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(54) **Titre : A method and an apparatus for manufacturing a storage bag, and a storage bag.**

(57) **Abrégé :**

The invention discloses a method for producing a storage bag with an integrally formed valve, a resulting bag and an apparatus for producing such a bag.

The method is characterised by forming the valve (3) of bag (2) by folding corner (13) of the tubular piece (5) at second open end (8) inwardly to the inside followed by cutting off edge strip (22) of tubular piece (5) with the valve (3) formed and closing the second open (8) end by attaching second sealing strip (25) thereto. In another aspect of the invention at least one hole (29) is made into side wall section (9A and/or 9B) of the tubular piece (5) to establish connection between second sealing strip (25) and at least one side wall (19) of the valve (3). The resultant bag has a valve (3) of height (23) smaller than depth (24) of valve (3) and where second sealing strip (25) is attached to second end (8) of tubular piece (5).

Figure 1

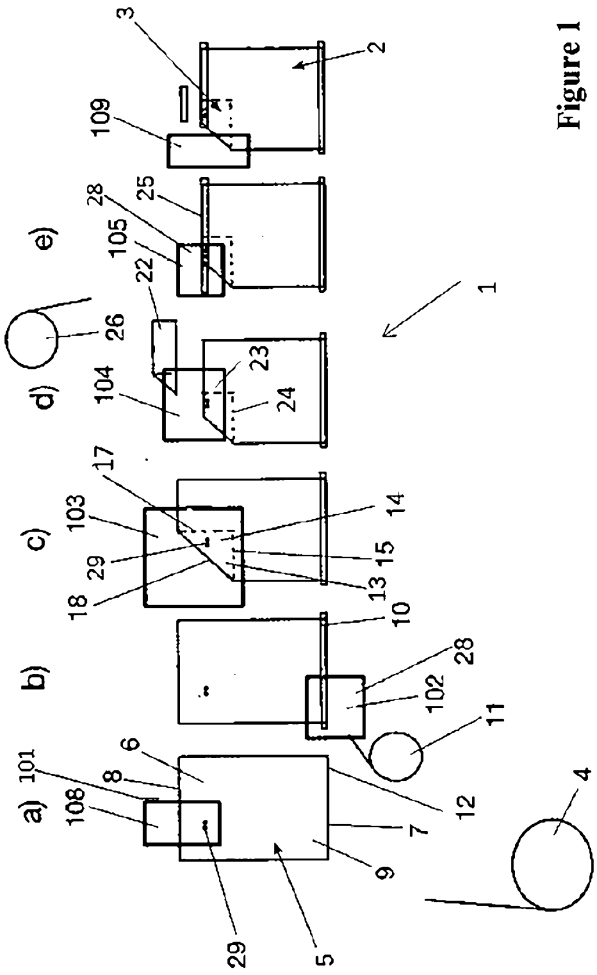

Figure 1

A METHOD AND AN APPARATUS FOR MANUFACTURING A STORAGE BAG, AND A STORAGE BAG

Field of the invention

The present invention generally relates to the field of bags for transporting, packaging and storage of powdery or granular material, for example cement.

In particular, the invention relates to a method for producing a bag with an integrally formed valve, a resulting bag and an apparatus for producing such a bag.

Background Art

Bags or sacks have been in use for packing/storage/ transportation of materials such as food grains, flour, and industrial materials of all kinds. There are primarily two types of bags in use: pillow type and box type. Box type bags are made using hot sealing technique, however, their manufacturing processes are capital intensive. Most common pillow type bags are made by stitching one end of the tubular web by suitable folding of the end to be stitched. Stitching is a simple and economic process which can either be carried out manually or automated. However, it compromises the integrity and strength of the web due to puncturing of the web material by the needle. Some manufacturers use high strength material to compensate for the loss of strength, however, it is not possible to achieve complete sealing of the filled materials from external environment. Stitching also results in pilferage of material, especially during transport and handling of the bags. The folding that is necessary at the end to be stitched also requires webs of

greater lengths, which is an economic disadvantage.

The problem of puncturing of the web and resultant pilferage may be overcome by using a thermal sealing technique such as heat bar or ultrasonic methods, however, these methods require precise operational control and also webs of high strength, without which there's a risk of bursting of the filled bags and which lowers the packaging weight limit.

A further problem exists with bags that have a filling valve which are provided for filling material more securely than filling it through the open ends of a bag. However, filling valves are typically not securely connected to the bag. Therefore, there is a risk that the valves may become unfolded or detached from the bags.

It is well known-in the art, for example from AT 512 459 A1, to provide bags with self-closing valves, which allow for fast filling and self-closing of the filled bags. The valve is formed in a flat state of the bag by means of a folding device. The bags are usually filled by means of a filling device, such as a filling pipe. For this purpose, the valve is spread-open and the filling device is inserted into the valve. After retracting the filling device from the bag, the valve is closed due to the internal pressure of the powdery or granular material filled into the bag. In this prior art, the open end of the bag having the valve is closed by folding the top edge and subsequent stitching. This, however, weakens the material and can thus lead to ruptures of the bag. Also, filling material may leak through the stitches which is of particular concern when cement is filled into the bags.

Accordingly, it is an objective of the present invention to eliminate or at least alleviate at least individual disadvantages of the prior art.

There is therefore a need for a bag/sack and a method to produce them which overcomes these drawbacks so that the integrity and strength of the web material is not unduly compromised and wherein the seals are strong and integral, and which have valves that are securely placed.

In particular, it is an objective of the present invention to provide a bag with an integrally formed valve that reliably closes the filled bag when the filling device is retracted from the valve, prevents leakage of the filling material and is particularly durable. Further it is an objective of the invention to provide a method and an apparatus for producing such a bag.

Summary of the invention

The invention provides for a method for producing a bag with a valve. The bag may be produced with web material which may be woven fabric, non-woven fabric or their composite, optionally coated or laminated. Woven polyolefin or woven polypropylene material is preferred. For the purpose of this description, the terms web, web material, or fabric are used synonymously.

Accordingly, the method comprises the following steps:

a) providing a tubular piece made of fabric, in particular polymer material, preferably woven polyolefin or woven polypropylene material, having a first open end and a second open end, each open end having a corre-

sponding circumferential edge;

b) closing the first open end of the tubular piece, preferably by attaching a first sealing strip thereto;

c) forming the valve of the bag by folding a corner of the tubular piece at the second open end inwardly to the inside of the tubular piece;

d) cutting off a lower edge strip of the tubular piece with the valve formed therein at the second open end thereof; and

e) closing the second open end by attaching a second sealing strip thereto.

Also provided is a fabric bag with a valve. The bag may be produced with web material which may be woven fabric, non-woven fabric both optionally coated and laminated. The sealing strips may be made from woven or non-woven materials, in particular polymer material, preferably woven polyolefin or woven polypropylene material preferably coated or laminated, optionally sealing strips may be pre-applied with adhesive on their faces that attaches itself to the bag. This means that the strips that are supplied come ready with the adhesive applied to them.

Accordingly, the bag of the invention comprises:

- a tubular piece made of a fabric, in particular polymer material, preferably woven polyolefin or woven polypropylene material, the tubular piece having a closed first end, preferably by means of a first sealing strip;

- a valve formed by a corner at the second end of the tubular piece being folded inwardly to the inside of the tubular piece, a height of the valve being smaller than a depth of the valve; and
- a second sealing strip attached to the second end of the tubular piece.

In another aspect, the invention provides an apparatus for producing a bag with at least on valve. The apparatus is capable of producing bags made from web material which may be woven fabric, non-woven fabric both optionally coated or laminated.

Accordingly the apparatus disclosed herein comprises:

a) a supply unit for providing a tubular piece made of fabric, in particular polymer material, preferably woven polyolefin or woven polypropylene material, having a first open end and a second open end, each open end having a corresponding circumferential edge;

b) a first closing unit for closing the first open end of the tubular piece, particularly by means of a first sealing strip;

c) a valve forming unit for forming the valve of the bag by folding a corner of the second open end inwardly to the inside of the tubular piece;

d) a cut-off unit for cutting off a lower edge strip of the second open end;

e) a second closing unit for closing the second open end by means of a second sealing strip.

All aspects of the invention relate to each other and any embodiment described for one aspect commensurately relates to all other aspects and embodiments mentioned. In particular, the advantages and features mentioned in the context of the method also relate to the apparatus and the bag.

Brief Description of Figures:

Fig. 1 shows an apparatus for producing a bag with a secure valve.

Figures 1A and 1B show the schematic of the folds formed for making a valve

Fig. 2 shows a welding unit for connecting at least one side wall of the valve to an adjacent side wall section of the tubular piece by means of a welding process.

Fig. 3 shows an alternative apparatus for producing a bag with a secure valve.

Fig. 4 shows the connection of side walls of the valve to adjacent side wall sections by means of a single welding unit.

Fig. 5 shows a punching unit in a side view.

List Of Parts:

1. Apparatus
2. Bag
3. Valve

4. Web/fabric roll
5. Tubular piece
6. Circumferential side wall
7. First open end 7A – circumferential edge of first open end
8. Second open end 8A - circumferential edge of second open end

9A/9B. Layers of flattened tubular piece

10. First sealing strip
11. Strip roll for first sealing strip
12. Edges of first open end
13. Corner
14. Triangle
15. First leg or first cathetus
16. Longitudinal axis of tubular piece
17. Second leg or second cathetus
18. Hypotenuse
19. Side wall of the valve
20. Separation element
21. Separation layer
22. Lower edge strip
23. Height
24. Depth
25. Second sealing strip
26. Strip roll for second sealing strip
27. Edges of second open end
28. Joining/sealing device
29. Hole

30. Bolt
31. Support element
101. Supply unit for tubular pieces
102. First closing unit for first open end
103. Valve forming unit
104. Cut-off unit
105. Second closing unit for second open end
106. Welding unit
107. Valve connecting unit
108. Punching unit
109. Sealing strip cutting unit

Detailed description of the invention

The present invention provides for a method for producing a bag with a valve, comprising the following steps:

a) providing a tubular piece made of fabric, in particular polymer material, preferably polyolefin or woven polypropylene material, having a first open end and a second open end, each open end having a corresponding circumferential edge;

b) closing the first open end of the tubular piece, preferably by attaching a first sealing strip thereto;

c) forming the valve of the bag by folding a corner of the tubular piece at the second open end inwardly to the inside of the tubular piece;

d) cutting off a lower edge strip of the tubular piece with the valve formed therein at the second open end thereof; and

e) closing the second open end by attaching a second sealing strip thereto and by securing the valve.

The bag may be produced with web material which may be woven fabric, non-woven fabric both optionally coated or laminated. Woven polyolefin or woven polypropylene material is preferred.

By carrying out steps a) to e) of the method – preferably but not necessarily sequentially – a particularly durable bag with an integrally formed self-closing valve is obtained, wherein the valve reliably closes the filled bag as soon as a filling device is retracted from the bag. The valve is closed due to the exerted pressure of the filling material. Leakage of filling material, in particular powdery or granular material such as cement, from the bottom end of the bag is reliably prevented. The valve is thereby formed by the tubular piece itself and thus constitutes an integral part of the bag. In other words, the bag including the valve is made in one piece, namely the tubular piece.

The type of the bag, e.g. pillow type or gusseted type, being produced is defined by the form of the tubular piece used in the manufacturing process. Therefore, depending on the type of bag being produced, the tubular piece may have folds. The inventive method and the inventive apparatus can be used for producing both types of bags.

The tubular piece may be made of a synthetic woven fabric, in particular polymer material, preferably polyolefin or polypropylene material. The fabric may consist of small ribbons or straps with a typical width up to 10 mm and a thickness of 15 to 120 µm. The fabric may be coated or may be uncoated. The tubular piece has a circumferential side wall which preferably has no openings or holes except the first and the second open end. The side wall may comprise several side wall sections. Typically, each side wall section defines one side of the bag being produced. Due to the flexibility of the used material, the tubular piece preferably lies essentially flat during the manufacturing of the bag. In this case, the side wall may be divided into at least two sections, a top and a lower side wall section, joined to each other at the side edges of the flattened tubular piece. The first open end of the tubular piece lies opposite to the second open end. At the beginning of the method in step a), both the first and the second open end preferably have essentially the same size.

In step a), the tubular piece is provided, i.e. physically placed and prepared for the subsequent steps. The step of providing the tubular piece may comprise the manufacturing of the same. For example, the tubular piece may be weaved or cut from a (web) roll or any other supply means with a continuous tubular piece of, in particular, woven fabric. Alternatively, the manufacturing may be independent from and performed prior to step a) as well. In this case, the tubular piece may simply be taken from a stack with numerous tubular pieces.

In step b), the first open end of the tubular piece is closed. For closing of the first open end, a variety of closing techniques can be applied. For

example, the first open end can be closed by stitching or gluing. However, it is preferred that the first open end is closed by means of a first sealing strip which is attached to the edges of the opposed side wall sections at the first open end. The first sealing strip may be taken from a stack with sealing strips or may be cut from a continuous sealing strip. If the first sealing strip is cut from a continuous sealing strip, the cut can take place before or after attaching the first sealing strip to the first open end. The first sealing strip preferably has two strip sections, one at each side wall section of the tubular piece, connected to one another. In particular, the cross-section of the first sealing strip forms a V or a U. The first sealing strip may be glued or welded, preferably by means of hot air or thermal welding, to the tubular piece. Thermal welding techniques may use laser technology, ultrasonic technology, or any other high frequency technology. The two strip sections, that is the legs of the U or V cross-sections, are thereby attached to the edges of the first open end. Alternatively or additionally, the first sealing strip at the first open end may be stitched to the tubular piece, as the loads on the stitches may be less at the first (upper) open end than at the second (lower) open end.

The first sealing strips may be made from woven or non-woven materials, in particular polymer material, preferably woven polyolefin or woven polypropylene material preferably coated or laminated, optionally may have pre-applied with adhesive.

In step c), the valve is formed by folding the corner of the second open end, which is still open at this stage, inwardly to the inside of the tubular piece. As the tubular piece usually lies flat due to its flexibility, it can be advanta-

geous to lift one edge of the second open end to facilitate folding of the corner. The resulting valve has two opposite side walls so that a filling device may be received there between. In step c), the height and the depth of the folded valve are essentially the same. The height of the valve extends into a direction parallel to the longitudinal axis of the tubular piece which extends from the first open end to the second open end. The depth extends in direction perpendicular to the longitudinal axis of the tubular piece.

In step d), a (lower) edge strip of the tubular piece with the valve formed therein at the second open end thereof is cut off, in particular by means of a knife. The cut is preferably a straight cut without any curved sections. As a result of the cut, the valve is truncated at its lower end. Thus, the resulting valve in its final state has a height that is shorter than its depth. In other words: The height of the valve is reduced by the width of the cut off lower edge strip after folding the corner. This improves the reliability of the self-closing mechanism of the valve in the final bag, as an accidental folding of the valve to the outside in response to the filling of the material is prevented. The lower edge strip has a width of at least 10 mm, preferably at least 70 mm, preferably less than 150 mm. After cutting off the lower edge strip, the tubular piece has the final length (i.e. extension in direction of the longitudinal axis) of the bag to be produced.

In step e), the second open end of the tubular piece, aside from the valve, is closed by attaching a second sealing strip thereto. The valve is not obstructed by the attachment of the second sealing strip. Corresponding to the attachment of the first sealing strip, the second sealing strip may be taken from a stack with sealing strips or may be cut from a continuous sealing

strip, in particular from a roll. If the second sealing strip is cut from a continuous sealing strip, the cut can take place before or after attaching the second sealing strip to the second open end. The second sealing strip preferably has two strip sections, one at each side wall section of the tubular piece, connected to one another. In particular, the cross-section of the second sealing strip forms a V or a U. The second sealing strip may be glued or welded to the tubular piece. The two strip sections, that is the legs of the U or V cross-sections, are thereby attached to the edges of the second open end. Alternatively or additionally, the second sealing strip at the second open end may be stitched to the tubular piece.

The second sealing strips may be made from woven or non-woven materials, in particular polymer material, preferably woven polyolefin or woven polypropylene material preferably coated or laminated, optionally may have pre-applied with adhesive.

As one key aspect of the invention, the valve that is formed is secured so that it doesn't unfold upon completion of filling or in any other event. The simplest way to achieve this is by securely attaching at least one of the valve walls to the second sealing strip. In a preferred method of securing the valve, at least one hole is formed in at least one adjacent side wall section so as to establish a secure connection between the second sealing strip and at least one side wall of the valve in step e). When the second sealing strip is attached to second open end in step e), for instance by gluing or welding, preferably hot air welding, or thermal welding, the at least one side wall of the valve is connected to the second sealing strip through the at least one hole. The second sealing strip may be glued or welded, preferably

by means of hot air or thermal welding, to the tubular piece. Thermal welding techniques may use laser technology, ultrasonic technology, or any other high frequency technology. As the second sealing strip is connected to the adjacent side wall of the tubular piece as well, consequentially the at least one side wall of the valve is connected to the adjacent side wall section via the second sealing strip. The at least one hole is preferably located so close to the second open end that it can be entirely covered by the second sealing strip.

Preferably, the first and/or the second sealing strip is attached to the tubular piece by means of welding, preferably hot air welding or ultrasonic welding, or gluing.

The position of the at least one hole may be predetermined depending on the size of the bag and the valve. Therefore the act of forming the at least one hole may also be carried out virtually at any point during the method (i.e. even prior to any of steps b, c, d and e) once the positions are known of the cuts to be made to make tubular pieces 5 from the tubular web.

In step e), the second open end of the tubular piece, aside from the valve, is closed by attaching a second sealing strip thereto. The valve is not obstructed by the attachment of the second sealing strip. Corresponding to the attachment of the first sealing strip, the second sealing strip may be taken from a stack with sealing strips or may be cut from a continuous sealing strip, in particular from a roll. If the second sealing strip is cut from a continuous sealing strip, the cut can take place before or after attaching the second sealing strip to the second open end. The second sealing strip pref-

erably has two strip sections, one at each side wall section of the tubular piece, connected to one another. In particular, the cross-section of the second sealing strip forms a V or a U. The second sealing strip may be glued or welded to the tubular piece. The two strip sections, that is the legs of the U or V cross-sections, are thereby attached to the edges of the second open end. Alternatively or additionally, the second sealing strip at the second open end may be stitched to the tubular piece.

After carrying out step e), the second sealing strip may be cut off to conform to the width of the (now closed) second open end without the valve. In this way, the second sealing strip does not protrude into the valve section.

As shown in Figures 1A and 1B, in a preferred embodiment the inwardly folded corner of the second open end for forming the valve has the shape of a triangle, in particular an isosceles triangle. In this embodiment, the first leg (first cathetus) of the triangle is oriented essentially in a direction perpendicular to the longitudinal axis of the tubular piece and the second leg (second cathetus) is oriented essentially in a direction parallel to the longitudinal axis of the tubular piece. As shown in Figure 1A, before the fold is formed by creasing the side walls, the first leg of the triangle was a part of a creased side edge of the flattened tubular piece. Similarly, before forming the fold, the second leg was a part of the open edge of second open end. The hypotenuse connects the side wall with the second open end.

According to one embodiment of the invention, step d) may comprise the cutting off of the lower edge strip at an essentially right angle to a longitu-

dinal axis of the tubular piece and along the full width of the second open end of the tubular piece with the valve formed therein. The longitudinal axis thereby extends from the first open end to the second open end of the tubular piece.

As an alternative method of securing the valve so that it doesn't unintentionally open or fold outwardly (i.e. the reverse of the inward folding described previously), after forming the valve according to step c), at least one side wall of the valve, preferably a bottom edge of the side wall of the valve, is securely connected to an adjacent side wall section of the tubular piece. Preferably, both side walls of the valve are each connected to their adjacent side wall section of the tubular piece.

A fast and reliable connection of the side walls of the valve can be achieved if the at least one side wall section of the valve is connected to the adjacent side wall of the tubular piece by means of a process through which hotmelt is administered for connection purpose. Alternatively, any welding process may be used for the purpose, using which the fabric can be melted partially and the at least one side wall of the valve can be connected to the adjacent side wall section of the tubular piece without the use of any connective material, such as a glue. Again, preferably, both side walls of the valve are connected to a respective adjacent side wall section of the tubular piece. To this end, both side walls of the valve may be connected to their respective adjacent side wall of the tubular piece at the same time. Alternatively, the side walls may be connected to their adjacent side wall sections one after another, i.e. in separate welding processes.

During the welding processes, in order to avoid connecting the side walls of the valves to each other, a separation element, particularly a separation layer preferably made of steel, can be used during the welding process to temporarily space the side walls of the valve from each other. The separation element has the advantage that the side walls of the valves are not welded to each other during the welding process.

Alternatively, the welding may be carried out using an ultrasonic welding process.

In a further embodiment, the two methods of securing the valve – i.e., the one involving making of at least one hole in at least one adjacent side wall section, through which hole(s) the second side strip is securely connected to one side wall of the valve, and the one where the at least one side wall of the valve, preferably a bottom edge of the side wall of the valve, is securely connected to an adjacent side wall section of the tubular piece – are both implemented.

The present invention further provides a fabric-bag comprising:

- a tubular piece made of a in particular woven fabric, the tubular piece having a closed first end, preferably by means of a first sealing strip;

- a valve formed by a corner at a second end of the tubular piece being folded inwardly to the inside of the tubular piece, a height of the valve being smaller than a depth of the valve;

- a second sealing strip attached to the second end of the tubular piece.

The bag can be obtained by the inventive method. Advantageously, the valve of the bag has a height which is shorter than its depth. The height of the valve extends into a direction parallel to the longitudinal axis of the tubular piece which extends from the first open end to the second open end. The depth extends in direction perpendicular to the longitudinal axis of the tubular piece. The longitudinal axis extends from the first open end to the second open end. The bag has a length that preferably lies between 200 mm and 1400 mm, more preferably between 350 mm and 950 mm. The bag has a width that preferably lies between 170 mm and 850 mm, more preferably between 270 mm and 620 mm.

In order prevent the valve of the bag from being unintentionally unfolded, at least one of the side walls of the valve can be connected to an adjacent side wall section of the tubular piece.

The invention also provides an apparatus for producing a bag with at least one valve, comprising:

a) a supply unit for providing a tubular piece made of in particular woven fabric, preferably made of Polypropylene, having a first open end and a second open, end each open end having a corresponding circumferential edge;

b) a first closing unit for closing the first open end of the tubular piece, particularly by means of a first sealing strip;

c) a valve forming unit for forming the valve of the bag by folding a corner of the second open end inwardly to the inside of the tubular piece;

d) a cut-off unit for cutting off a lower edge strip of the second open end;

e) a second closing unit for closing the second open end by means of a second sealing strip.

The inventive apparatus is capable of conducting the above described method. Preferably, the units are arranged sequentially from a) to e). The supply unit can comprise a roll with a coiled continuous tubular piece, from which tubular piece can be cut, for example by means of cold cutting, hot cutting, ultrasonic cutting or laser cutting. Alternatively, the supply unit can comprise a stack from which tubular pieces can be taken one after another. The first closing unit can comprise a supply of sealing strips, in particular V- or U-strips. The sealing strip can be taken from a stack or cut from a roll. For cutting, the first closing unit can comprise a knife. Alternatively, cold cutting, hot cutting, ultrasonic cutting or laser cutting can be used by the first closing unit. The valve forming unit can comprise a folding member that folds, i.e. presses or shifts, the corner of the tubular piece into the inside of the tubular piece. Expediently, the valve forming unit can further comprise a lifting member that lifts an edge of the second open end of the tubular piece for facilitating the folding of the corner. The cut-off unit can comprise a knife. The second closing unit can be built similar to the first closing unit. For attaching the first and/or the second sealing strip to the tubular piece, welding, preferably hot air welding, ultrasonic welding, or gluing can be used by the first and/or second closing unit.

In a first embodiment of the apparatus, the first and/or the second closing unit has a welding device for connecting the first/second sealing strip to the first/second open end of the tubular piece. The welding device, preferably a thermal welding device, can heat and partially melt the first/second sealing strip and/or the first/second open end so as to form an integral connection of the first/second sealing strip and the tubular piece. The welding device may also be an ultrasonic welding device.

Further, the apparatus can comprise a gluing unit for connecting at least one side wall of the valve to an adjacent side wall section of the tubular piece by means of a glue.

In a preferred embodiment, the apparatus further comprises a punching unit for punching at least one hole in at least one side wall section of the tubular piece before closing the second open end by means of the second sealing strip, wherein the hole(s) is punched close to the second open end so that a connection between the second sealing strip and at least one side wall of the valve is established when the second sealing strip is attached.

The position of the at least one hole may be predetermined depending on the size of the bag and the valve. Therefore the act of forming the at least one hole may also be carried out virtually at any point during the method (i.e. even prior to any of steps b, c, d and e) once the positions are known of the cuts to be made to make tubular pieces 5 from the tubular web.

In another embodiment, the apparatus comprises a welding unit for connecting at least one side wall of the valve to an adjacent side wall sec-

tion of the tubular piece by means of a welding process, preferably a thermal welding process. However, the process may also be an ultrasonic welding process.

In order to avoid connecting the side walls of the valve during the welding process, the welding unit can comprise a separation element, in particular a separation layer preferably made of metal, which can be inserted between the side walls of the valve during the welding process.

In yet another embodiment, the apparatus comprises both the afore mentioned punching unit for the purpose for which it was provided in the preferred embodiment and the welding unit for connecting at least one side wall of the valve to an adjacent side wall section of the tubular piece by means of a welding process.

In the following, preferred embodiments of the invention will be described by means of the figures.

Fig. 1 schematically shows an apparatus 1, here a production line, for producing bags 2 with integrated valves 3. The production line has a number of stations for producing the bags (from left to right). The sequence shown in Fig. 1 is but one preferred embodiment, while individual steps may be exchanged or combined as long as the result remains essentially the same. Each step performed may be carried out by a dedicated unit of the apparatus 1. As such units are known per se, the units are merely indicated schematically in the drawings.

Fig. 1 also shows a web roll 4 from which tubular pieces 5 are cut by means of a cutting device, such as a knife or a laser cutter (not shown). Each tubular piece 5 generally each has a circumferential side wall 6 that extends in the direction of the longitudinal axis of the tubular piece with preferably no openings or holes except a first open end 7 and a second open end 8 at opposite ends of tubular piece 5. Each open end, 7 and 8, has a corresponding circumferential edge, 7A and 8A. Tubular pieces 5 are made of a woven fabric, in particular a polymer material, preferably woven polyolefin or woven polypropylene material. Due to their flexibility, tubular pieces 5 essentially lie flat during the manufacturing process as shown in the figures. In this flat state, at least two opposite side wall sections 9A and 9B of tubular piece 5 are formed with the creased side edges 6A and 6B formed between them. In Fig. 1, only the top side wall section 9A can be seen as tubular piece 5 is shown in top view.

Alternatively, instead of cutting, the tubular pieces 5 of course could be simply taken from a stack or another production line for producing tubular pieces 5. The step of cutting or simply taking tubular pieces 5 may be generally referred to as a step for providing tubular pieces or simply as step a). This step may be carried out by a supply unit 101.

In a subsequent step, which may be referred to as step b) and may be carried out by a first closing unit 102, first open ends 7 of tubular pieces 5 are closed entirely so that material filled into bag 2 cannot exit this side of bag 2. Preferably, this is done by attaching a first sealing strip 10 to first open end 7. To this end, first sealing strip 10 may be cut from a continuous strip roll 11 or alternatively taken from a stack. The length of first sealing strip

10 may be greater than the width of first open end 7. There are various ways for attaching or joining first sealing strip 10 to first open end 7. However, welding or gluing is preferred. For this purpose, a joining or sealing device 28, in particular a device joining using glues/adhesives (natural or synthetic) or a device that uses welding technologies such as laser welding, ultrasonic welding or any other high frequency welding, or a hot air welding device is preferred. Such joining device 28 can be included in first closing unit 102.

First sealing strip 10 preferably has two strip sections (not shown), one for each side wall section 9A (the top side) and 9B (the lower side) of tubular piece 5, connected to one another. In particular, the cross-section of first sealing strip 10 forms a V or a U. The two strip sections of the first sealing strip 10, that is the legs of the U or V cross-sections, are thereby attached to edges 12 of first open end 7. Alternatively or additionally, first sealing strip 10 at first open end 7 may be stitched to the tubular piece 5, as the loads on the stitches may be less at the first (upper) open end 7 than at the second (lower) open end 8.

Subsequently, in step c), carried out by a unit generally referred to as valve forming unit 103, valve 3 is formed into tubular piece 5. To this end, a corner 13 at second open end 8 is folded inwardly to the inside of tubular piece 5. As can be seen in Fig. 1, upon inward folding, the corner 13 is shaped into two isosceles triangles 14 that have a common side or edge between them, the common side being the first leg 15 (first cathetus). The first leg 15 of the triangles 14 is thereby formed by what was a part of the side edge 6A, and which is oriented essentially in a direction perpendicular

to a longitudinal axis 16 of the tubular piece 5. Similarly, upon inward folding, a second leg (second cathetus) 17 of each triangle 14 is formed from what was a part of the circumferential edge 8A. The second leg 17 of each triangle 15 is oriented essentially in a direction parallel to longitudinal axis 16 of tubular piece 5. Finally, the hypotenuses 18 of the triangles 14 are formed by creasing of the side walls, 9A and 9B.

It is evident that the integrity of the valve 3 that eventually forms with the rest of the bag comes from the fact that:

- the first leg 15 of triangles 14 is an integral part of the creased side edge 6A;

- the second legs 17 of the triangles 14 are an integral part of the circumferential edge 8A; and

- the hypotenuses 18 are an integral part of side walls 9A and 9B.

While the valve 3 has an integrity with the bag in the manner explained here, in order to prevent the valve from being unintentionally unfolded outwardly (i.e. the reverse of the inward folding described previously), the apparatus of the invention is provided with a punching unit 108.

After cutting the tubular piece 5 from web roll 4, at least one hole 29 is formed in at least one of adjacent side wall sections 9A and 9B by means of the punching unit 108 (see Figure 3) so as to establish a connection between second sealing strip 25 and at least one of side walls 19 of valve 3 in step e).

In the embodiment shown, two holes 29 are punched. Both holes 29 may be in the same wall section 9A or 9B, or they may be in different wall sections 9A or 9B. The holes 29 may be placed in any configuration relative to each other so long as the second sealing strip 25, when placed in its final position, covers at least one of the holes 29. The punching of the holes 29 must take place prior to or at the start of step e). Punching unit 108 can therefore be placed anywhere in the apparatus 1, as long as holes 29 are punched prior to or at the start of step e). Holes 29 can be through-holes which go through both side wall sections 9A and 9B of the tubular piece 5 and both side walls 19 of valve 3. Alternatively, it is sufficient if the holes 29 only go through only one of the respective adjacent side wall sections 9A and 9B of tubular piece 5. Second sealing strip 25 is finally attached to second open 8 end in step e), using a second welding device 28 which may be a part of a second closing unit 105. Welding or gluing is preferred, however, ultrasonic welding may also be used.

As a consequence of attaching second sealing strip 25 to the second open end 8, side wall 19 of the valve 3 is connected to second sealing strip 25 through holes 29. As second sealing strip 25 is connected to a respective side wall section 9A or 9B at second open end 8 of tubular piece 5 as well, side wall 19 of valve 3 is connected to adjacent side wall section 9A or 9B via the second sealing strip 25. Holes 29 are located so close to second open end 8 that it can be entirely covered by second sealing strip 25.

Fig. 5 shows punching unit 108 in a side view. Punching unit 108 comprises a slidable bolt 30 which punches at least one hole 29, preferably two holes 29, through the side walls sections 9 and the side walls 19 of valve 3.

A support element 31 supports tubular member 5 and receives bolt 30.

The position of the holes 29 may be predetermined depending on the size of the bag and the valve. Therefore the act of forming the holes 29 may also be carried out virtually at any point during the method (i.e. even prior to any of steps b, c, d and e) once the positions are known of the cuts to be made to make tubular pieces 5 from the tubular web.

As an alternative to securing the valve using holes 29, at least one of the side walls 19 of valve 3, preferably an edge close to second open end 8 of at least one of the side walls 19 of valve 3, is securely connected to a respective adjacent side wall sections 9A and 9B of tubular piece 5. This step may be carried out by a unit that may be generally referred to as valve connecting unit 107 (see Fig. 3). Preferably, both side walls 19 of valve 3 are each connected to the respective adjacent side wall section, 9A or 9B, of the tubular piece 5. In a flat state of the tubular piece 5, side wall sections 9A and 9B lie opposite to each other (see Fig. 2 or Fig. 5).

A fast and reliable connection of side walls 19 of valve 3 can be achieved if side walls 19 of valve 3 are connected to respective adjacent side wall sections 9A and 9B of tubular piece 5 by means of a welding process, in particular an ultrasonic welding process carried out by a welding unit 106. This is shown in Fig. 2 in greater detail. Through the welding process, the fabric of tubular piece 5 and valve 3 formed therein is partially melted and the walls 19 of valve 3 is connected to respective adjacent side wall sections 9A and 9B of tubular piece 5 without the use of any adhesive material, such as a glue.

As already described, preferably, both side walls 19 of valve 3 are connected to a respective adjacent side wall section 9A or 9B of tubular piece 5. To this end, separate welding processes carried out by separate welding units 106 may be used. Welding units 106 may be activated at the same time or one after another. As shown in Fig. 1, welding units 106 may be integrated into valve connecting unit 107.

In order to avoid connecting side walls 19 of valves 3 to each other, a separation element 20, particularly a separation layer 21 preferably made of steel, can be used during the welding process to temporarily space side walls 19 of the valve 3 from each other. Separation element 20 has the advantage that side walls 19 of the valves 3 are not unintentionally welded to each other during welding process(es).

Instead of welding, side walls 19 of valve 3 can be connected to the respective adjacent side wall sections 9A or 9B of tubular pieces 5 by means of a glue material, which may be natural or synthetic adhesives, preferably hotmelt. This step may be carried out by a gluing unit, which may be integrated into valve connecting unit 107.

In yet another embodiment, the apparatus comprises both the aforementioned punching unit 108 for the purpose for which it was provided in the preferred embodiment, and the welding unit 106 for connecting at least one side wall of the valve to an adjacent side wall section of the tubular piece by means of a welding process.

In step d), which may be carried out by a cut-off unit 104 and may follow

valve forming unit 103 or valve connecting unit 107, a lower edge strip 22 of the tubular piece 3 with valve 3 formed therein at the second open 8 end thereof is cut off, for example by means of a knife or another cutting device (not shown). The cut is preferably straight without any curved sections. As a consequence, resulting valve 3 in its final state has a height 23 that is shorter than its depth 24. In other words: Height 23 of valve 3 is reduced by the width of cut off lower edge strip 22. Height 23 of valve 3 extends into a direction parallel to longitudinal axis 16 of tubular piece 5 which extends from first open end 7 to second open end 8. The depth 24 extends in direction perpendicular to longitudinal axis 16 of the tubular piece 5. This improves the reliability of the self-closing mechanism of valve 3 in final bag 2, as an accidental folding of valve 3 to the outside in response to the filling of the material is prevented. The cutting off of lower edge strip 22 may be performed at an essentially right angle to longitudinal axis 16 of tubular piece 5 and along the full width of second open end 8 with valve 3 formed therein.

After cutting off lower edge strip 22, second open end 8 is closed by attaching a second sealing strip 25 thereto in a step which may be referred to as step e). This step may be carried out by a second closing unit 105 which can be similar to the first closing unit 102. In this regard, "closing" means to close second open end 8 after removing lower edge strip 22 but leaving valve 3 open. In other words: Second open end 8 is closed but valve 3 is still open for receiving material. Again, second sealing strip 25 can be taken from a stack or, as shown, cut from a continuous strip roll 26. Similar to first sealing strip 10, second sealing strip 25 preferably has two strip sections, one for each side wall section 9A and 9B of tubular piece 5, connect-

ed to one another. In particular, the cross-section of second sealing strip 25 forms a V or a U. The two strip sections of the second sealing strip 25, that is the legs of the U or V cross-sections, are thereby attached to edges 27 of second open end 8. Alternatively or additionally, second sealing strip 25 at second open end 8 may be stitched to tubular piece 5. Second sealing strip 25 may be glued, or preferably welded to tubular piece 5. For this purpose, another joining or sealing device 28 can be included in second closing unit 105.

As second sealing strip 25 may be too long and protrude from bag 2 due to the presence of valve 3, a sealing strip cutting unit 109 may be placed at the end of apparatus 1. This unit 109 may cut off parts of second sealing strip 25 protruding over valve 3.

The process described above carried out with apparatus 1 results in a bag 2 with a closed first end (corresponding to former first open end 7) and a second end 8 with valve 3 formed therein. Second end 33 corresponds to second open end 8 closed by means of second sealing strip 25.

Preferably, the units 101, 102, 103, 104 and 105 shown in the figures are arranged in a production line in the order 101, 102, 103, 104 and 105.

The advantages of the bags made using the method and apparatus disclosed herein are obvious.

While the above description contains much specificity, these should not be construed as limitation in the scope of the invention, but rather as an exem-

plification of the preferred embodiments thereof. It must be realized that modifications and variations are possible based on the disclosure given above without departing from the spirit and scope of the invention. Accordingly, the scope of the invention should be determined not by the embodiments illustrated, but by the appended claims and their legal equivalents.

Claims:

1. Method for manufacturing a storage bag (2) with a valve (3), comprising the steps of providing a tubular piece (5) made of fabric, in particular polymer material, preferably woven polyolefin or woven polypropylene material, having a first open end (7) and a second open end (8) followed by closing the first open end (7) of the tubular piece (5), preferably by attaching a first sealing strip (10) thereto, characterised in that these steps are followed by the steps of:

a. forming the valve (3) of the bag (2) by folding a corner (13) of the tubular piece (5) at the second open end (8) inwardly to the inside of the tubular piece (5);

b. cutting off an edge strip (22) of the tubular piece (5) with the valve (3) formed therein at the second open end (8) thereof; and

c. closing the second open (8) end by attaching a second sealing strip (25) thereto.

2. The method as claimed in claim 1, wherein the inwardly folded corner (13) of the second open end (8) for forming the valve (3) has the shape of a triangle (14).

3. The method as claimed in claim 1 or 2, wherein step b) comprises the cutting off of the edge strip (22) at an essentially right angle to a longitudinal axis (16) of the tubular piece (5) and along the full width of the second

open end (8) of the tubular piece (5) with the valve (3) formed therein.

4. The method as claimed in claims 1 to 3, wherein prior to step c), at least one hole (29) is made into the adjacent side wall section (9A and/or 9B) so as to establish a connection between the second sealing strip (25) and the at least one side wall (19) of the valve (3) in step c).

5. The method as claimed in claims 1 to 3, wherein, after forming the valve (3) according to step a), at least one side wall (19) of the valve (3), preferably a lateral edge of the side wall (19) of the valve (3), is connected to an adjacent side wall section (9A or 9B) of the tubular piece (5).

6. The method as claimed in claims 4 and 5, wherein the at least one side wall (19) of the valve (3) is connected to the respective adjacent side wall section (9A or 9B) of the tubular piece (5) by means of a welding process, in particular an ultrasonic welding process.

7. The method as claimed in claim 6, wherein during the welding process a separation element (20), particularly a separation layer (21) preferably made of metal, is used to temporarily space the side walls (19) of the valve (3) from each other.

8. The method as claimed in claim 5, wherein the at least one side wall (19) of the valve (3) is connected to the respective adjacent side wall section (9A or 9B) of the tubular piece (5) by means of a glue material, preferably hotmelt.

9. The method as claimed in claims 1 to 8, wherein the first (10) and/or the second sealing strip (25) is attached to the tubular piece (5) by means of welding, preferably hot air welding or ultrasonic welding, or gluing using adhesives.

10. The method as claimed in claims 5 to 9, wherein said holes (29) are two or more in number and arranged in any relative configuration with respect to each other.

11. The method as claimed in claims 5 to 10, wherein after closing said second open end (8), said second sealing strip covers at least one said hole (29).

12. The method as claimed in claims 1 to 11, wherein said first and second sealing strips are in the form of U or V sections.

13. The method as claimed in claims 1 to 12, wherein the first sealing strips (10) and/or the second sealing strips 25 are made from woven or non-woven materials, in particular polymer material, preferably woven polyolefin or woven polypropylene material preferably coated or laminated.

14. The method as claimed in claims 1 to 13, wherein the first and second sealing strips are pre-applied with adhesive on their face that attaches itself to the bag.

15. A storage bag (2), made of fabric material, characterised in that said bag comprises:

- a tubular piece (5) made of a fabric, in particular polymer material, preferably woven polyolefin or woven polypropylene material, the tubular piece (5) having a closed first end (32), preferably by means of a first sealing strip (10);

- a valve (3) formed by a corner (13) at a second end (8) of the tubular piece (5) being folded inwardly to the inside of the tubular piece (5), a height (23) of the valve (3) being smaller than a depth (24) of the valve (3);

- a second sealing strip (25) attached to the second end (8) of the tubular piece (5).

16. The bag as claimed in claim 15, wherein said wall sections (9A or 9B) have at least one hole (29) made in them which is covered by said second sealing strip (29).

17. The bag as claimed in claims 15 and 16, wherein at least one of the side walls (19) of the valve (3) is connected to an adjacent side wall section (9) of the tubular piece (5).

18. The bag as claimed in claim 16, wherein said holes (29) are two or more in number and arranged in any relative configuration with respect to each other.

19. The bag as claimed in claims 15 to 18, wherein the first sealing strips (10) and/or the second sealing strips 25 are made from woven or non-woven materials, in particular polymer material, preferably woven polyole-

fin or woven polypropylene material preferably coated or laminated.

20. The bag as claimed in claims 15 to 19, wherein the first and second sealing strips are pre-applied with adhesive on their face that attaches itself to the bag.

21. An apparatus (1) for producing a storage bag (2) with at least one valve (3), charactersised in that said apparatus comprises:

a) a supply unit (101) for providing a tubular piece (5) made of fabric, in particular polymer material, preferably woven polyolefin or woven polypropylene material, having a first open end (7) and a second open end (8);

b) a first closing unit (102) for closing the first open end (7) of the tubular piece (5), particularly by means of a first sealing strip (10);

c) a valve forming unit (103) for forming the valve (3) of the bag (2) by folding a corner (13) of the second open end (8) inwardly to the inside of the tubular piece (5);

d) a cut-off unit (104) for cutting off an edge strip (22) of the second open end (8);

e) a second closing unit (105) for closing the second open (8) end by means of a second sealing strip (25).

22. The apparatus (1) as claimed in claim 21, wherein the apparatus (1) fur-

ther comprises a punching unit (108) for punching at least one hole (29) in at least one side wall section (9A and/or 9B) of the tubular piece (5) before closing the second open end (8) by means of second closing unit (105), wherein the hole (29) is positioned so that a connection between the second sealing strip (25) and at least one side wall (9A or 9B) of the valve (9) is established when the second sealing strip (25) is attached.

23. The apparatus as claimed in claims 21 and 22, wherein said punching unit is positioned upstream of at least said second closing unit (105).

24. The apparatus (1) as claimed in claims 21 to 23, wherein the first (102) and/or the second closing unit (105) has a gluing device or a welding device (28) for connecting the first (10)/second sealing strip (25) to the first (7)/second open end (8) of the tubular piece (5), wherein the welding device (28) preferably can conduct hot air welding or ultrasonic welding.

25. The Apparatus (1) as claimed in claims 21 to 24, wherein the apparatus (1) further comprises a gluing unit for connecting at least one side wall (19) of the valve (3) to an adjacent side wall section (9A or 9B) of the tubular piece (5) by means of a glue.

26. The apparatus (1) as claimed in claims 21 to 25, wherein the apparatus (1) further comprises a welding unit (106) for connecting at least one side wall (19) of the valve (3) to an adjacent side wall section (9A or 9B) of the tubular piece (5) by means of a welding process, preferably an ultrasonic welding process.

27. The apparatus (1) as claimed in claim 26, wherein the welding unit

(106) comprises a separation element (20), in particular a separation layer (21) preferably made of metal, which can be inserted between the side walls (9) of the valve (3) during the welding process.

28. The apparatus as claimed in claim 22, wherein said punching device (108) has a slidable bolt (30) to punch the hole (29), and a support element (31) that is provided under said tubular piece (5) at the time of punching the hole (29).

ABSTRACT

The invention discloses a method for producing a storage bag with an integrally formed valve, a resulting bag and an apparatus for producing such a bag.

The method is characterised by forming the valve (3) of bag (2) by folding corner (13) of the tubular piece (5) at second open end (8) inwardly to the inside followed by cutting off edge strip (22) of tubular piece (5) with the valve (3) formed and closing the second open (8) end by attaching second sealing strip (25) thereto. In another aspect of the invention at least one hole (29) is made into side wall section (9A and/or 9B) of the tubular piece (5) to establish connection between second sealing strip (25) and at least one side wall (19) of the valve (3). The resultant bag has a valve (3) of height (23) smaller than depth (24) of valve (3) and where second sealing strip (25) is attached to second end (8) of tubular piece (5).

Reference Figure: Figure 1

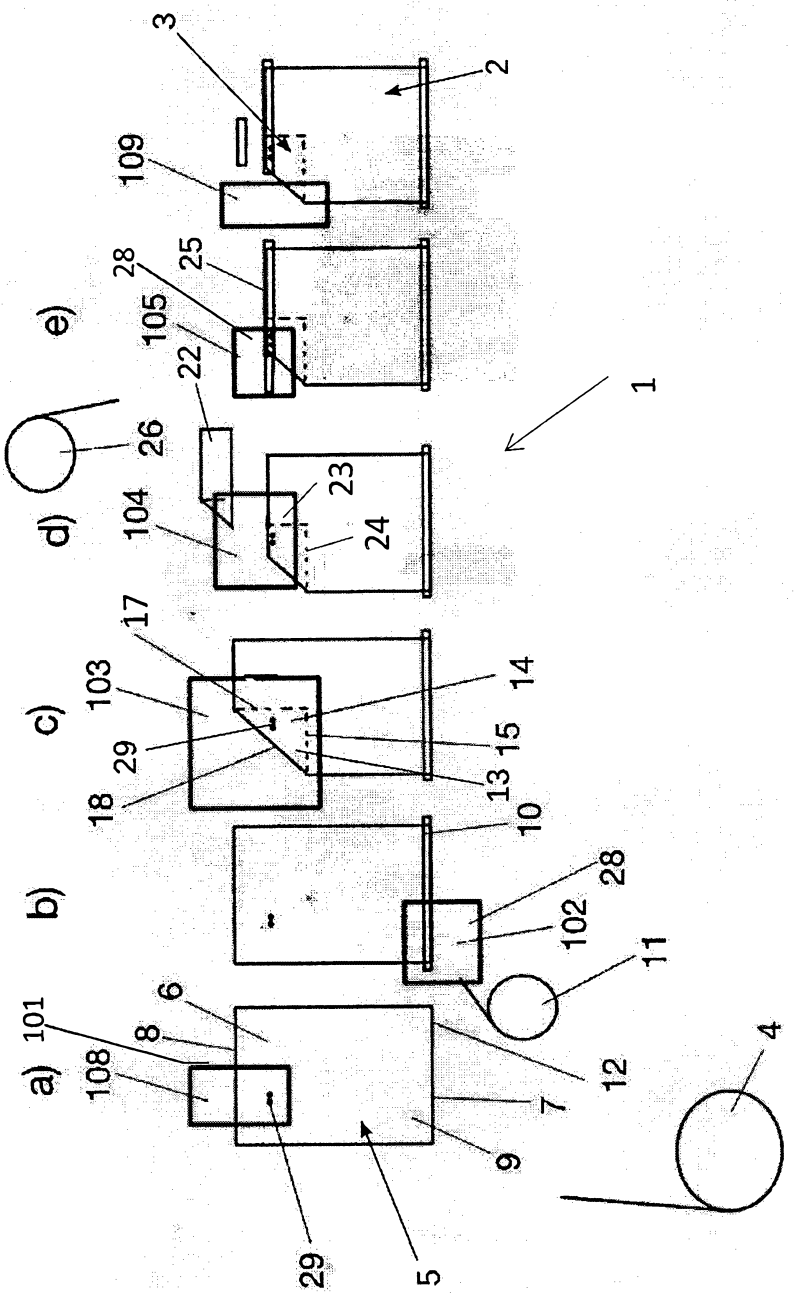
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Figure 1

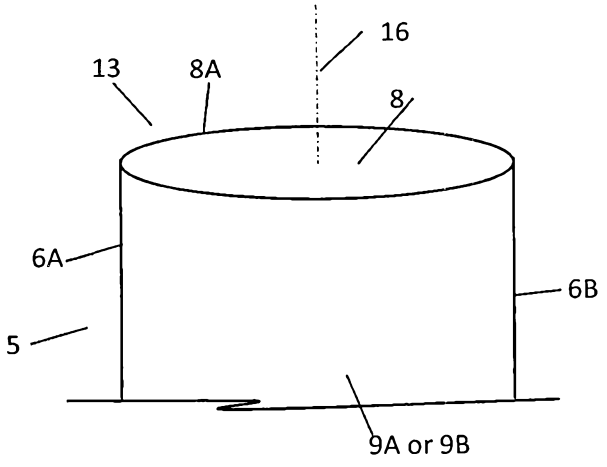

Figure 1A

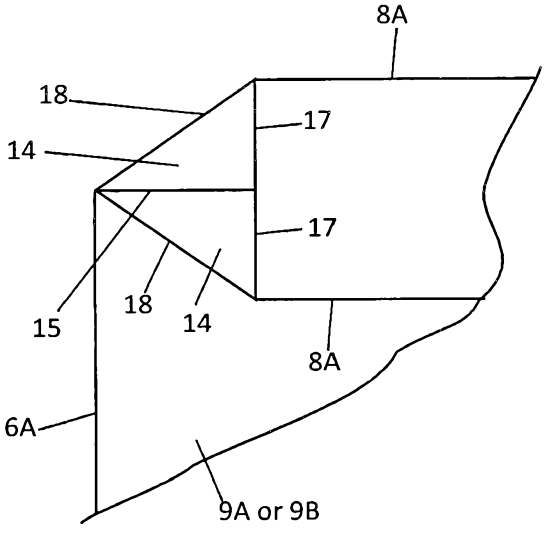

Figure 1B

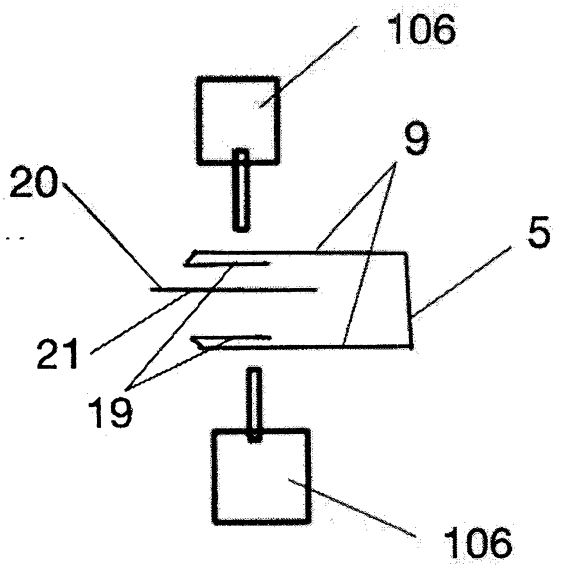

Figure 2

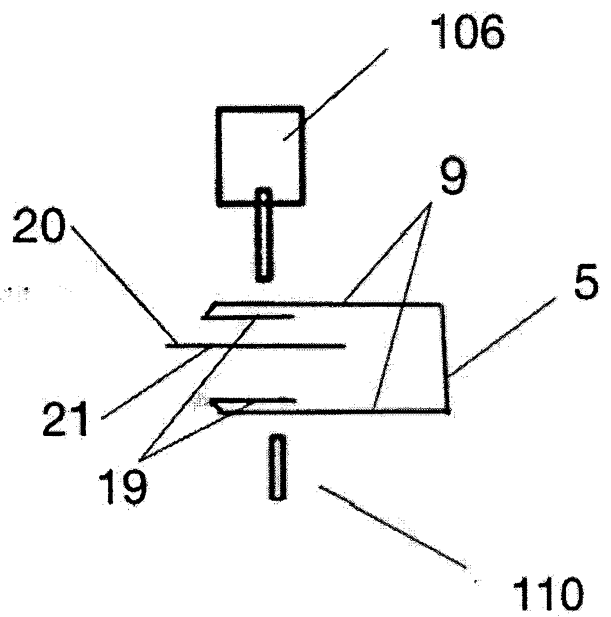

Figure 3

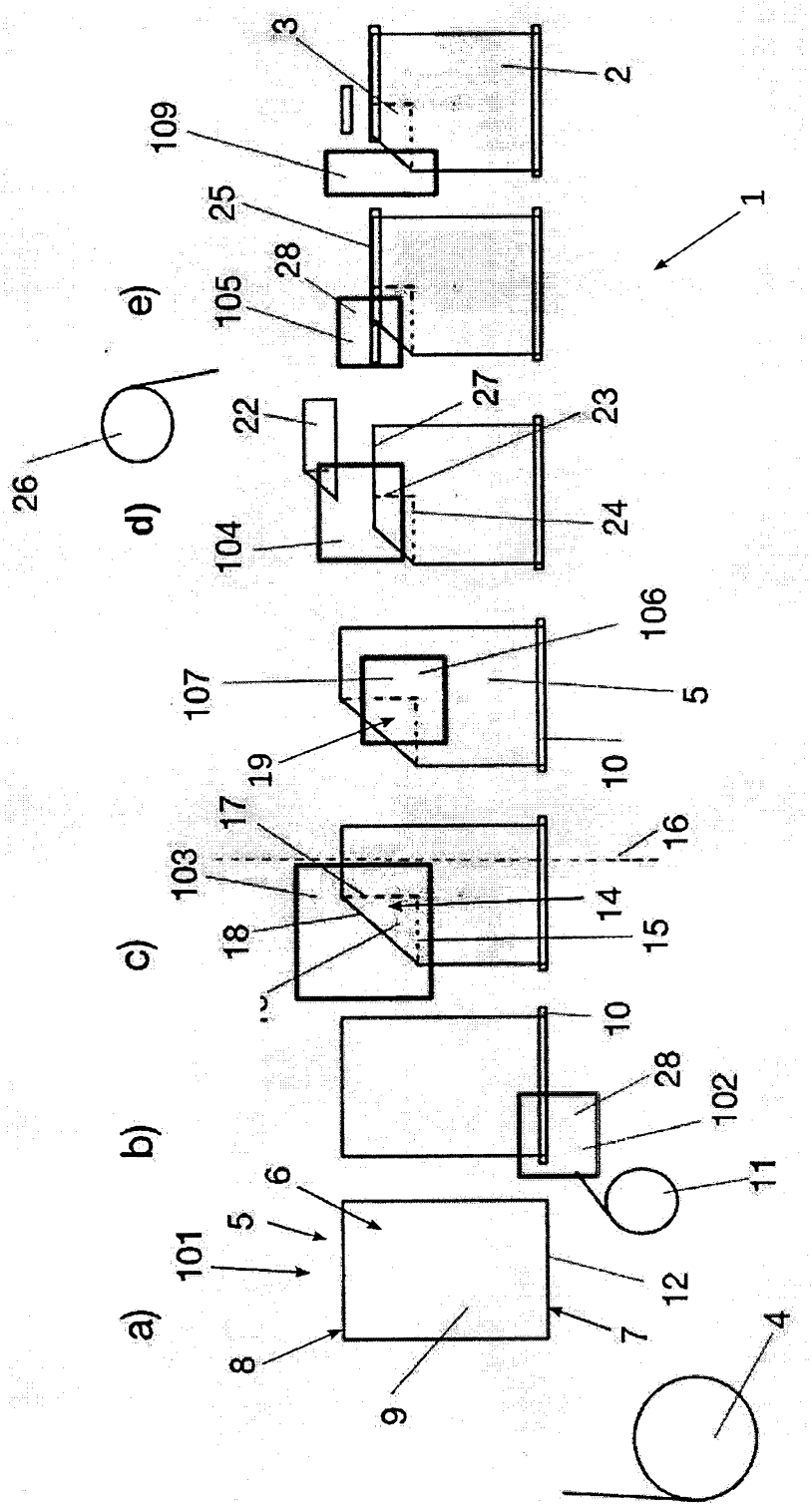
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Figure 4