 of the second duct 13 with respect to the direction of advance indicated by arrow F. Furthermore, the longitudinal welding means 27 are positioned at a first distance D1 (fig. 4) from the longitudinal axis A. Said first distance D1 is understood to be measured perpendicularly with respect to said longitudinal axis A. In the case where the longitudinal axis A is substantially vertical the first distance D1 is measured in a substantially horizontal direction.

[0066] In accordance with one aspect of the present invention, the machine 10 further comprises preliminary sterilization means 31 configured to deliver at least one preliminary sterilizing agent S2 at the portions of the one or more sheets 21 that will form the longitudinal welds 29 of the tubular casing.

[0067] In the example provided herein the preliminary sterilization means 31 comprise at least one sterilization duct 32, disposed upstream of the first welding means 27 with respect to the direction of advance F of the tubular casing 20, and having a delivery aperture 33 positioned in proximity to the point where the longitudinal welding means 27 bring in contact with each other two portions of the one or more sheets 21 to form the longitudinal weld 29.

[0068] The preliminary sterilizing agent S2 is preferably delivered in the form of vapor so that it condenses on the portions of the one or more sheets 21 which will subsequently be welded onto each other by the longitudinal welding means 27 to form the longitudinal weld 29. In this case, the longitudinal welding means 27 that operate the welding, thanks to their operating temperature, also allow the preliminary sterilizing agent S2 to evaporate again in order to prevent residues of this agent from remaining in the packages B.

[0069] Preferably, the preliminary sterilization means 31 are positioned at a second distance D2 (fig. 4) from the longitudinal axis A and which is understood to be measured perpendicularly with respect to said longitudinal axis A. In the case where the longitudinal axis A is substantially vertical the second distance D2 is measured in a substantially horizontal direction.

[0070] By way of example only, the ratio of the second distance D2 to the first distance D1 is comprised between about 0.5 and about 1.2. However, this ratio may also depend on the width of the packages B to be made.

[0071] Advantageously, this allows to deliver the preliminary sterilizing agent S2 not only on the aforementioned portions of the one or more sheets 21 that will form the longitudinal weld 29 but also on portions of the one

or more sheets 21 that are adjacent, or flanked, to the longitudinal weld 29.

[0072] The conformation and the position of the preliminary sterilization means 31 may depend on the final shape to be given to the packages B and the number of sheets 21 that are used to make them.

[0073] For example, in the case where the tubular casing 20 is defined by two sheets 21 facing each other, the preliminary sterilization means 31 comprise two ducts 32 each of which has a respective delivery aperture 33 disposed above two opposite sides of the two sheets 21 which, two by two overlap each other, at the sides of the nozzle 11.

[0074] Alternatively, in the case where the tubular casing 20 is defined by a single sheet 21 folded on itself, the preliminary sterilization means 31 comprise a single nozzle 32 having a delivery aperture 33 disposed above the sides of the same sheet 21 which overlap the side of the nozzle 11.

[0075] Exemplarily, said preliminary sterilizing agent S2 is hydrogen peroxide preferably in vapor form, still more preferably in condensing form.

[0076] The preliminary sterilization means 31 are configured to deliver the preliminary sterilizing agent S2 at a temperature and at a pressure such as to guarantee the delivery in the form of vapor and the subsequent condensation thereof on the aforementioned portions of the one or more sheets 21 that will form the longitudinal weld 29. To this end, the distance of the preliminary sterilization means 31 from the formation zone of the tubular casing 20 is such as to guarantee the condensation of the preliminary sterilizing agent S2, regardless of the speed of advance of the sheets 21.

[0077] The delivery of the preliminary sterilizing agent S2 on the portions of the internal surface 22 of the tubular casing 20 that constitute the, or are immediately adjacent to, longitudinal welds 29 made by the longitudinal welding means 27 eliminates, or at least reduces, the risk of bacterial proliferation within each package B potentially caused by a direct exposure of the product P on a non-decontaminated area, for example placed in the longitudinal welds 29 or in their immediate vicinity.

[0078] Advantageously, the fact that the delivery opening 33 of the sterilization duct 32 is disposed in proximity to the point where the longitudinal welding means 27 bring two portions of the one or more sheets 21 in contact with each other to form the longitudinal weld 29 results in the almost immediate re-evaporation and activation of the preliminary sterilizing agent S2. This prevents hydrogen peroxide residues from remaining inside the package B.

[0079] Furthermore, this reduces the time that elapses between the delivery of the preliminary sterilizing agent S2 and the execution of the longitudinal welding 29.

[0080] Each nozzle 11 is also associated with transverse welding means 40 disposed downstream of the delivery outlets 15, 16, 17 of the ducts 12, 13, 14 and configured to make transverse welds 41 on the tubular casing 20.

[0081] Each transverse weld 41 joins two facing portions of the internal surface 22 of the tubular casing 20 along the transverse development thereof and develops by connecting the longitudinal sides of the tubular casing 20, between the two opposite longitudinal welds 29. In this way the transverse welds 41 define the transverse sides of the packages B.

[0082] In the example provided herein, the transverse welds 41 are made intermittently, in accordance with the advance of the tubular casing 20 and with the desired longitudinal dimension for the packages B.

[0083] The operation of the machine 10 described so far, which corresponds to the method according to the present invention, comprises the following steps.

[0084] It should be specified that in the description of the following method, the steps that contribute to making the tubular casing 20 and subsequently the steps that provide for the delivery of the sterilizing agents S, S2 of the product P and of the sterile gas G inside the tubular casing 20 will be described first. However, the person skilled in the art understands that the formation of the tubular casing 20 occurs substantially continuously and simultaneously with the steps that provide for the delivery of the sterilizing agents S, S2, of the product P and of the sterile gas G.

[0085] The method provides for a feeding step in which the tubular casing 20 is made to advance with respect to the nozzle 11 and parallel to the longitudinal axis A.

[0086] In particular, the tubular casing 20 is made to advance toward the delivery outlets 15, 16, 17 of the ducts 12, 13, 14, along a direction of advance parallel to the longitudinal axis A and indicated by the arrow F.

[0087] In the example provided herein, the tubular casing 20 is made to advance from top to bottom.

[0088] It should be specified that, during the feeding step, the feeding means 19 impart the desired tubular shape to the one or more sheets 21 so that it/they wrap(s) the nozzle 11 and define(s) the tubular casing 20.

[0089] The method also provides for a longitudinal welding step in which the longitudinal welding means 27 weld the one or more sheets 21 that wrap the nozzle 11 stabilizing the shape of the tubular casing 20.

[0090] In this step the longitudinal welding means 27 make one or more longitudinal welds 29, each of which defines a longitudinal side of the tubular casing 20.

[0091] For example, in the case where the tubular casing 20 is defined by two sheets 21 facing each other, the longitudinal welding step provides for welding together the four sides of the two facing sheets 21 which, two by two, overlap the sides of the nozzle 11. In this example, the longitudinal welding step provides for performing two longitudinal welds 29.

[0092] Preferably, the longitudinal welds 29 are performed continuously in accordance with the advance of the sheet 21 with respect to the nozzle 11 along the longitudinal axis A and in the direction of advance indicated by the arrow F.

[0093] The method also provides for a preliminary sterilization step in which the preliminary sterilization means 31 deliver the preliminary sterilizing agent S2 in proximity to the point where the first welding means 27 join the sheets 21 to create the longitudinal welds 29.

[0094] In this way the method according to the present invention allows to sterilize the sheets 21 in the areas where the longitudinal weld 29 will be made in order to avoid problems of sterility of the package B in case of defective longitudinal weld 29. The machine 10 as a whole, thanks to the sterilization step with the sterilizing agent S, also allows to eliminate, or at least reduce, the risk of bacterial proliferation within each package B.

[0095] In addition, the method also provides for a transverse welding step in which the transverse welding means 40 produce a plurality of transverse welds 41 that join two facing portions of the internal surface 22 of the tubular casing 20 along the transverse development thereof and develop by connecting the longitudinal welds 29.

[0096] By virtue of this, in use, the tubular casing 20 that slides with respect to the nozzle 11 is closed laterally by the longitudinal welds 29, made substantially continuously, and is closed at the lower part by the last transverse weld made, indicated with the number 41A in the figures.

[0097] Furthermore, it should be noted that the tubular casing 20 therefore remains open at the top at an upper opening 43, thus defining the aforementioned semi-closed chamber C (fig. 1-3).

[0098] It should be noted that the same portion of tubular casing 20 that slides along the longitudinal axis A, during full operation of the machine 10, is first subjected to the preliminary sterilization step in the area where the longitudinal welds 29 will be made and then to the longitudinal welding step that performs such longitudinal welds 29.

[0099] The method also provides for a sterilization step in which the second duct 13 delivers the sterilizing agent S inside the tubular casing 20. In this way the inside of the package B is completely sterilized.

[0100] It should be noted that, from the point of view of a same portion of tubular casing 20 that slides along the longitudinal axis A, during full operation of the machine 10, the sterilization step occurs after the preliminary sterilization step and the longitudinal welding step.

[0101] This is a consequence of the mutual arrangement between the preliminary sterilization means 31, the longitudinal welding means 27 and the delivery outlet 16 of the second duct 13.

[0102] The method also provides for a filling step in which the first duct 12 delivers a dosed amount of product P inside the tubular casing 20, preferably above the last transversal weld 41A performed (fig. 2).

[0103] It should be noted that, from the point of view of a same portion of tubular casing 20 that slides along the longitudinal axis A, during full operation of the machine 10, the filling step occurs after the other steps listed above.

[0104] Advantageously, the preliminary sterilization step sterilizes the portions of the internal surface 22 of the tubular casing 20 which define the, or are immediately adjacent to, the longitudinal welds 29.

[0105] The method also provides for a purging step in which the third duct 14 delivers a sterile gas G under pressure inside the tubular casing 20.

[0106] The purging step has the function of purging a certain volume of sterilizing agent S from the lower portion of the tubular casing 20 so as to be able to deliver a dose of product P without the latter coming in contact with the sterilizing agent S.

[0107] Preferably, the filling step provides for delivering the product P precisely in the lower area of the casing where, in use, the sheet 21 advances by contacting the sterile gas G so that the product P does not come into contact with the sterilizing agent S. Furthermore, in this way it is avoided trapping a volume of sterilizing agent S inside the packages B.

[0108] The person skilled in the art easily understands that the delivery of the product P, of the sterilizing agent S and of the sterile gas G can take place in any known manner, without thereby departing from the present invention.

[0109] Purely by way of example, according to preferred embodiments, the delivery of the sterilizing agents S, S2 occurs continuously, in accordance with the advance of the tubular casing 20. In addition, the delivery of the sterile gas G can take place continuously or intermittently, in accordance with the advance of the tubular casing 20 and/or with the delivery of the sterilizing agent S.

[0110] In addition, in some embodiments the delivery of the product P may take place intermittently, in accordance with the embodiment of the transverse welds 41, or continuously.

[0111] As the packages B continue their advance along the direction of advance F, a subsequent transverse welding 41 operated by the transverse welding means 40 seals the package B, closing it at the top. It should be noted that this subsequent transverse weld 41 will constitute the last transverse weld performed, indicated with the number 41A, which corresponds to the bottom area of a subsequent package B.

[0112] It is clear that modifications and/or additions of parts can be made to the machine 10 and to the method as described heretofore, without departing from the field and scope of the present invention, as defined by the claims It is also clear that, although the present invention has been described with reference to some specific examples, a person of skill in the art shall certainly be able to achieve other equivalent forms of the machine and method for packaging a product into flexible packages in a sterile environment, having the characteristics as set forth in the claims and hence all coming within the field of protection defined thereby. In the following claims, the sole purpose of the references in brackets is to facilitate

their reading and they must not be considered as restrictive factors with regard to the field of protection defined by the claims.

Claims

1. Method for packaging a product (P) into flexible packages (B) in a sterile environment in a machine (10) that comprises one or more shaping and filling units (30) for shaping and filling said packages (B), each of said shaping and filling units (30) extending along a longitudinal axis (A) and comprising at least one nozzle (11), wherein said method comprises at least:

   - a feeding step in which a tubular casing (20), made of a material suitable to produce said packages (B), which has an internal surface (22) facing toward said nozzle (11), is made to advance with respect to the nozzle (11) and along said longitudinal axis (A);
   - a longitudinal welding step in which said tubular casing (20) is welded along at least one longitudinal side thereof defining at least one longitudinal weld (29);
   - a preliminary sterilization step in which preliminary sterilization means (31) deliver a preliminary sterilizing agent (S2) in the form of vapor onto portions of said internal surface (22) which define, or are adjacent to, said longitudinal welds (29);
   - a sterilization step of said tubular casing (20) in which a second duct (13) comprised in said nozzle (11) delivers a sterilizing agent (S) into said tubular casing (20);

   characterized in that said preliminary sterilization step is followed by a condensation step of the preliminary sterilizing agent (S2) and **in that** said longitudinal welding step is further configured to cause re-evaporation of the preliminary sterilizing agent (S2).

2. Method as in claim 1, **characterized in that** said preliminary sterilization step occurs prior to said longitudinal welding step and said sterilization step of said tubular casing (20).

3. Method as in claim 1 or 2, **characterized in that** preliminary sterilizing agent (S2) delivered in said preliminary sterilization step is hydrogen peroxide, which, during the delivery step, is preferably in the form of vapor.

4. Method as in any claim hereinbefore, **characterized in that** it also comprises a transverse welding step in which transverse welding means (40) perform a transverse weld (41A) adapted to close a respective one of said packages (B) at a lower part.

5. Method as in any claim hereinbefore, **characterized in that** it also comprises a filling step in which a first duct (12) comprised in said nozzle (11) delivers said product (P) inside said tubular casing (20).

6. Method as in claims 4 and 5, **characterized in that** said filling step occurs after said sterilization step and said transverse welding step.

7. Machine (10) for packaging a product (P) into flexible packages (B) in a sterile environment which comprises one or more shaping and filling units (30) for shaping and filling said packages (B); each of said shaping and filling units (30) extends along a longitudinal axis (A) and comprises:

   - at least one nozzle (11) provided with a first duct (12) configured to deliver said product (P) and a second duct (13) configured to deliver a sterilizing agent (S),
   - feeding means (19) configured to make one or more sheets (21) advance in a direction of advance (F), said one or more sheets (21) defining a tubular casing (20) around said nozzle (11) which has an internal surface (22) facing toward said nozzle (11),
   - longitudinal welding means (27) configured to form at least a first longitudinal weld (29) which joins longitudinal sides of said one or more sheets (21),

   characterized in that it further comprises preliminary sterilization means (31) configured to deliver a preliminary sterilizing agent (S2), at a temperature and at a pressure such as to guarantee both the delivery thereof in the form of vapor, and the subsequent condensation thereof on portions of said internal surface (22) which define, or are adjacent to, said longitudinal welds (29), wherein said preliminary sterilization means (31) comprise at least one duct (32) disposed in proximity to said longitudinal welding means (27).

8. Machine (10) as in claim 7, **characterized in that** said at least one duct (32) of said preliminary sterilization means (31) is disposed upstream of said longitudinal welding means (27) with respect to said direction of advance (F).

9. Machine (10) as in claim 7 or 8, **characterized in that** said at least one duct (32) of said preliminary sterilization means (31) comprises a delivery aperture (33) disposed in proximity to said longitudinal welding means (27) and upstream thereof with respect to said direction of advance (F).

10. Machine (10) as in claim 9, **characterized in that** said delivery aperture (33) is disposed directly above the point where said longitudinal welding means (27) bring two portions of said one or more sheets (21) in contact with each other to form said longitudinal weld (29).

11. Machine (10) as in any claim from 7 to 10, **characterized in that** said preliminary sterilizing agent (S2) is hydrogen peroxide.

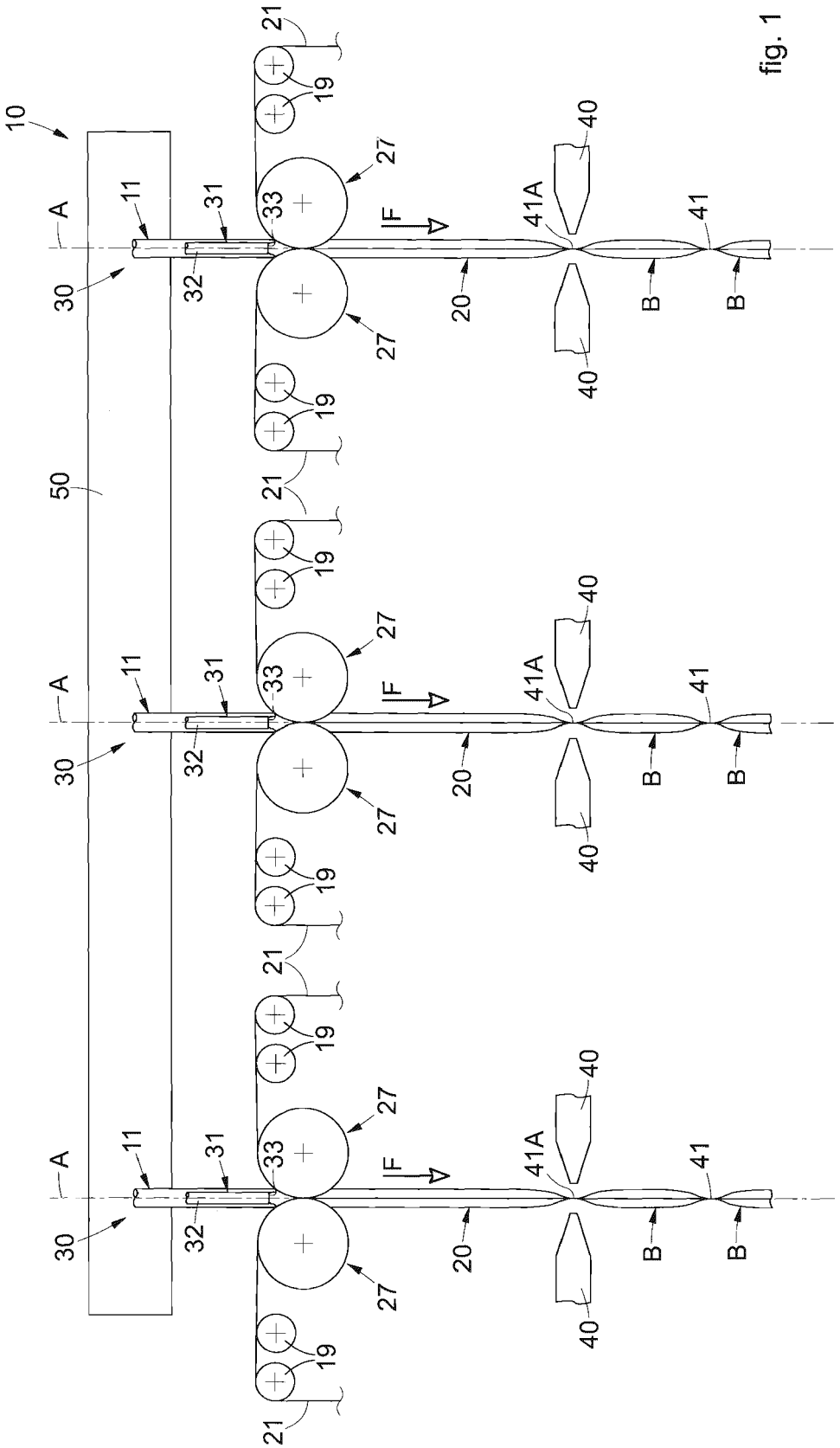

fig. 1

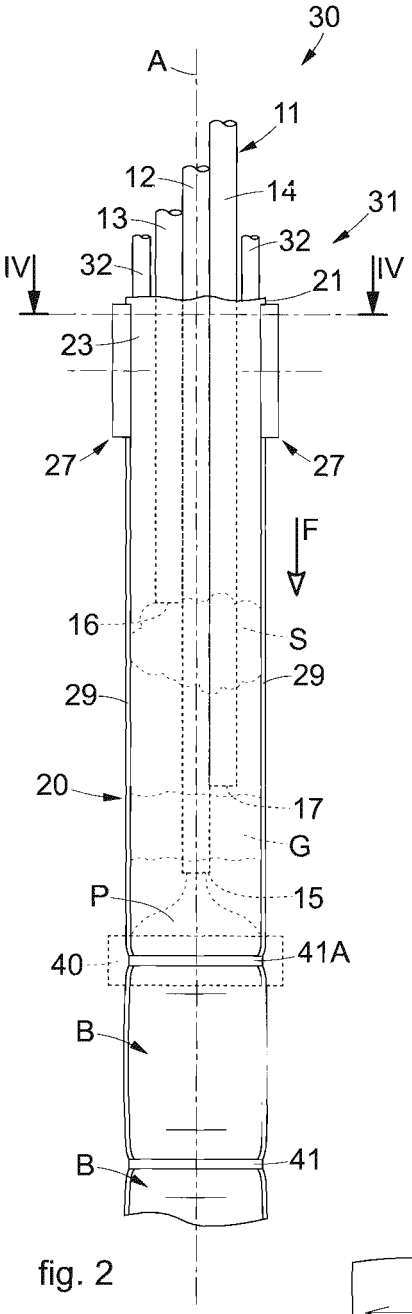

fig. 2

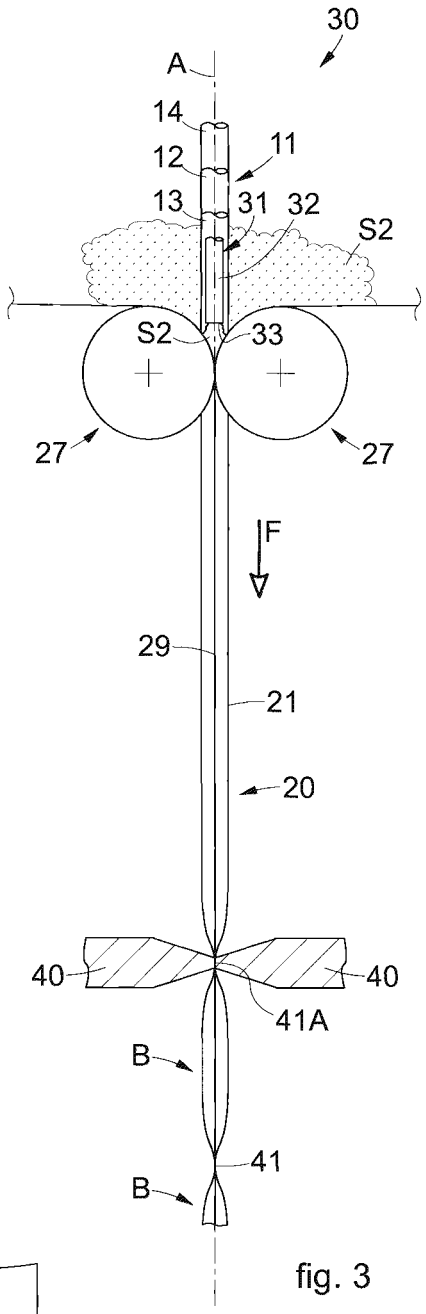

fig. 3

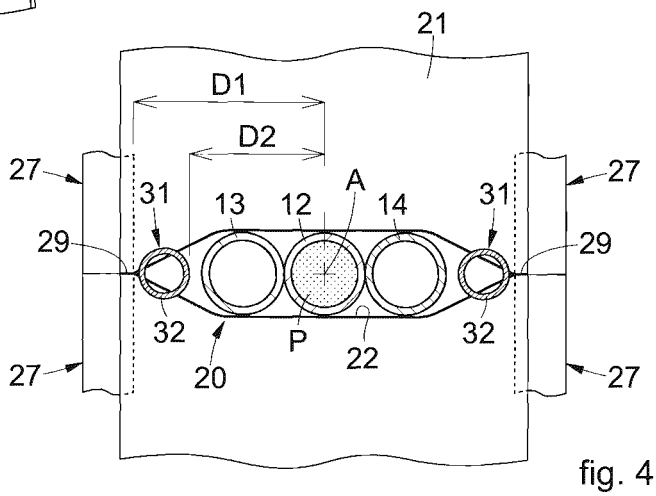

fig. 4

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EUROPEAN SEARCH REPORT

Application Number
EP 23 18 8142

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B65B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	22 January 2024	Lawder, M

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