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(54) PACKAGED PLANT, METHOD FOR MAINTAINING FRESHNESS TO PLANTS AND METHOD FOR PACKAGING PLANTS

(57) Described is a potted plant package (1) comprising: a potted plant (4) in a pot (5), the said potted plant comprising one or more stems (6a), roots, leaves (6b) and optionally one or more flowers (6c) grown from the said one or more stems (6a); and a sleeve element (7) with a top (2) and a bottom (3) defining the height (H) of the package, the sleeve element accommodating the potted plant and comprising at least two substantially parallelly extending foil portions (7a, 7b), the foil portions (7a,7b) being connected to one another to define a closed inner space (8) that accommodates at least the stems (6a), the leaves (6b) and if present, the one or more flowers (6c) of the potted plant (4), the sleeve element (7) comprising and upper portion (UP), middle portion (MP) and a lower portion (LP), the middle portion (MP) comprising a plurality of perforations (9) having a diameter of 0.1 - 4.0 mm, the upper portion (UP) extending from the top (2) of the sleeve element (7) by at least a quarter of the height (H) thereof and the lower portion (LP) extending from the bottom (3) of the sleeve element (7) by at least a quarter of the height (H) thereof, the upper and lower portions (UP, LP) of the sleeve element (7) being void of such perforations (9), as well as a method for packaging a potted plant (4) into such a potted plant package (4), and a sleeve (7) for the preparation of such a potted plant package (1).

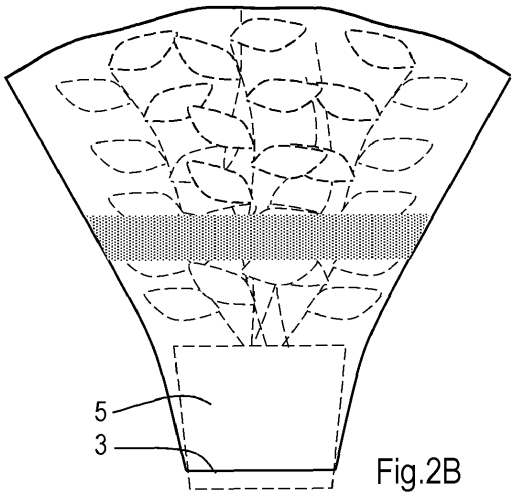

Fig.2B

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Description

[0001] The invention relates to a potted plant package, comprising a potted plant, at least comprising one or more stems, roots, leaves and optionally one or more flowers grown from the said one or more stems, to a method for packaging a potted plant into such a potted plant package, to sleeve for the preparation of such a potted plant package. Also, a method for maintaining freshness to a potted plant, and to a device for the preparation of such potted plant packages are described.

[0002] In the art, potted plants are often being wrapped in a plastic foil when being shipped from the plant grower to the florists or when being sold by the florist to the end user. The foil protects the plants from being damaged during transportation and also defines the separate plant units, allowing compact arrangement of the plant without becoming intertangled with one another.

[0003] The term 'potted plant' herein is used for a plant that comprises one or more stems and one or more roots and leaves grown from the said one or more stems. The roots are grown in a solid or semi solid substrate, held in a pot. Such a substrate is e.g. potting soil, stone or glass wool, an agar or a gel medium wherein the roots grow. The substrate may also comprise nutrients and/or a superabsorber that improves the water retaining capacity of the substrate. Suitable absorbers are known in the art, such as e.g. Luquasorb, BASF SE, Germany, or Geohumus, Geohumus GmbH, Germany. Preferably, the potted plant also comprises one or more flowers and/or flower buds growing from the said one or more stems. The term 'plant' also encompasses a plant, comprising one or more stems, one or more leaves and roots grown from the said stem or stems, such as a plant that is viable when potted in potting soil. Such plant may or may not have flowers when being wrapped in the foil.

[0004] In the art, plant packages comprising plastic foil are known, wherein the plants as defined above are packaged in cylindrically or conically shaped sleeves of plastic foil, such as polypropylene. The upper part, and often also the lower part of the said package is open in order to allow the plant to breathe. However, while being packed in the plant package, the plant itself tends to dry out as the amount of water present in the package is limited, and the water can easily evaporate out of the package. Further, the plants are vulnerable to environmental effects, e.g. the presence of harmful compounds, that may be present in the air, such as ethylene, in particular when such plant packages are kept in the vicinity of fruits. For larger supermarkets having a florist section, it is up to now difficult, or impossible to offer potted plants at a location close to the section where vegetables and fruits are displayed, although from a marketing point of view, the presentation of flowers close to the vegetable and fruit section is desired. On the other hand, some potted plants produce ethylene and it may not be desired to allow the ethylene to freely escape from the package, in particular when such plants are kept in close vicinity to other plants that are vulnerably to ethylene.

[0005] A plant package where a sleeve of plastic foil is closed around the plants are known from WO03/075638. Such an arrangement is however not desired as this blocks the free gas and damp exchange between the plant and the environment. The plant would simply suffocate with the hermetically sealed package. For cut flowers, a plant package is described wherein the cut flowers are sealed in a plastic foil, where the foil comprises perforations to allow gas exchange. WO03075638 describes such a sleeve package, comprising evenly distributed perforations in the upper to-third of the package, where the perforations are 0.1 - 2 mm or more in size. WO2018/125933 describes a sleeve package for cut flowers comprising a plurality of holes, extending from the top towards the bottom, where the lowest 15% of the package is free of perforations to accommodate the water wherein the cut flowers are kept. The number of perforations in the top portion may be more than in lower portions. The perforations in the upper portions are intended to allow ethylene gas to diffuse away from the flowers, i.e. into the environment.WO2007/127238 describes a multicompartment plant package for cut flowers, where the flowers are contained in an upper compartment, separated from a lower compartment comprising the leaves. Described are arrangements where either the flowers compartment or the leaves compartment comprises perforations.

[0006] An improved package for potted plants is desired, avoiding or reducing the above-mentioned drawbacks.

[0007] The invention provides a plant package comprising:

- a potted plant in a pot, the said potted plant comprising one or more stems, roots, leaves and optionally one or more flowers grown from the said one or more stems;
- a sleeve element with a top and a bottom defining the height of the package, the sleeve element accommodating the potted plant and comprising at least two substantially parallelly extending foil portions, the foil portions being connected to one another to define a closed inner space that accommodates at least the stems, the leaves and if present, the one or more flowers of the potted plant, the sleeve element comprising and upper portion, middle portion and a lower portion, the middle portion comprising a plurality of perforations having a diameter of 0.1 - 4.0 mm, the upper portion extending from the top of the sleeve element by at least 25% of the height thereof and the lower portion extending from the bottom of the sleeve element by at least 25% of the height thereof, the upper and lower portions of the sleeve element being void of such perforations.

[0008] In such a package, the perforations are located close to the plurality of the leaves of the plant, whereas

the upper quarter of the package is void of such perforations, i.e. being closed. The perforations are in the middle portion of the sleeve element, i.e. where the majority of the leaves are, allowing optimal exchange of oxygen and carbon dioxide between the leaves in the inner space of the sleeve element and the environment, resulting in elongated freshness of the potted plants, whereas the upper portion is closed resulting in limitation of undesired water loss by evaporation. Further, the ethylene exchange with the environment is limited, as the flower portion is in the upper portion of the package.

[0009] The package also protects the living plant from microbial attack and allows a dense packing of multiple plant packages together for efficient transport.

[0010] The upper portion extends from the top of the sleeve element by at least 25% of the height thereof, and the lower portion extends from the bottom of the sleeve element by at least 25% of the height thereof. This means that the lower portion of the sleeve element encompasses the lower 25%, and the upper portion the upper 25% of the sleeve element. The middle portion encompasses the portion of the sleeve element between the upper and lower portion. Accordingly, when the sleeve element has a height of 50 cm, the lower portion thereof comprises the lower 12.5 cm of the sleeve element, whereas the upper portion comprises the upper 12.5 cm of the said sleeve element, the remaining being the middle portion. The upper and lower portion can attractively extend beyond a quarter of the height, e.g. to one third of the height. The size of the middle portion can vary accordingly. The middle portion is preferably 2 - 50 % of the height of the sleeve element, more preferably 2.5 - 40%, more preferably 5 - 20% and most preferably 10 - 15% of the total height of the sleeve element. The middle portion preferably covers the middle of the height of the sleeve element, and the height of the upper and the lower portion are preferably equal in height. The lower and upper portions do not comprise perforations such as the middle portion, and the said upper and lower portions are preferably void of any kind of perforation.

[0011] The sleeve element comprises two substantially parallelly extending foil portions, e.g. two foils lying on top of each other, or a single foil being folded, so as to define two substantially parallelly extending foil portions from both sides of the said fold.

[0012] Between the said foil portions, and inner space is defined as soon as the foil portions are moved away from each other. The inner space is closed, and this can be accomplished by connecting both foil portions to one another around the potted plant in a sealing manner. The sleeve element does not have to be sealed at the bottom if the potted plant fits snugly in the sleeve element, meaning that the sleeve element is sealed around the pot. In such a case, the inner space is defined by the closed foil above the pot and the pot with the substrate therein. However, if the pot is smaller than the inner diameter of the sleeve element, the bottom of the sleeve needs to be closed, e.g. by welding the two foil portions at the bottom. In case the two foil portions are formed from a folded foil as described above, the said fold can constitute the said closure at the bottom of the sleeve element.

[0013] The inner space comprises the stems, leaves and, if present, the flowers and flower buds. This means that the inner space is not separated into multiple compartments wherein the flowers are separated from the leaves or a portion thereof. The inner space constitutes a single continuous compartment.

[0014] Advantageously, the perforations in the middle portion of the sleeve element are arranged in a linear fashion to provide one or more perforation lines. One or more of the foil portions preferably comprises multiple perforation lines, arranged in parallel to one another, the multiple perforation lines preferably being spaced way from one another by a regular spacing distance. Although alternative arrangements of the perforations are possible, the linear arrangements as discussed are conveniently applied to the one or more foil portions and allow to provide a foil with the envisaged number of perforations in an accurate manner.

[0015] The plurality of perforations of the middle portion of the sleeve element are preferably arranged as a band. The said band can be interrupted by non-perforated sections, but preferably constitutes a continuous band, extending substantially perpendicular around the potted plant, i.e. extending over any of e foil portions. The term 'perpendicular around the potted plant' means that the band extends horizontally when the plant, accommodated in the sleeve element, is in upright position, i.e. the pot facing down. The band preferably has a width of at least 3% of the circumference of the sleeve at the middle of the band. The middle of the band is defined as the middle between the longest vertical distance between the perforations when the plant package is in upright position. The density of the holes is preferably 1,000 - 100,000 perforations per m^2 in order to allow sufficient gas exchange between the inner space of the sleeve element and the environment, while keeping the humidity withing the inner space to an envisaged high level.

[0016] Such a band is preferably located as explained above, i.e. underneath the majority of the foliage where most respiration takes place and where the partial water vapor pressure will be at its peak. A too low water vapor pressure gives a risk of wilting, whereas a too high water vapor pressure gives a risk of mould growth.

[0017] The potted plant can be any ornamental plant offered for sale by the florist, but can also be an herb, such as basil, parsley, chives, etcetera. In particular these herbs are offered for sale in supermarkets at the fruit and vegetable section and are therewith exposed to the ethylene produced by the ripening and ripe fruits of that section.

[0018] In an attractive embodiment, the plant of the living plant package is an ornamental plant. Ornamental plants should be displayed to the end customer in an optimal aesthetic shape, having the highest ornamental value possible. The plant package provides optimal con-

ditions therefor.

[0019] The band of perforations preferably has a width 5 - 30%, more preferably of 8 - 25 %, most preferably of 10 - 20 % of the circumference of the sleeve element (7) at the middle of the band.

[0020] The perforations preferably have a diameter of 0.1 - 2.0 mm, more preferably of 0.1 - 1.0 mm, even more preferably of 0.2 - 0.8 mm, and most preferably of 0.3 - 0.5 mm. Such dimensions allow optimal gas exchange while maintaining relative humid conditions within the inner space.

[0021] The perforations in the middle portion of the sleeve element preferably have a density of 5,000 - 75,000 perforations per m^2, preferably 20,000 - 50,000 perforations per m^2, more preferably 30,000 - 40,000 perforations per m^2. Such densities allow optimal gas exchange between the inner space of the sleeve element and the environment. The number of perforations per m^2 will have a direct effect on the permeability of the foil for gas exchange. A higher number of perforations can be attractive for packaging plants that need a high level of gas exchange, whereas other plants may need less perforations.

[0022] The foil material of the sleeve element of the potted plant package is preferably a polymeric material, in particular a thermoplastic material. The skilled person will be aware of suitable polymeric materials to be used for the sleeve element of the invention. In a preferred embodiment, the at least two foil portions of the sleeve element each comprise a layer being chosen from cellulose, polypropylene, polyvinylidene chloride, polyethylene, polyvinyl alcohol, polyamide, ethyl vinyl alcohol, polystyrene, polyvinyl chloride, ethylene vinyl acetate and polylactic acid, or a coherent laminate of two or more of said layers. The polymeric foil preferably comprises polyethylene, such as casted polypropylene, more preferably oriented polypropylene, even more preferred biaxially oriented polypropylene, such as Rincel MXM-AF from Casfil, Portugal. The foil can also be a laminate, with one or more additional layers, e.g. comprising an anti-fog layer and/or a heat seal layer, or a layer suitable for printing. The foil can e.g. optionally be treated with an anti-dew treatment if desired.

[0023] In an attractive embodiment, the foil is biodegradable, such as a cellulose film, e.g. NatureFlex NVS from Futamura, Japan.

[0024] The polymeric film is preferably transparent, so that the customer can see the living plant inside the package. However, it can be advantageous to use opaque films, such as black polyethylene, when light should not or to a very limited extend enter the inner space.

[0025] As explained above, the sleeve element of the potted plant package comprises two substantially parallelly extending foil portions, the two foil portions being connected to one another around the potted plant in a closing manner. Although it is also possible to use a continuous tube shaped foil and to close the said tube shaped foil with an upper and a lower closure, therewith defining a closed space therebetween wherein the potted plant can be accommodated, it is of practical benefit to use two separate extending foil portions, and to connect these foil portions to one another, in particular by welding. The skilled person will be aware of suitable welding techniques to provide a closed seal between the two foil portions.

[0026] Advantageously, the at least two foil portions of the sleeve element are connected to one another by a first lateral weld and a second lateral weld, diverging coaxially along the axis of the plant from the bottom to the top of the sleeve element, defining a first and a second connection between the foil portions, respectively. The 'axis of the plant' corresponds to the direction of the main stem extension of the plant, i.e. the vertical axis when the plant is in upright position with the pot facing down. By these welds, the inner space of the sleeve element is laterally closed, that widens from the bottom towards the top. The first and second lateral welds extend in a rejuvenating manner along the axis of the plant towards the bottom part of the plant. This arrangement provides a plant package that has a large upper opening and a small bottom part, allowing convenient entry of the plant into the inner space of the sleeve element. Such design is very advantageous for plants that grow in laterally, i.e. widening from the bottom upwards. After positioning of the plant in the sleeve, the top of the sleeve is sealingly closed therewith providing the closed inner space.

[0027] However, for plants that grow in a more or less linear fashion, such as Sansevieria, the first and second welds can also extend substantially parallel to one another, therewith defining a tube-shaped inner space of the sleeve element.

[0028] As explained above, the two foil portions can be part of a single foil segment, the said foil segment being folded over a fold, the said fold dividing the foil segment in the two foil portions and defining a folding connection between the foil portions. In this arrangement, the fold defines one of the connections between the two foil portions without the need for welding of this connection. To this end, the first and second lateral welds preferably extend to cover the fold, therewith providing a continuous connection of the two foil portions, between the first and second connection. The fold preferably defines the bottom of the inner space of the sleeve element, both the first and second lateral welds extending in a direction perpendicular to the said fold. As in this embodiment the welds extend to cover the fold, the transition between the fold and the welds are closed. It is however also possible to apply a weld between two separate foil portions instead of, or in addition to the fold.

[0029] The bottom of the inner space of the sleeve element can be defined by a weld instead of or in addition to a fold as explained above, said weld being defined herein as the bottom weld. Accordingly, in an attractive embodiment, the at least two foil portions of the sleeve element are connected to one another at the bottom of the sleeve element by a bottom weld extending from the

first lateral weld to the second lateral weld, so as to provide a continuous sealed connection between the two foil portions between the first and second lateral welds, and defining the bottom of the sleeve element.

[0030] In another embodiment, the two foil portions are part of a single foil segment, the said foil segment being folded over a bottom fold, the said bottom fold dividing the foil segment in the two substantially parallelly extending foil portions, and defining the bottom of the sleeve element by a folding connection between the foil portions.

[0031] The sleeve element of the potted plant package preferably widens towards the top of the package. This widening can be linear, i.e. the first and second welds being a single straight line from the bottom to the top of the sleeve. Attractively, the sleeve element comprises a first section accommodating the pot at least partially, and a second section above the first section, accommodating the one or more stems, leaves and, if present, the one or more flowers of the potted plant, wherein the first section diverges with a smaller angle as compared to the second section.

[0032] The first section is intended to accommodate the pot of the potted plant. As potted plants are grown in standard pots with an upwardly diverging side wall, the first section is adapted to the size of the envisaged pot and preferably diverges in the same fashion. Above the pot, the plant will grow laterally beyond the sides of the pot, and for that reason, the sleeve element preferably diverges stronger above the pot. It is possible for the sleeve element to comprise an additional third section above the second section, that diverges in a lesser extent than the second section.

[0033] The first section preferably accommodates the majority of the pot, more preferably the complete pot. The second section preferably starts at or close to the rim of the pot, when accommodated in sleeve element. Accordingly, the first section preferably extends from 10% to 30%, more preferably from 15 to 25% of the total height of the sleeve element. The second upper section comprises the perforations.

[0034] The plant package preferably comprises an upper weld, connecting the at least two foil portions of the sleeve element to one another, the upper weld extending from the first lateral weld to the second lateral weld, so as to provide a continuous sealed connection between the foil portions between the first and second lateral welds and defining the top of the sleeve element. The upper weld is intended to weld the first and second foil portions above the plant, and provides a continuous connection of the two foil portions between the first and second connection, starting at the first lateral weld, via the upper weld, to the second lateral weld. This upper weld closes the top portion of the inner space of the sleeve element.

[0035] In a very advantageous embodiment, the upper weld is bow-shaped, extending the inner space outwardly. Such a bow-shape provides for additional space in the upper portion of the closed space of the sleeve element, and the plant is kept in the sleeve element in conformity with the natural shape of the plant. It was found that the bow-shape reduces the sharpness of the corners at the top of the sleeve element, where most water vapor was observed to collect to build up condensate, i.e. close to the flowers of the potted plant. Contact of such condensate with the flowers however needs to be reduced to the minimum. Furthermore, condensate formation results in a less attractive product. The bow-shape of the sleeve element provides for a solution to these problems.

[0036] The bow-shape also allows for an even more dense packing of a plurality of potted plant packages, resulting in lower transportation costs.

[0037] The bow shape of the upper weld preferably extends upwardly with a length being 2 - 25% of the circumference of the sleeve element measured between connection of the upper weld with the first lateral weld on the one hand, and the connection of the upper weld with the second lateral weld on the other hand. The said length is more preferably 4 - 20%, more preferably 6 - 15% and most preferably 8 - 10%.

[0038] The invention also relates to a plant package as described above with a bow-shape, the sleeve element thereof being void of the perforations in the middle portion as described above such a sleeve element may have no perforations, or may have perforations but in a different fashion, e.g. extending in one or more of the upper, lower and middle portion of the sleeve or of a different size or density.

[0039] In another embodiment, the invention relates to a sleeve element as described above, in particular intended to be used for a potted plant package as described herein.

[0040] The plant package as described above can also be incorporated in a package cover, e.g. made of cardboard, conferring increased strength to the package, and allowing the application of printed information and/or decoration on the said cover.

[0041] The present invention also relates to a method for packaging a potted plant in a potted plant package as defined herein, comprising the steps of:

a) providing a plant as defined herein,
b) providing at least two foil portions as defined herein,
c) positioning the at least two foil portions around the plant, or inserting the plant between the at least two foil portions,
d) connecting the foil portions together so as to provide a closed inner space accommodating the plant.

[0042] Steps a) - d) are preferably performed while the potted plant is in upright position, i.e. with the pot facing down.

[0043] The closed inner space is obtained by connecting the foil together in step d). This can be done e.g. by using an adhesive tape, sealing the foil connections. It is also possible to provide the foil as a tube, either as a tube-shaped foil, or by connecting two opposed sides of

a rectangular foil section with adhesive tape or by a weld in a sealing manner. The thus obtained tubular foil or foil section defines an inner space, wherein the plant is inserted. Below and above the plant, the inner space can be closed e.g. by making a knot in the tube, or by welding the tube wall together, or closing it with an adhesive tape. The foil portions are preferably welded to one another, in particular in the form of a bow shape at the top of the sleeve element.

[0044] Preferably at least two, more preferably two, substantially parallelly extending foil portions are provided in step b), and in step c) the plant is positioned between the said two foil portions, and in step d) the two portions of the foil are connected to one another around the plant in a closing manner. As discussed above, the foil portion can be connected to one another in a closing manner by the use of adhesive tape or, preferably, by welding the foil portions to one another.

[0045] In an attractive embodiment, in step d) the at least two foil portions are welded to one another by a first and second lateral weld, both welds extending in axial direction of the plant, the first and second lateral welds being positioned on opposite sides from the axis of the plant, defining a first and a second connection between the foil segments, respectively. By these welds, the inner space of the plant package is laterally closed.

[0046] In one embodiment, the first and second lateral welds extend substantially parallel to one another. Such a design of the plant package is advantageous for packaging potted plants that do not significantly grow in lateral direction, such as Sansevieria.

[0047] In another preferred embodiment, the first and second lateral welds extend in an upwardly diverging manner, i.e. along the axis of the plant. This arrangement of the first and second lateral welds allows convenient entry of the potted plant into the inner space of the sleeve element in step c). Such an arrangement is particularly suitable for plants that grow in lateral direction.

[0048] As discussed above, in step b), the foil is folded to provide the two substantially parallelly extending foil portions on both sides of the fold. In this respect, a flattened tubular foil provides two parallelly extending lateral folds and can be welded by an upper and bottom weld to close both upper and lower open ends, therewith providing a closed inner space. It is also possible to fold a single foil , the foil providing the bottom connection between the two foil segments. By this measure, the fold provides a connection between the foil portions in a closed manner.

[0049] In an attractive embodiment, in step c), step plant is positioned between the two foil portions such, that the one or more leaves and or flowers are directed away from the fold, i.e. the fold defining the lower, or bottom part of the inner space of the plant package. To this end, both first and second welds extend to cover the fold, providing a continuous connection of the two foil portions, between the first and second connection, i.e. the first and second welds. The bottom can also be welded instead of the presence of a fold or in addition thereto.

[0050] As discussed above, in step d) the two foil portions are preferably welded to one another by an upper weld, connecting the first and second lateral welds to one another opposite from the bottom weld or fold, therewith providing the inner space, the said upper weld preferably being bow-shaped.

[0051] The invention also relates to the sleeve element for the preparation of a potted plant package as described above, comprising two substantially parallelly extending foil portions, the two foil portions being connected to one another in a closed fashion at a bottom portion, the foil on opposite sides being welded towards the bottom portion, so as to provide an inner space between both foil portions, the said inner space being open on the side opposite of the bottom portion, allowing a plant to be brought in the inner space and to allow the foil to be welded in a closed fashion by welding the two foil portions above the top of the plant between the opposite welds, preferably in a bow-shape. In an attractive embodiment, the opposite welds extend substantially parallel to one another towards the bottom portion, and in another embodiment, the opposite welds extend in a rejuvenating manner towards the bottom portion. In a particularly attractive embodiment, the bottom portion is defined by a fold between two substantially parallelly extending foil portions.

[0052] The invention also relates to a method for maintaining freshness to a potted plant as defined herein, the method comprising packaging the potted plant in a closed plastic sleeve element, defining a closed inner space comprising the one or more plants, the sleeve element comprising in the middle portion thereof a plurality of perforations having a diameter of 0.1 - 4.0 mm, allowing exchange of at least oxygen and carbon dioxide through the said perforations between the inner space and the environment. The sleeve is preferably as described above.

[0053] The invention also relates to a device for the preparation of potted plant packages as described above, comprising:

a. means for feeding, in a transport direction, two substantially parallelly longitudinally extending foil portions, the said foil portions having a top side and a bottom side, and an upper portion, middle portion and lower portion therebetween, the upper and lower portion each constituting at least a quarter of the height of the foil portions, the middle portion comprising a plurality of perforation having a diameter of 0.1 - 4 mm, the transport direction being substantially perpendicular to the bottom side en top side of the foil portions,

b. means for sealing the two foil portions from the top side towards the bottom side in a closing manner by a plurality of lateral welds spaced away from one another, two adjacent lateral welds forming an inner space between the two foil portions, with an open

top between the foil portions,
c. optionally, means for welding the two foil portions at the bottom in a closing manner,
d. means for providing a potted plant in the inner space between the foil portions,
e. means for welding the top of the two foil portions, for welding the two foil portions above the top of the potted plant between the two adjacent lateral welds in a closing manner, for closing the inner space at the top, the plant being packaged in the closed inner space,
f. transport means for transporting the packaged potted plant in transport direction,
g. cutting means for cutting the two foil portions upstream the welds made by the sealing means so as to separate the packaged plant from the remaining foil portions upstream of the cutting means.

[0054] The device of the invention can e.g. be based on existing packaging machines that are capable of welding plastic foil and filling the packages with content. It is to be understood that the potted plants to be packaged need special attention and in particular the step d) of providing the plant in the space between the foil portions is a delicate one. The plants are preferably kept in upright position throughout the method steps and should preferably not be harmed in any way during the process steps. For example, packaging machine Yukon PE series from Delfin, Italy may be used as basis for a device of the present invention.

[0055] The means for sealing the two foil portions from the top portion towards the bottom portion in a closing manner, are preferably arranged to provide adjacent welds in a rejuvenating manner towards the bottom portion. The upper weld is preferably in a bow-shape as described above.

[0056] The device may also comprise means for applying the perforations in the foil. In this embodiment, an unperforated foil can be fed to the device.

[0057] The invention is now further illustrated by way of the following figures, wherein

Figure 1 shows a schematic diagram of a plant package of the invention in sideview (figures 1A and 1B) from the top (figure 1C) and from the bottom (figure 1D), and with an open bottom (figure 1E).
Figure 2 shows a plant package having a bow-shaped upper weld, both with a closed and an open bottom (figures 1A and 1B, respectively)
Figure 3 shows a sleeve element (figure 3A) and a detail thereof (figure 3B).
Figure 4 shows a plant package of figure 2, without perforations.
Figure 5 shows a schematic diagram of a device for preparation of a plant package of figure 2A or 2B.
Figure 6 shows a side view of a foil for the preparation of a plant package of the present invention.
Figure 7 shows a photograph of a plant package of figure 2A.

[0058] Throughout the figures, the same features are given the same reference numbers, or are left out for clarity reasons.

[0059] In figure 1, a potted plant package of the invention is indicated by 1. The potted plant package comprises a potted plant 4, comprising stems 6a, leaves 6b and leaves 6c. The potted plant grows in pot 5, that comprises a growth substrate such as potting soil. In the substrates, roots of the plant are present (not shown). The axis of the plant is shown by vertical dotted line Y. The axis of the plant coincides with the longitudinal axis of the plant package. The potted plant 4 is packaged in a closed plastic sleeve element 7, with a top 2 and a bottom 3, and comprises two substantially parallelly extending foil portions 7a and 7b, shown in figure 1B, defining the front and back side of the potted plant package, respectively. The sleeve element 7 is closed at the bottom by a bottom weld 74a. The said bottom weld 74a extends from the first lateral weld 71 to the second lateral weld 72, so as to provide a continuous sealed connection between the two foil portions 7a, 7b between the first and second lateral welds 71, 72, and defines the bottom 3 of the sleeve element 7).

[0060] The foil portions are preferably made of a flexible plastic transparent foil, which foil portions are welded together by a first lateral weld 71 and a second lateral weld 72, that extend from the bottom 2 to the top 3 of sleeve element 7. Both lateral welds 71 and 72 diverge coaxially along the axis Y of the potted plant 4 from the bottom 3 to the top 2 foil a fold. The two foil portions 7a, 7b of the sleeve element 7 are connected to one another by a linear upper weld 73, extending from the first lateral weld 71 at the connection 731 of the upper weld 73 with the first lateral weld, to the second lateral weld 72 at the connect 731 of the upper weld 73 with the second lateral weld 72.

[0061] Accordingly, a continuous sealed connection between the foil portions 7a, 7b between the first and second lateral welds 71, 72 is provided, defining the bottom 3 of the sleeve element 7. Both foil portions define a closed inner space 8 accommodating the potted plant 4.

[0062] The height H of the sleeve element 7 is indicated in figure 1B by H, defined by the top 2 and bottom 3 of sleeve element 7. The lower portion LP of the sleeve element 7 extends from the bottom 3 of the sleeve element 7 by 45% of the height H thereof. The upper portion UP of the sleeve element 7 extends from the top 2 of the sleeve element 7 by 45% of the height H thereof. The middle portion MP of the sleeve element 7 extend over 10% of the height H of the sleeve element 7. The middle portion comprises a plurality of perforations, arranged in a continuous band 10, extending perpendicular around the potted plant, i.e. perpendicular to the axis Y. The middle of band 10 is exactly halfway the height H of the sleeve element 7 and has a width of 8% of the circumference of the sleeve at the middle of the band. Its however very

well possible to choose for a wider band 10, as a result of which the length of the upper portion and lower portion of the sleeve element 7 will decrease.

[0063] The potted plant is fully accommodated within the closed inner space 8 of the sleeve element 7, bottom weld 74a being positioned below the pot 5, shown in the sideview of figure 1B and the view from below in figure 1D.

[0064] Instead of a bottom weld 74a, foil portions 7a and 7b can be connected to one another by a fold 74b in case the foil portions 7a and 7b originate from a single folded foil segment 75, shown in figure 6. In that case, the first and second lateral welds 71, 72 extend to cover the fold 74b, therewith providing a continuous connection of the two foil portions 7a. 7b, between the first and second connection of the foil portions. The fold 74b extends substantially perpendicular to the axis Y of the plant.

[0065] Figure 1E shows an embodiment of the plant package, where the bottom 3 of the sleeve element 7 is left open. A closed inner space 8 is obtained, as the pot 5 snugly fits in the sleeve element 7, providing a sealed closure around the pot 5 at the bottom 3 of the sleeve element 7.

[0066] Figures 2A and 2B show the same plant package as in figures 1A and 1E, respectively, but now the upper weld 73 is bow-shaped, extending outwardly, i.e. in upper direction. The bow-shape of the upper weld 73 extends with a length of 9 % of the circumference of the sleeve element 7 measured between connection 731 of the upper weld 73 with the first lateral weld 71 on the one hand, and connection 732 of the upper weld 73 with the second lateral 72 weld on the other hand.

[0067] Figure 3A shows a sleeve element 7 for the plant package of the invention, where the upper weld can be applied in a linear fashion (dotted line 73a) or can be bow-shaped (dotted line 73b). The sleeve element 7 comprises a first section 1A to accommodate the pot of the potted plant to be packaged at least partially, and a second section 1B above the first section 1A, accommodating the one or more stems, leaves and, if present, the one or more flowers of the potted plant, wherein the first section 1A diverges with a smaller angle α as compared to the second section 1B, diverging with a larger angle β. The first section 1A extends 25% of the total height of the sleeve element 7, defined by either linear weld 73a or the top of the bow-shaped weld 73b. The second section 1B comprises the perforation band. The circle in figure 3A shows t location of the clos-up of figure 3B, showing perforations 9.

[0068] Figures 4A and 4B show the same plant packages as shown in figures 2A and 2B, respectively, but now, the sleeve does not comprise and perforations.

[0069] Figure 5 shows a packaging device 100, comprising a roll 300 of polymeric plastic foil, having a top side 301 and a bottom side 302. The foil is folded at the bottom side 302 resulting in two foil segments extending parallel from the bottom side 302 to the top side 301. In the middle between top side 301 and bottom side 302 a perforation band 10 is present comprising a plurality of perforations. The foil 300 is transported into the device 100 by transport means in a transport direction (horizontal arrow), and the folded foil 300 passes means 70 for sealing the two foil portions 7a and 7b from the top side towards the bottom side in a closing manner. Sealing means 70 apply a plurality of welds 71, 72 spaced away from one another, that form inner space 40 between the two foil portions 7a, 7b with an open top 410 between the said foil portions. It is also possible that the foil 300 is fed to the machine as two substantially parallelly extending separate foil segments, providing for the foil segments 7a, 7b, respectively. In that case, sealing means 91 are present that seal the bottom of the foil portions, therewith connecting the first and second welds to one another, providing a continuous connection 74 of the two foil portions 7a, 7b, between the first connection 71 and second connection 72 at the bottom portion 3 of the plant package. In the device100 as shown, the first and second welds are applied at an angle with the transport direction, resulting in a conically shaped inner space 40. The welding means can also be shaped and positioned such, that welds are made substantially perpendicular to the transport direction, resulting in a substantially tubular or cylindrically shaped inner space. The foil 300 is preferably perforated before the roll of foil 300 is mounted on the device. However, the foil can also be perforated within the device. To that end, the device can comprise a perforation device, e.g. a laser device, that perforates the foil, preferably before the potted plant 4 is inserted in the inner space 40. The device comprises means 80 for inserting a potted plant in the space 40 between the foil portions 7a, 7b and defined by welds 71 and 72 (vertical arrow), and welding means 90 for welding the top of the two foil portions 7a, 7b welding the two foil portions 7a, 7b above the top of the potted plant 4 between the two adjacent welds 71, 72 in a bow shaped closing manner, for closing the inner space 40, resulting in a closed inner space 8 of the plant package with a bow-shaped upper weld 73, the plant 4 being packaged in the closed inner space 8. welding means 90 can also be designed to provide for a linear upper weld. Cutting means 110 for cutting the two foil portions 7a, 7b upstream the welds 71, 72 made by sealing means 70 separating the packaged plant from the remaining foil portions upstream of the cutting means. A plurality of cutting means can be present to cut on desired sides of the welds 71, 72, or the package can be torn off from the remaining foil portions. After being cut apart or torn from the foil, the separated plant package 1 is further transported on an endless belt 120 for further processing, such as being packed in a cardboard box, or being labelled, printed, stored and the like. The above-described means can be housed in a single housing but can also be arranged as separate units.

[0070] Figure 6 shows a folded foil that can be used for the sleeve element 7 of the plant package, with foil section 75 that comprises two substantially parallelly extending foil portions 7a and 7b, connected to one another via fold 74b. So, both foil portions 7a and 7b are from a

single piece of folded foil. In the figure, both foil portions are taken away from one another to generate an inner space 8.

[0071] Figure 7 shows a photograph of a potted plant of the Rosaceae family, packaged in a package of the invention. The perforation band 10 is indicated

Examples

[0072] Both a bi-oriented polypropylene film (Rincel MXM-AF, Casfil, Portugal) and a biodegradable cellulose-based film NatureFlex NVS, Futamura, Japan), both having a thickness of 30 μm. The polypropylene film comprises a heat sealable layer and a heat sealable antifog layer on opposite sides of the foil and has an oxygen transmission rate of 1210 cm^3 per day at 23°C. The antifog layer was used for the inside of the plant package. The cellulose based film comprises heat seal coatings on both sides of a transparent cellulose film and has an oxygen transmission rate of 5 cm^3 per day at 23°C.

[0073] Films of the above-described foil materials, from a roll having a height of 110 cm were folded over the length thereof, resulting in two parallelly extending foil portions of equal height of 55 cm connected to one another via the fold.

[0074] The thus folded foils were perforated to provide a single band of 4 mm perforations with a perforation density of 35,000 perforations per m^2 through both foil portions, the perforation band being 5 cm wide extending parallelly to the fold. Such perforation results in an oxygen transmission rate of 30,000 cm^3 per day at 23°C in both foils. The height of the sleeve element was 40 cm with a maximum circumference of 82 cm at the location where the bow-shaped weld crosses the lateral first and second welds.at the bottom, the sleeve element has a circumference of 23 cm.

[0075] The foils were used to pack plants by closing the foils by heat sealing to a package as depicted in figure 2A. The perforation lines on both foil portions extend substantially parallel to the fold at the bottom of the package, halfway the height of the package, i.e. at about 275 mm from the fold.

[0076] It was found that the plant in the plant packages of the invention remained longer fresh as compared with unpackaged plants or plants packed in similar packages, however without the micro-perforations, kept at the same conditions. The same results were observed when using separate oil portions of the above materials, however without a fold to prepare the sleeve elements but being welded together at the bottom of the sleeve element.

Claims

1. Potted plant package (1) comprising:

- a potted plant (4) in a pot (5), the said potted plant comprising one or more stems (6a), roots, leaves (6b) and optionally one or more flowers (6c) grown from the said one or more stems (6a); and
- a sleeve element (7) with a top (2) and a bottom (3) defining the height (H) of the package, the sleeve element accommodating the potted plant and comprising at least two substantially parallelly extending foil portions (7a, 7b), the foil portions (7a,7b) being connected to one another to define a closed inner space (8) that accommodates at least the stems (6a), the leaves (6b) and if present, the one or more flowers (6c) of the potted plant (4), the sleeve element (7) comprising and upper portion (UP), middle portion (MP) and a lower portion (LP), the middle portion (MP) comprising a plurality of perforations (9) having a diameter of 0.1 - 4.0 mm, the upper portion (UP) extending from the top (2) of the sleeve element (7) by at least 25% of the height (H) thereof and the lower portion (LP) extending from the bottom (3) of the sleeve element (7) by at 25% of the height (H) thereof, the upper and lower portions (UP, LP) of the sleeve element (7) being void of such perforations (9).

2. Potted plant package (1) of claim 1, wherein the plurality of perforations (9) is arranged as a band (10) in the middle portion (MP) of the sleeve element (7), preferably as a continuous band, the band (10) extending substantially perpendicular around the potted plant (4), the band (10) having a width of at least 3% of the circumference of the sleeve element (7) at the middle of the band (10), the density of the perforations (9) being 1,000 - 100,000 perforations per m^2.

3. Potted plant package (1) of claim 2, wherein the band (10) has a width 5 - 30%, preferably 8 - 25 %, more preferably 10 - 20 % of the circumference of the sleeve element (7) at the middle of the band.

4. Potted plant package (1) of any of the preceding claims, the perforations (9) having a diameter of 0.1 - 2 mm, preferably 0.1 - 1.0 mm, more preferably 0.2 - 0.8 mm, most preferably 0.3 - 0.5 mm.

5. Potted plant package (1) of any of the preceding claims, wherein the perforations (9) in the middle portion (MP) of the sleeve have a density of 5,000 - 75,000 perforations per m^2, preferably 20,000 - 50,000 perforations per m^2, more preferably 30,000 - 40,000 perforations per m^2.

6. Potted plant package (1) of any of the preceding claims, wherein the at least two foil portions (7a, 7b) of the sleeve element (7) each comprise a layer chosen from polypropylene, cellulose polyvinylidene chloride, polyethylene, polyvinyl alcohol, polyamide,

ethyl vinyl alcohol, polystyrene, polyvinyl chloride, ethylene vinyl acetate and polylactic acid, preferably propylene, or a coherent laminate of two or more of said layers, the polypropylene preferably being oriented polypropylene, more preferably biaxially oriented polypropylene.

7. Potted plant package (1) of any of the preceding claims, wherein the at least two foil portions (7a, 7b) of the sleeve are connected to one another by a first lateral weld (71) and a second lateral weld (72), diverging coaxially along the axis (X) of the plant (4) from the bottom (3) to the top (2) of the sleeve element (7), defining a first and a second connection between the foil portions (7a, 7b), respectively.

8. Potted plant package of claim 7, wherein:

- the at least two foil portions (7a, 7b) of the sleeve element (7) are connected to one another at the bottom (3) of the sleeve element (7) by a bottom weld (74a) extending from the first lateral weld (71) to the second lateral weld (72), so as to provide a continuous sealed connection between the two foil portions (7a, 7b) between the first and second lateral welds (71, 72), and defining the bottom (3) of the sleeve element (7); or
- the two foil portions (7a, 7b) of the sleeve element (7) are part of a single foil segment (75), the said foil segment (75) being folded over a bottom fold (74b), the said bottom fold (74b) dividing the foil segment (70) in the two foil portions (71, 72), and defining the bottom (3) of the sleeve element (7) by a folding connection between the foil portions (7a, 7b).

9. Potted plant package (1) of any of the preceding claims, wherein the sleeve element (7) comprises a first section (1A) accommodating the pot (5) at least partially, and a second section (1B) above the first section (1A), accommodating the one or more stems (6a), leaves (6c) and, if present, the one or more flowers (6c) of the potted plant (4), wherein the first section (1A) diverges with a smaller angle (α) as compared to the second section (1B), the first section (1A) preferably extending 10 - 30% of the total height (H) of the sleeve element (7), the second section (1B) comprising the perforations (9).

10. Potted plant package (1) of any of the claims 7 - 9, wherein the at least two foil portions (7a, 7b) of the sleeve element (7) are connected to one another by an upper weld (73), extending from the first lateral weld (71) to the second lateral weld (72), so as to provide a continuous sealed connection between the foil portions (7a, 7b) between the first and second lateral welds (71, 72) and defining the top (2) of the sleeve element (7).

11. Potted plant package (1) of claim 10, wherein the upper weld (73a) is bow-shaped, extending the inner space (8) outwardly.

12. Potted plant package of claim 11, wherein the bow-shape of the upper weld (73) extends with a length being at least 2 - 25% of the circumference of the sleeve element (7) measured between connection (731) of the upper weld (73) with the first lateral weld (71) on the one hand, and connection (732) of the upper weld (73) with the second lateral (72) weld on the other hand.

13. Potted plant package (1) according to claim 12, the sleeve element being void of the perforations (9) as defined in any of claims 1 - 5.

14. Sleeve element (7) as defined in any of the claims 1 - 13.

15. Method for packaging a potted plant (4) into a potted plant package (1) of any of the claims 1 - 13, comprising the steps of:

a) providing a potted plant (4) as defined in claim 1,
b) providing the at least two foil portions (7a, 7b) as defined in any of the claims 1 - 13,
c) positioning the at least two foil portions (7a, 7b) on opposite sites around the plant (4), or inserting the plant (4) between the at least two foil portions (7a, 7b),
d) connecting the foil portions (7a, 7b) together so as to provide a closed inner space (8) accommodating the plant (4), the foil portions (7a, 7b) preferably being welded to one another at the top (2) of the package (1) in a bow shape.

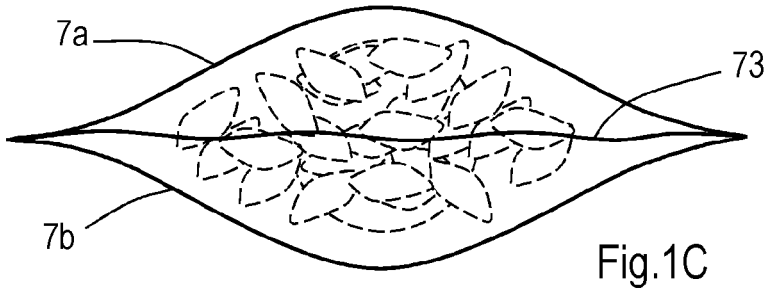

Fig.1C

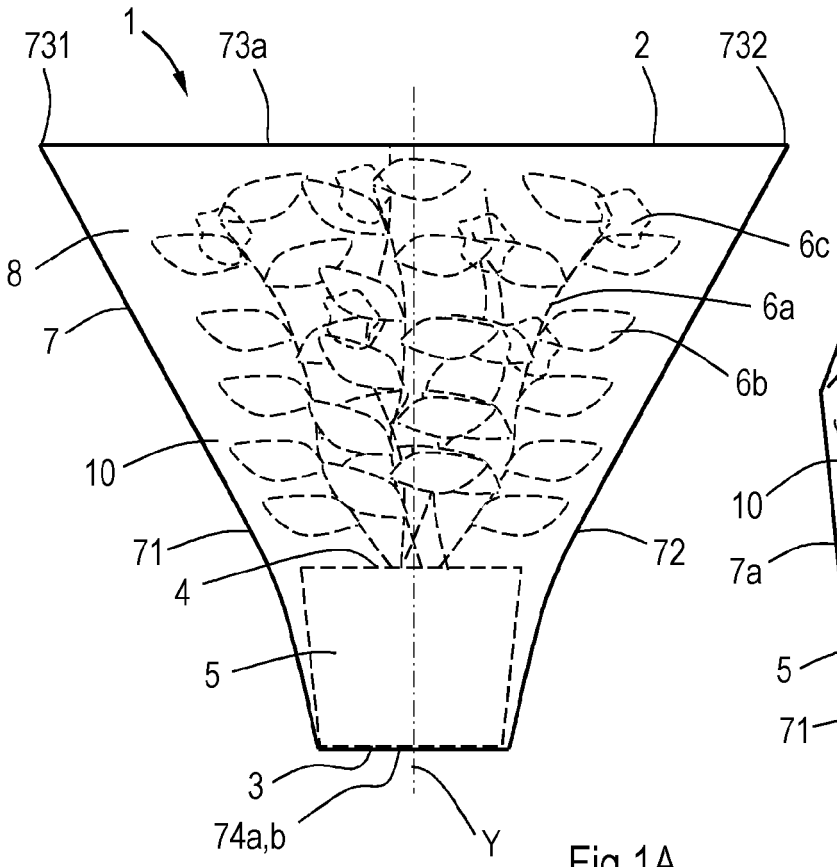

Fig.1A

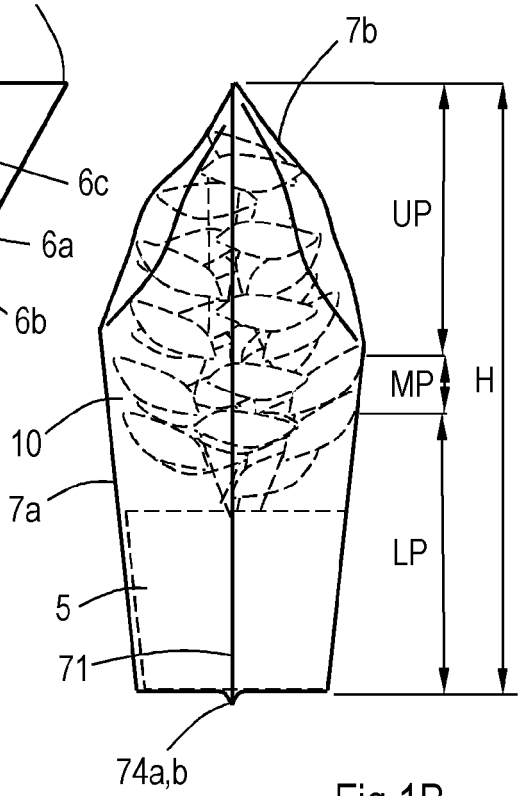

Fig.1B

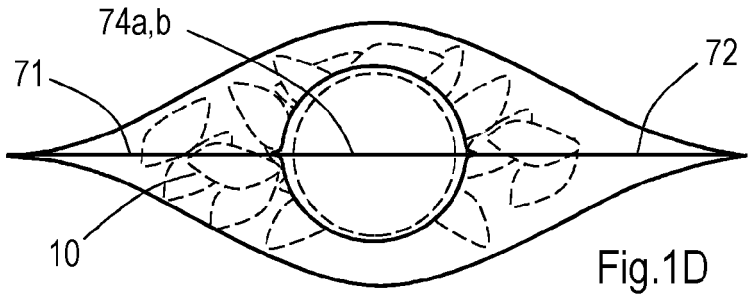

Fig.1D

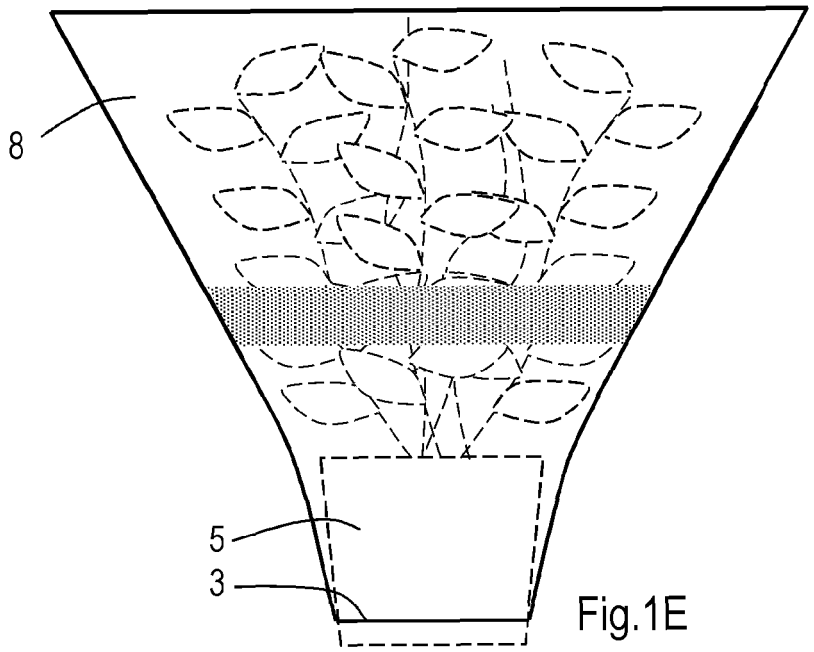

Fig.1E

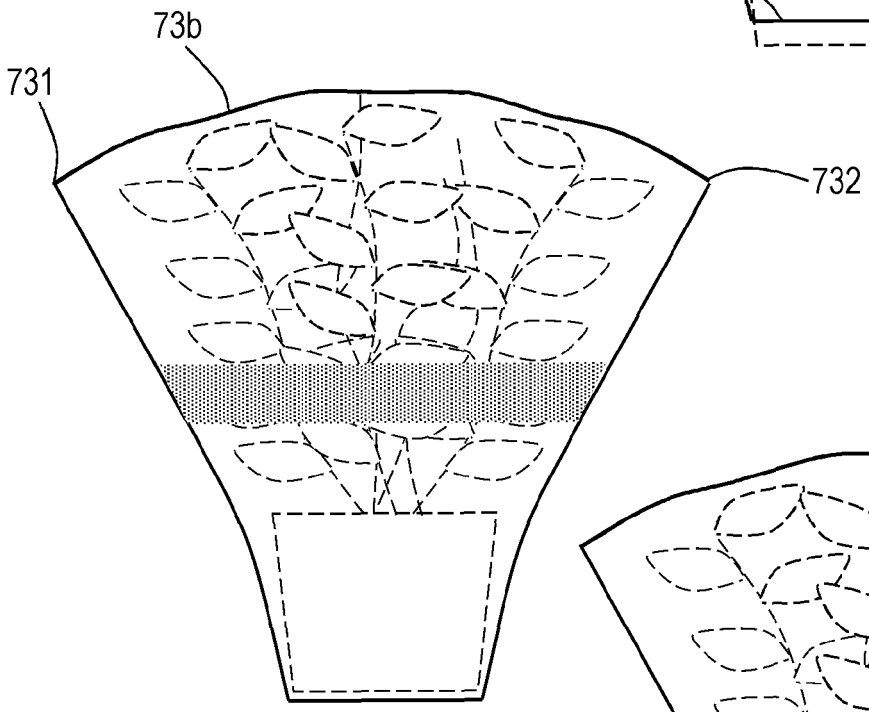

Fig.2A

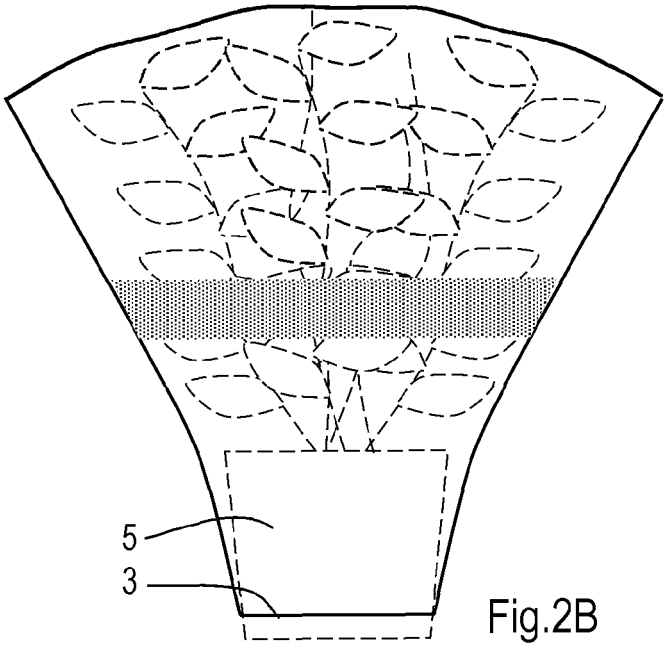

Fig.2B

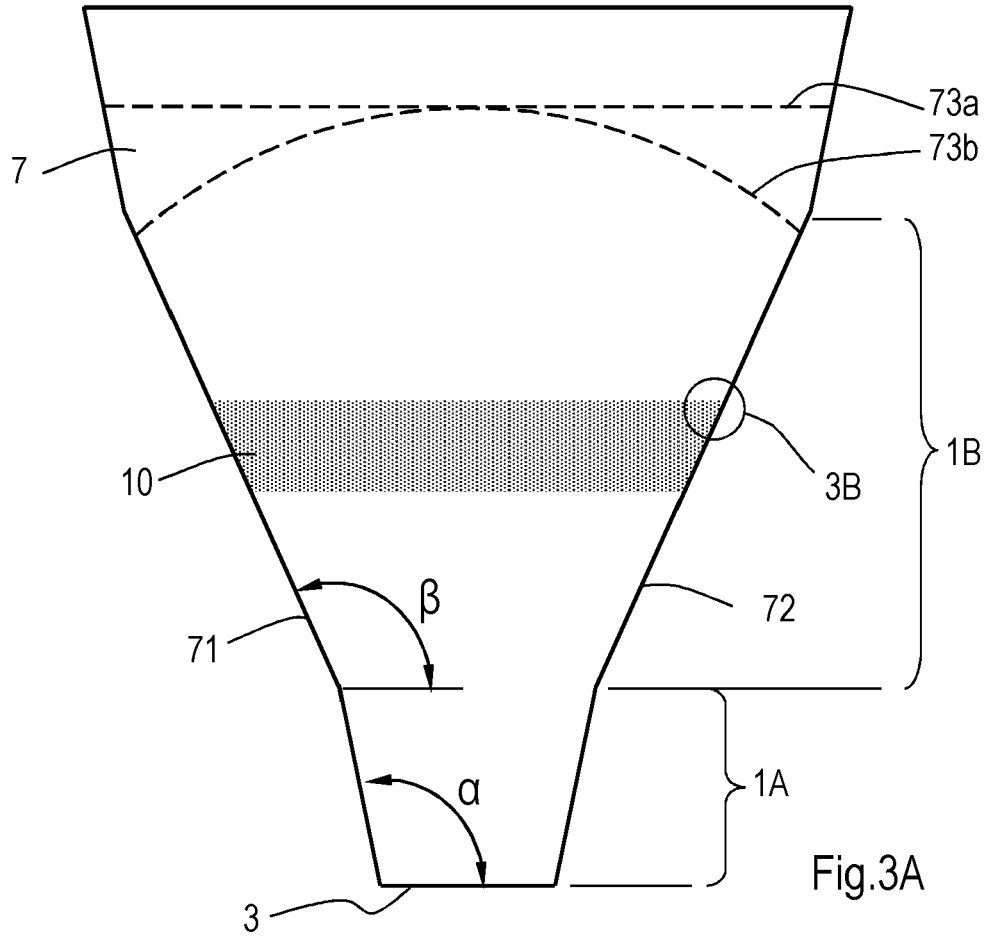

Fig.3A

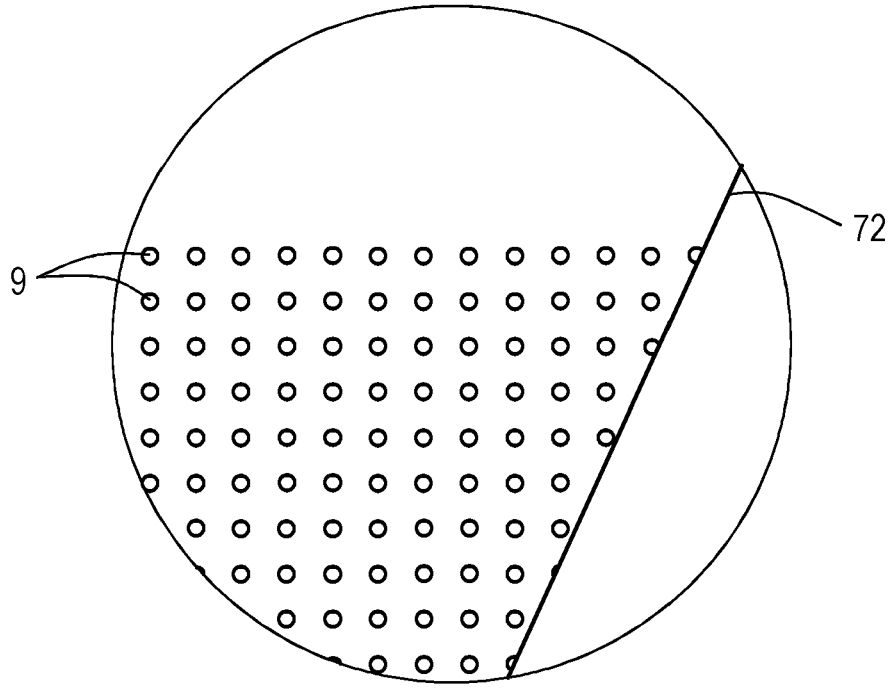

Fig.3B

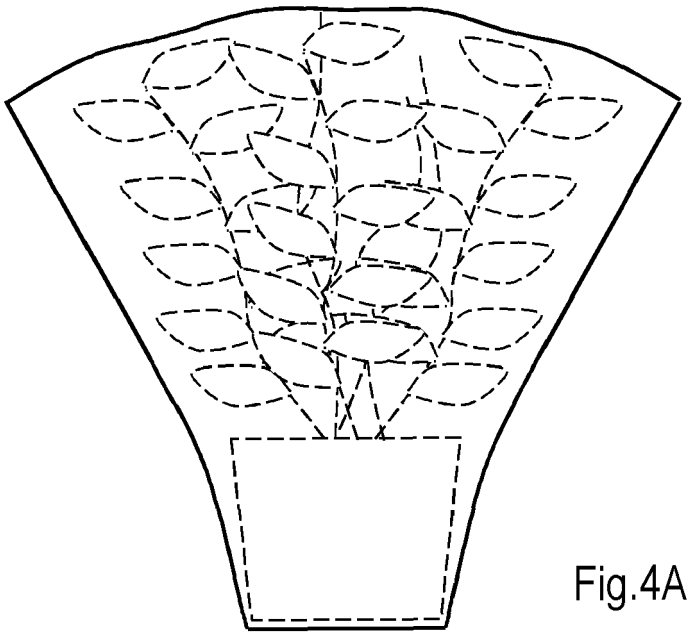

Fig.4A

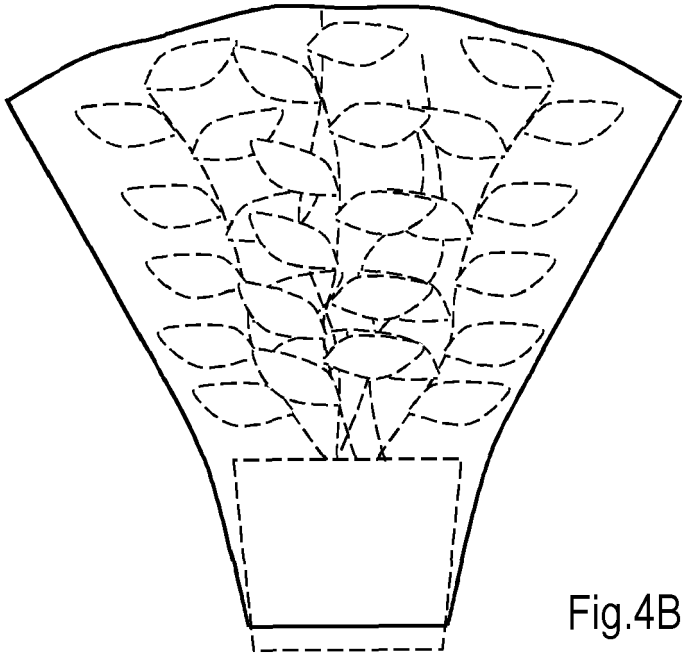

Fig.4B

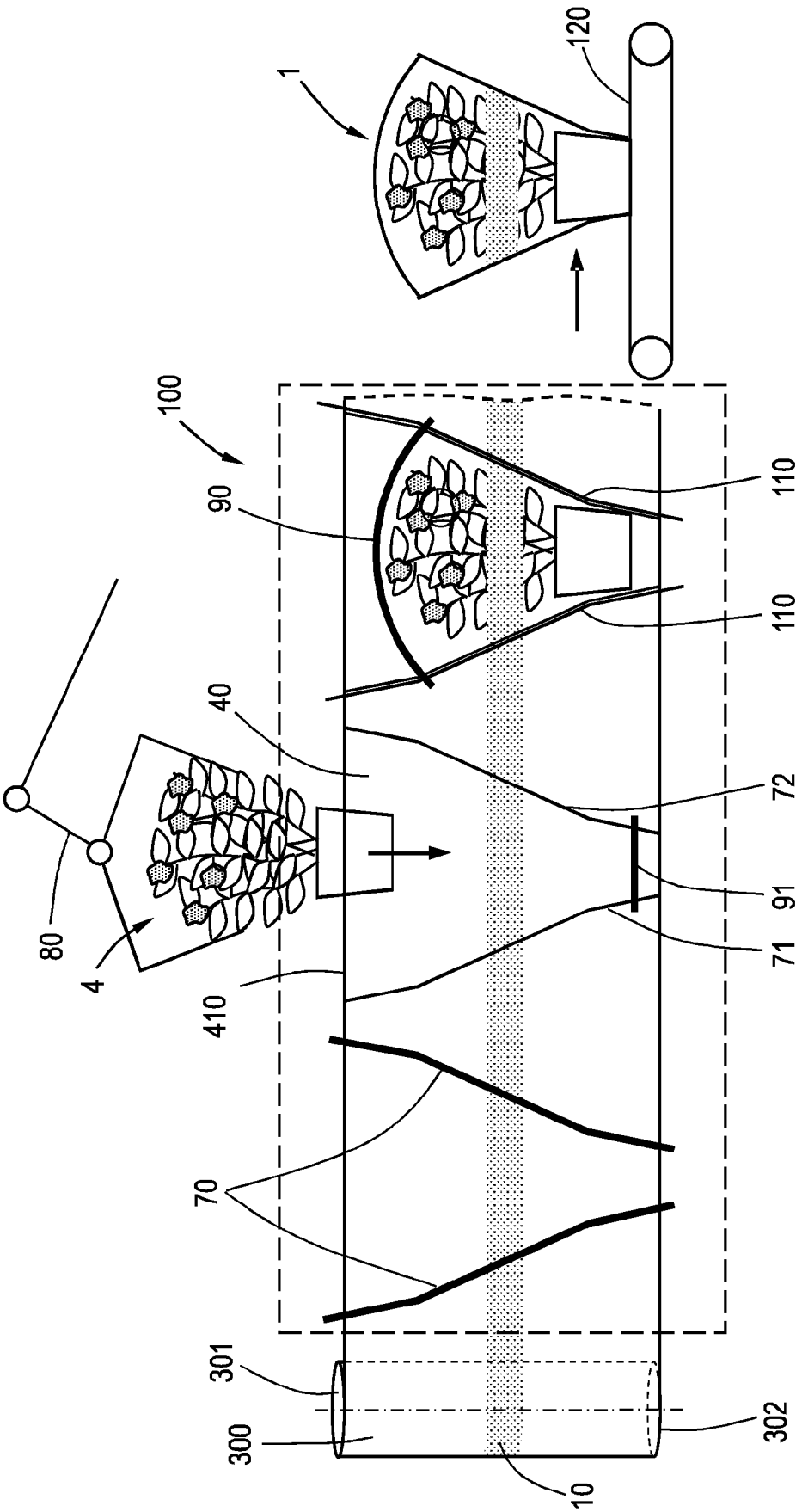

Fig.5

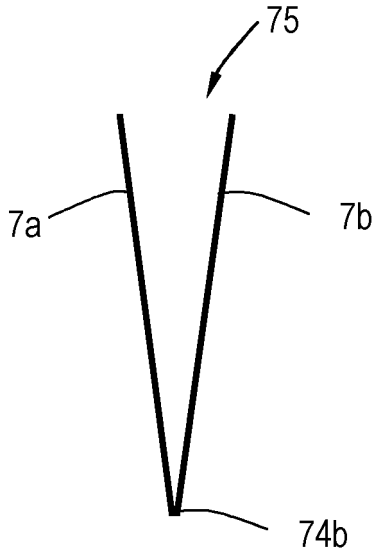
75
7a
7b
74b

Fig.6


AirPack
LESS
WASTE
MORE
FLOWERS
New Packaging
10
10

Fig. 7

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EUROPEAN SEARCH REPORT

Application Number
EP 20 18 9941

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B65D
A01G
B65B
B31F
B31B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	8 October 2020	Leijten, René

CATEGORY OF CITED DOCUMENTS

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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