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(54) Title: AN APPARATUS AND A METHOD FOR SEALING OPEN ENDS OF BAGS WITH EASILY OPENABLE SEAM AND A BAG WITH EASILY OPENABLE SEAM

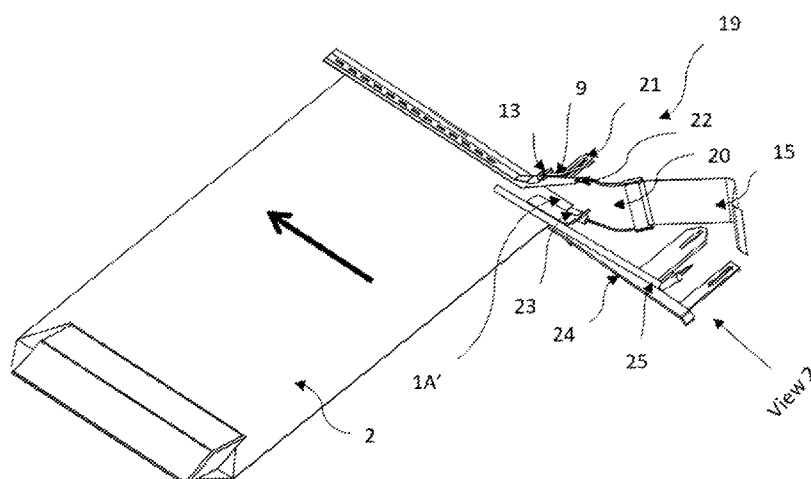


Figure 5

(57) Abstract: Invention discloses a method and an apparatus for making easily openable seams at open ends of bags and bags with openable seams. The bags may be block-bottom, pillow-type, and with or without side gussets. For seaming the open end of the bag, the apparatus has been provided with a folding means (19) which comprises a folder (20) which is capable of receiving a flat closing strip (15) and converting it into a U-shaped closing strip (15A) having two arms (15B and 15C), and between which the open end is placed. The apparatus is also capable of receiving a seam opening strip (9) that is placed over the open end that is placed inside the U-shaped closing strip (15A) to form a composite open end (33A). The composite open end (33A) is sewn or stitched to form the easy-to-open seam. The seam is openable simply by pulling the seam opening strip (9).



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## **An Apparatus And A Method For Sealing Open Ends Of Bags With Easily Openable Seam And A Bag With Easily Openable Seam**

### **Field Of Invention**

5 The present invention relates bags with openable seam and bags with openable seam produced using said method and apparatus. In a particular, the invention relates to an apparatus by which an easily openable seam is made at the open end of a storage bag and a method for making an easily openable seam at the open end of a storage bag. The apparatus and the method of invention are applied in  
10 manufacturing process of a storage bag. The openable seams made using the apparatus and method of invention are easy to open.

### **Background Of Invention**

Conventional woven packaging bags of a wide variety of size and shape are used  
15 in various situations. Bulk materials, such as flour, sugar, rice, seed, animal feed, chemicals, powdered materials or the like, for example, typically have been packaged in woven plastic bags in the past. Pet food, bird seed and other products sold in retail stores typically have been packaged in plastic film bags, due to limitation in the high-speed requirements in the filling and packaging operations  
20 limited the use of the woven bags in these applications.

Moreover, the pillow shaped bags have the drawback that stacking of the bags is difficult and also their high-speed filling on packaging line is not possible as the speed of stitching is typically less than the line speed of the modern packaging  
25 systems of making block bottom and valved bags. As a further major drawback, some bags after packing/stitching are not easily openable without use of scissors, knives or any other sharp instruments, which will eventually damage the bag. While opening the bag with use of such kind of sharp objects such as defined above may lead to spill out the material as well, therefore utmost care is taken  
30 while opening such kind of bags.

Presently, block bottom bags which are well known for rapid filling of the material with the provision of valve at end and can be stacked properly as well, due to the block bottom shape or square shape. But main disadvantage of such  
5 kind of bags is that these are not easily openable. There is therefore a need to provide bags that overcome the aforementioned limitations and that can be stacked, filled and closed as well as easy openable.

The term openable seam implies seams that are easily openable. As such it  
10 suggests that seams made using the apparatus and method of invention can be opened with ease or without any much efforts such that it does not require tearing of bag on which they are provided in any way including by use of sharp instrument like knives, scissors, hooks or any other method involving sharp instruments known to person skill in art.

15 Further, there are developments such as coated woven polypropylene fabric which are in the form of two layered structure on which third layer of bi-oriented polypropylene film (BOPP) is applied that can be reverse printed with high end graphics suitable for consumer type of packaging. This multilayer structure  
20 provides a stronger, more attractive bag than the conventional bags used for that purpose. Due to their tough, strong structure and good aesthetics, these multilayer woven bags are typically sewn shut on both ends such that they cannot be reused.

Many prior arts describe different kinds of easily openable techniques of opening  
25 bag.

U.S. patent 2008/0063322A1 ('322) discloses easy open re-closable packaging mesh bag where in the one end of the bag is pillow shaped while other end has drawstring, perforating around the end of mesh bag. It also describes one pull,  
30 easy to open mechanism with stitches which sew small strip of hard paper with

the end of mesh bag. It is evident from their Figure 3A, 4A that invention ('322) relates to pillow shaped bag and not the block bottom bag. Also, it is further evident from description given at para 0008 of invention ('322) that it relates to the mesh type bag without any coating or BOPP lamination. Further the invention  
5 does not disclose anything about how the technique of easy open is achieved.

A further example of conventional woven plastic bag is disclosed in U.S. patent 4373979 ('979). The patent ('979) describes the use of woven strips of highly longitudinally-oriented, high-density polyethylene or polypropylene in a bag  
10 construction in which the bag is formed from a seamed tube made of the woven plastic material. The seamed tube has gussets on either side with two open unsealed ends.. The patent ('979) describes the use of ultrasonic spot welds to seal portions of a bag made of such woven plastic strips, as opposed to sewing the seams of a bag or using a hot melt adhesive to seal the gusset forming pleat. The  
15 patent ('979) is hereby incorporated by reference herein. The patent ('979) purports to be an improvement for sealing a plastic bag. As noted in the patent ('979), sewing one end tends to take longer, thus adding time to the manufacturing process. In addition, the sewn ends in a conventional bag tend to be a weak portion of the bag, and a likely location for rips, tearing, and subsequent loss of  
20 contents during storing, shipping and handling.

Thus, the present invention overcomes the drawbacks in the stacking, rapid filling and easy closing and opening operations, and its multilayer structure also allows an attractive graphic display of the bags' ends (for example the front and the back)  
25 at the retail outlet. Further, there is a provision of easily openable seam for rapid opening of bag without usage of sharp instruments.

### **Objects of Invention:**

The main objective of invention is to provide a method and an apparatus for manufacturing woven packing bag which has at least at one end a block bottom shape.

- 5 Another objective of this invention is to provide a method and an apparatus for manufacturing woven packing bag which has atleast at one end a valve.

Further, objective of this invention is to provide an easily openable seam \ on the one end of bag to make bags easier to open.

10

Another object of invention is to provide a block bottom bag with an easily openable seam for easy upright stacking, quick filling and closing operation.

- Further objective of this invention is to provide an apparatus making easily  
15 openable seams on automated bag manufacturing lines that operate at high speeds.

**Brief Description Of Figures:**

Figure 1 shows a process of making bag with easily openable seam

Figure 1A shows the tubular fabric cut to a required length

- 20 Figure 1B shows the bottom open end of cut piece of fabric is drawn in on side and folded into an open base

Figure 1C shows a valve patch is attached to the open folded base on one side

Figure 1D shows folded edge with valve in place

Figure 1E shows cover patch sealing on the folded edge with valve

- 25 Figure 1F shows the top end of cut piece of fabric with improved opening strip

Figure 1G shows the top end of cut piece of fabric with stitching to form easily openable seam

Figure 2 shows a bag of the invention with easily openable seam wherein openable seam end and the block bottom end is shown

- 30 Figure 3 shows perspective view of the apparatus of invention

Figure 3A shows enlarge view 1 of the apparatus of invention

Figures 4, 4A, and 4B show the perspective views of apparatus with different stages of bag formation with easily openable seam mechanism

Figure 5 shows perspective view of the folding means and mechanism to form  
5 openable seam in bag

Figure 5A shows enlarge view 2 of the folding means

Figure 5B shows composite form due to folding means

Figures 6, 6B show the different type of construction of folding means

Figure 6A shows the U-shaped closing strip as it is formed from the flat closing  
10 strip

Figure 6C shows the composite end

#### **Summary Of Invention:**

The present invention provides a method and apparatus for manufacturing of  
15 storage bags with easily openable seams that are easy to open and a bag having  
easily openable seam that is easy to open. The bags may be block-bottom type,  
may have a valve, or may be of pillow type and made from a web sheet with  
more than one layer, comprises of a front wall, a back wall, a first side wall, a  
second side wall, an interior surface, an exterior surface, a top end, and a bottom  
20 end. The web sheet comprises a first layer made of a woven polymer or optionally  
non-woven polymeric web and a second layer made of adhesive coating or  
extrusion coating which is made from any material such as polypropylene,  
polyethylene, polyethylene terephthalate, polyamide, or any combination thereof,  
or paper.

25  
Optionally, a third layer is provided which comprises oriented polypropylene,  
biaxially-oriented polypropylene, oriented polyethylene, biaxially-oriented  
polyethylene, oriented polyethylene terephthalate, biaxially-oriented polyethylene  
terephthalate, oriented polyamide, biaxially-oriented polyamide, coated paper or  
30 any combination thereof.

- In an embodiment, the third layer is of BOPP lamination film with high end graphics or printing, such that it formed three layered structured bag. In further embodiments bag comprise of at least two layers such that first layer is made of a woven polymer or optionally non-woven polymeric web over which a second layer which is formed by coating is laid. Further, it is possible that the second layer comprises a printed area such that printing can be done by use of any such known printing methods performed by printing machine.
- 10 In an automated bag making line, a number of processes are carried out by which a tubular or a flat fabric is converted into a bag. A number of stations are provided to carry out these processes. Some of these are:
- Web roll feeding means wherein woven or non-woven fabric roll is loaded to feed the fabric is forward direction
  - 15 • Web edge guiding and unwinding means wherein the fabric is guided over rollers and unwinds from the fabric roll
  - Web fabric preparatory means wherein
    - o Preparatory means optional consist of web perforation means which removes all the air traps between the layers of the fabric for smooth
    - 20 o operation
    - o Preparatory means optionally consist of index hole punching means
    - o Web cleaning means
  - Inspection and sensing means which senses the quality of the fabric
  - Web cut length cutting means which cuts the fabric in required bag length
  - 25 • Transportation means which transports the fabric towards different zones of bag manufacturing
  - Traverse transfer and guiding/feeding means which changes the direction of fabric from longitudinal to transverse for bag formation
  - Defect Rejection means which rejects the defective fabric before bag
  - 30 formation

- Top and bottom edge opening means wherein one side either top or bottom edge of fabric is opened or folded
  - o the edge opening means vertically position
  - o Opening means have rotary mechanism
- 5 • Valve patch storing, conveying & pasting means wherein a patch is applied on the folded fabric before making the valve
  - Folding means which folds the fabric edge with valve patch to form a valve
  - Further transporting means further transports the bag with valve at one end to the further stations
- 10 • Seaming means wherein openable seam is made at the open end of the bag
  - Stacking means store the bags

Main automation & controlling means refers to the automatic process or high-speed delivery of the bag formation with controlled process

- 15 In the apparatus of the invention which is designed to provide an easily openable seam on a bag manufactured on an automated line, the seaming means (32) may be a part of an independent seaming station suitably attached to said automated line. In particular, the apparatus of the invention receives the cut piece of fabric (1) with sealed bottom formed at one of its two ends. At the open end of the bag,
- 20 the apparatus has a provision by which an easily openable seam is formed which is easy to open. For this purpose, the a folding means (19) is provided in the apparatus which comprises a folder (20) which is capable of receiving a flat closing strip (15) and converting it into a U-shaped closing strip (15A) having two arms (15B and 15C), and which is laid at the open end such that the open end is
- 25 placed between the two arms (15B and 15C). The apparatus is also capable of receiving a seam opening strip (9) that is placed over the open end that is placed inside the U-shaped closing strip (15A) to form a composite open end (33A). The composite open end is sewn or stitched to form the easily openable seam that is easy to open. The seam is openable simply by pulling the seam opening strip (9).
- 30 The seaming means (32) provides seaming with an easily openable mechanism

using conventional stitching means wherein the strip seam refer to overlaying of the strip on the bag and simultaneously stitching it with sewing means which is referred as conventional stitching method such that end user has to just pull of the strip to open the bag without much efforts and without damaging the bag.

5

Further in one of the embodiments, the seaming mechanism by which the easily openable seam is formed may be defined as any of such method of forming a seam such that it can be opened with ease. The bag having such easily openable seam may be termed as easily openable bag. Such kind of seaming mechanisms can be strip stitching or zip lock or strip welding or pasting.

10

In another embodiment, the block bottom bag with easily openable seam can be without valve at one end. Thus, in situations where prefilling of material is done block bottom bags without valve at one end is preferred in which easily openable seam can be made post filling.

15

The invention also describes a method by which an easy-to-open or easily openable seam is formed at an open end of a bag on an automated bag making line. The method uses the apparatus disclosed herein. Finally, the invention describes a bag provided with an easily openable seam that is openable by pulling the seam opening strip (9).

20

**List of Parts:**

- |           |  |  |
|-----------|--|--|
| <p>25</p> | <p>1. Cut piece of Fabric<br/>1A'. Open top end of cut piece of fabric<br/>1B'. Open bottom end of the cut piece of fabric<br/>1C'. Valve end of cut piece of fabric</p> | <p>1D'. Stitched end of cut piece of fabric<br/>2. bag<br/>3. Conveyor table<br/>35 4. Conveyor Belt Upper<br/>5. Conveyor Belt Lower<br/>6. Pressure pads</p> |
| <p>30</p> |  |  |

	7. Main Frame		20B. Planer second end
	8. First roll	20	20C. Transition area
	9. Seam opening strip		20D and 20E. Longitudinal
	10. Guide Rod		edges
5	11. Collar-1		21. Bracket
	12. Guide-1		22. Folder upper lip
	13. Guide-2	25	23. Folder lower lip
	14. Second roll		24. Lower bag end guide
	15. Flat closing strip		25. Upper bag end guide
10	15A. U Shaped closing strip		26. Sewing means
	15B. Upper arm		27. Cutter assembly
	15C. Lower arm	30	28. blade
	16. Collar-2		29. cylinder
	17. Horizontal Flange Roller		30. spring
15	18. Vertical Flange Rollers		31. support sheet
	19. Folding means		32. seaming means
	20. Folder body	35	33. composite
	20A. Planar first end		33A. Composite open end

**Detail description of Invention:**

The term fabric used in the present application is meant to encompass woven and  
 40 nonwoven fabric, sheet or flexible films made of any material suitable for sack  
 making. Fabric can be made from a web sheet with more than one layer. It  
 comprises a first layer made of a woven polymer or optionally non-woven  
 polymeric web and a second layer made of adhesive coating or extrusion coating  
 which is made from any material such as polypropylene, polyethylene,  
 45 polyethylene terephthalate, polyamide, or any combination thereof, or paper.

Optionally, a third layer is provided which comprises oriented polypropylene, biaxially-oriented polypropylene, oriented polyethylene, biaxially-oriented polyethylene, oriented polyethylene terephthalate, biaxially-oriented polyethylene terephthalate, oriented polyamide, biaxially-oriented polyamide, coated paper or  
5 any combination thereof.

The apparatus and the method of invention are described here on the basis of a block-bottom bag provided with an easily openable seam that is easy to open. However, the apparatus may be used on pillow shaped bags or bags with gussets  
10 on the sides, or bags with valves at one end without any alterations to the apparatus.

Figure 1 shows a cut piece of fabric (1) as shown in Figure 1A made from a flat web tube or tubular multilayer web proceeds on a bag making line from cutting  
15 station to a folding station where at one end of the cut piece of fabric (1), preferably bottom end (1B'), the cut piece (1) is drawn on side and folded into an open base as shown in Figure 1B. Such kind of folding can be achieved by any electro mechanical method of bag folding. The cut piece of the fabric (1) is  
20 advanced in forward direction (shown by arrows in Figure 1) in a manner that a valve patch is attached to the bottom end (1B') of the cut piece (1) of the fabric as shown in Figure 1C wherein the valve patch can be applied by any known means such as by gluing, pasting, hot air, welding or any other such method to provide good adherence.

25 Over the course of following steps, the bottom base is folded as shown in Figure 1D and a cover patch is applied as shown in Figure 1E which forms a seal to form a block bottom bag (2) with a valve at one end from a cut piece of fabric (1). The cut piece of fabric (1) with sealed block bottom formed at its one end is then taken to seaming station where combination of folded and non-folded strips are overlaid  
30 on the top end (1A') of the cut piece of fabric (1) as shown in Figure 1F.

Simultaneously, the bag (2) is sent for strip-sealing by any of the conventional sealing method such as by use of sewing means such that the sealed end is easily openable as shown in Figure 1G.

- 5 Figure 2 shows a block bottom bag with valve at one end with an easily openable seam wherein the bag is opened without damaging or without using any kind of sharp object to tear it.

10 In another embodiment, figure 2 shows a bag of invention with an easily openable seam.

Those skilled in the art will understand and appreciate that the bag according to the invention may vary in size, dimensions, and shape without departing from the scope of the invention, and that the foregoing description of the preferred  
15 embodiments is not intended to limit the scope of the invention as defined by the claims. For example, those skilled in the art will understand and appreciate that the inventive bag can have sealed and sewn ends in a tubular bag with side gussets, or a block bottoms at both ends, or a block bottom at one and a pillow shaped end at the other, although not shown. Those skilled in the art will also  
20 appreciate that an easily openable seam can be provided in a number of ways that may vary from those expressly described and shown. Similarly, those skilled in the art will appreciate that terms such as “front” and “rear,” and “top” and “bottom”, are useful in describing a bag, but essentially depend on a bag's orientation when such terms are used and are therefore not limiting as to a bag's  
25 orientation.

Figure 3 shows the perspective view of apparatus of invention wherein an arrangement of continuous bag making with easily openable seam with block bottom valve on other side of cut piece of the fabric (1) is shown.  
30

The block bottom bag (2) with valve at one end obtained after valve formation, is conveyed further on a conveyor table (3) by upper and lower conveyor belts (4, 5) which is attached to the main frame (7) holding the bag (2) from top and bottom and making fabric slide on the conveyor table (3). As the bag (2) advances, the  
5 spring (30) loaded pressure pads (6) (shown in Figure 3A also) which makes the block bottom bag (2) with valve at one end properly spread over conveyor table (3) in a straight line to avoid any misalignment or crease formation during bag making process. Such pressure pads (6) can be a block or any other holding means which apply a sufficient pressure to hold the block bottom bag (2) with valve at  
10 one end. Pressure applied on the bag can be controlled or monitored by spring (30) arrangement provided (as shown in Figure 3A).

A block bottom bag (2) with valve at one end is further transferred by the upper and lower conveyor belts (4, 5) to the stitching zone for providing an easily  
15 openable seam. To the open end of the cut piece of the fabric (1A') stitching is done which is performed by overlaying the flat closing strip (15) with U-shaped closing strip (15A), wherein the U-shape is formed by the folding means (19). At least one seam opening strip (9) overlays onto the U-shaped closing strip (15A) such that bag, flat closing strip (15) in the form of U-shaped closing strip (15A)  
20 and a seam opening strip (9) form a composite (33) (as shown in Figure 5C). The composite (33) is then conveyed along the conveyor table (3) simultaneously for stitching by the sewing means (26).

In one of the embodiments, the width of the flat closing strip (15) can be of any  
25 size such that during U-shape formation, it covers the top open end of cut piece of fabric (1A') from front till back and also sufficient in width after fold such that the seam opening strip (9) can be overlaid on it and can be stitched (see Figure 6C).

In Figure 3A, the enlarged view of the Figure 3 observed from view 1, wherein the direction of movement of the flat closing strip (15) is shown.

5 In Figure 4, the apparatus of invention where the block bottom bag (2) with valve at one end is conveyed over conveyor table (3).

In the Figure 4A, a block bottom bag (2) with valve at one end is moved to the position by the upper and lower conveyor belts (4, 5) wherein the flat closing strip (15) in the form of U-shaped closing strip (15A) covers the bag (2) (shown in  
10 Figure 5, 5B). The block bottom bag (2) with valve at one end is raised to a height just to clear the lower bag end guide (25) so that it enters the folder body (20), such that it is positioned in the vicinity of the upper and lower lip (22, 23) of the folder body (20). The folder body (20) has a surface (20A) which supports the wider strip during its advancement. Towards the end of the surface (20A), two  
15 lips, namely the upper lip (22) and the lower lip (23) are formed by curving the edges of the surface (20A). The positioning of the bag (2) in the vertical direction is governed by the lower bag end guide (24) and upper bag end guide (25) such that these guides (24, 25) act a barrier to the bag (2) so that the bag (2) only moves between them. Once bag (2) has taken proper vertical position such that the  
20 bag (2) lies in the vicinity of the folder body (20) upper and lower lips (22, 23), the folder body (20) will form the advancing flat closing strip (15) into a U-shaped structure with U shaped closing strip (15A) to cover the open end of the cut piece of fabric (1A') and simultaneously seam opening strip (9) is overlaid over the U-shaped flat closing strip (15).

25 U-shaped closing strip (15A) formed by the folder body (20) from the flat closing strip (15) is drawn from a second roll (14) and it is pulled by the sewing machine (26). From the second roll (14) the flat closing strip (15) is laid on a guide rod (10) (shown in Figure 3A) wherein a collar-2 (16) (shown in Figure 3A) is  
30 provided to avoid fall off of flat closing strip (15) from the guide rod (10). Then

the flat closing strip (15) goes to horizontal flanged roller (17) such that it changes its direction and move along the direction of the movement of bag (2). The flat closing strip (15) is now transferred to the vertical flanged rollers (18) which makes strip vertical such that now the plane of the flat closing strip (15) lies  
5 perpendicular to the plane of the conveyor table (3). After that, flat closing strip (15) from the vertical flanged rollers (18) enters into folding means (19) which makes flat closing strip (15) shape like U-type and that's U-shaped covering strip (15A) covers open end of the cut piece of fabric (1A').

10 Simultaneously, seam opening strip (9) which is coming from a first roll (8) through the guide rod (10) (shown in Figure 3A) mounted with a collar-1 (11) (shown in Figure 3A) is provided to avoid fall off seam opening strip (9) from guide rod (10). The seam opening strip (9) goes to guide-1 (12) (shown in Figure 3A) so as to align the seam opening strip (9) properly. Further the seam opening  
15 strip (9) enters into the guide-2 (13) (shown in Figures 5 and 5A) which is located over the folding means (19) to ensure that the seam opening strip (9) is aligned with top surface of the U-shaped covering strip (15A) obtained from flat closing strip (15) such that, it forms a pull off element to open the bag (shown in Figure 2).

20 In one of the embodiments, collar-1 and collar-2 (11, 16) (shown in Figure 3A) provided on the guide rod (10) can be of any shape such as round metallic or non-metallic element, flat or round sheets or any other structure which covers the seam opening strip (9) as well as flat closing strip (15) and act as a barrier such that the  
25 said seam opening strip (9) and flat closing strip (15) may not fall off the guide rod (10).

In another embodiment, guide-1 (12) (shown in Figure 3A) can be of U-shape structure wherein the width of the guide-1 (12) is more than the width of the seam

opening strip (9) so that seam opening strip (9) can easily pass through it without being damaged.

Further in another embodiment, the guide-2 (13) (shown in Figure 5, 5A) is a part of folding means (19) which can also have U-shape or structure for easy movement of seam opening strip (9). Round edges are preferred at the inner surfaces of the guide-2 (13) for smooth movement of seam opening strip (9) without damaging.

Once all three components i.e. the block bottom bag (2) with valve at one end, the flat closing strip (15) folded in the form of U-shaped closing strip (15A) and the seam opening strip (9) form the composite end (33A) of the composite (33) (shown in Figure 5B). As soon as the composite end (33A) is formed then simultaneously stitching starts with the help of the sewing means (26) on the block bottom bag (2) with valve at one end with the seam opening strip (9) and the U-shaped closing strip (15A) in the same direction of the movement of the fabric bag (2).

In the Figure 4B, bag after stitching moves out of the sewing means (26) and is conveyed to a cutter region wherein a cutter assembly (27) is provided. As the multiple bags are advancing during continuous production of the bags, these bags are well connected by each other with flat closing strip (15) and seam opening strip (9) as well as stitching thread. The cutter assembly (27) comprises a blade (28) and a cylinder (29) wherein said blade (28) which can be any sharp object or cutting can be done by any means such as hot thermal cutting, cold cutting or ultrasonic cutting. The movement of cylinder (29) perpendicular to the direction of the moving bag facilitates the movement of the blade (28), thus the perpendicular movement of the cylinder (29) converts movement of the blade (28) to rotational so as to engage with the bag during cutting process and disengage the same blade (28) when cutting is not required. Such movement of the blade (28)

can also be done by any commercially available electronic devices so as to provide the rotational movement to the blade (28).

As shown in Figure 5, a folding means (19) is designed to lay the flat closing strip (15) over the open top end of the cut piece of the fabric (1A'). Such overlay can be done by making the flat closing strip (15) in the form of U-shaped closing strip (15A) over the front and back side of the bag (2) which enables to provide a path for the seam opening strip (9) so that it can be aligned with flat closing strip (15) and block bottom bag (2) with valve at one end. This folding means (19) comprises of a folder body (20), lower bag end guide (24) and upper bag end guide (25). A folder body (20) comprises a planar first end (20A) through which the flat closing strip (15) enters the folder body (20), whereby the folder upper lip (22) and folder lower lip (23) convert the flat closing strip (15) into a U-shaped covering strip (15A). The said folder body (20) also comprises an adjustable bracket (21) which is attached to the base of the sewing means (26) wherein a slot is provided in order to move the folder body (20) perpendicularly to the direction of the moving bag (2) so as to facilitate the wide range of length of bag (2) which can be formed.

Figure 5A shows the enlarged view of the Figure 5, specially of folding means (19) which also comprises of a pair of upper and lower bag end guides (25, 24) forming between them a guiding space G through which bag end (1A') travels before entering the U-shaped closing strip (15A). The upper and lower bag end guides (25, 24) are liner members in the shape of plate, rods, or bars and having a collection surface at their upper end.

In figure 5B, the bag (2) is shown with the flat closing strip (15) in the form of U-shaped closing strip (15A) to form a composite (33) where composite end (33A) is formed and after which the process of sewing begins.

30

Figure 6, 6A, and 6B show the perspective views of different type of construction of folding means wherein Figure 6 shows folding means (19) comprises of a folder body (20) guide-2 (13) and bracket (21). The folder body (20) is constructed in such a way that it has a first end (20A) which receives the flat closing strip (15), second end (20B) that is in U shaped and a transition area (20C) that covers the area from first end (20A) and second end (20B).

In another embodiment, the folder body comprises of upper and lower lip (22, 23) at the second end (20B) of the folder body (20), which are formed by folding the longitudinal edges (20D, 20E). The flat closing strip (15) while passing through the lips (22, 23) contributes to the formation of a U-shaped structure. Flat closing strip (15) thus transforms into the form of U-shaped closing strip (15A) with two arms; namely upper arm (15B) and a lower arm (15C) for laying of the upper surface of fabric and lower surface of fabric respectively.

A guide-2 (13) is provided to guide the seam opening strip (9) so that it is perfectly laid onto the U-shaped closing strip (15A). A bracket (21) affixed to the main frame (7) (as shown in Figure 3A) is provided to move the folding means (19) perpendicular to the direction of the moving bag (2) such that bag (2) of wide range of length can be formed with improved opening feature.

Figure 6B shows the folding means (19) comprising of folder body (20) wherein said folder body (20) is constructed in such a way that it has a first end (20A) which is in oblong or slotted form with smooth edges to facilitate the movement of flat closing strip (15) with ease and second end (20B) that is in U shaped and a transition area (20C) that covers the area from the planar first end (20A) and second end (20B). Here the transition area (20C) has a support sheet (31) which guides the flat closing strip (15) into the folder upper and lower lips (22, 23). The folder body also, comprises of upper and lower lip (22, 23) at the second end (20B) of the folder body (20), which are formed by folding the longitudinal edges

(20D, 20E). The flat closing strip (15) while passing through the lips (22, 23) contributes to the formation of a U-shape structure. Flat closing strip (15) thus transform in the form of U-shaped closing strip (15A) of which two arms; namely upper arm (15B) and a lower arm (15C) for laying of the upper surface of fabric and lower surface of fabric respectively.

The method of formation of easily openable seam on a storage bag involves the following steps:

- a. Loading the woven or non-woven fabric roll on the web roll feeding means and moved longitudinal to the direction of the conveyor table.
- b. Guiding the web fabric is then guide over roller and unwinds from fabric roll by the web guiding and unwinding means
- c. Passing the said web fabric over fabric preparatory means where in optionally web perforation means removes all the air traps between the layers of the fabric for smooth operation
- d. Cutting the web fabric into desired bag length by web cutting means and is transported to different zones by transportation means provided that the web fabric is preferably inspected by inspection means for quality of the fabric
- e. Moving the said bag to the seaming means (32) where easily openable seam is constructed at the open end of the bag characterised in that
  - supplying on a conveyor table (3) bags (2) with one end (1A') to be sealed,
  - supplying a flat closing strip (15) and a seam opening strip (9)
  - passing said flat closing strip (15) through the folding means (19) to form U-shaped closing strip (15A) having upper and lower arms (15B and 15C),

- passing the bags (2) with open end (1A') through the guiding space (G) formed between the pair of upper and lower bag end guides (25, 24) before entering the U-shaped closing strip (15A),
- 5                   • passing the seam opening strip (9) through the guide-2 (13) located over the planer second end (20B) to align said seam opening strip (9) within the depth of upper arm (15B) of said U-shaped closing strip (15), to form a composite open end (33A) formed by said seam opening strip (9), said U-shaped closing strip (15A) and said open end (1A'),
- 10                   • making a seam through the composite open end (33A) using the seaming means (32) so as to provide a bag with easily openable seam.

f. After stitching, the bag is conveyed to the stacking means where it is stored.

- 15 From the foregoing discussion, it is clear that there are a number of embodiments of the invention.

In the preferred embodiment, an apparatus for sealing ends of bags with easily openable seam is disclosed. It is affixed to a main frame (7) provided on a bag making line. The apparatus comprises of:

20                   - a first roll (8) for rolling out a seam opening strip (9) and a second roll (14) to roll out a flat closing strip (15),

                      - a conveyor table (3) to convey bags (2) with open end (1A'),

                      - a set of vertical rollers (18) changing the orientation of the flat closing strip (15) into a vertical plane,

25                   - a folding means (19) to fold the vertically positioned flat closing strip (15) into a U-shaped closing strip (15A) of predetermine depth of its upper and lower arms (15B, 15C), wherein said folding means (19) has a folder body (20) having a planar first end (20A) which receives said flat

- 5 closing strip (15), and a second end (20B) that is shaped in a U-shape, a transition area (20C) that transitions from planar shape at said first end (20A) to the U-shape at the second end (20B); upper lip (22) and a lower lip (23) leading to said second end (20B) that are formed by folding of the longitudinal edges (20D, 20E) of said folder body (20),
- a pair of upper and lower bag end guides (25, 24) forming between them a guiding space (G) through which said bag end (1A') travels before entering the U-shaped closing strip (15A),
  - a guide-2 (13) located over the second end to align said seam opening strip (9) within the depth of upper arm (15B) of said U-shaped closing strip (15), to form a composite open end (33A) formed by said seam opening strip (9), said U-shaped closing strip (15A) and said open end (1A'),
  - a seaming means (32) to form a seam through the composite open end (33A).
- 10
- 15

In one embodiment, the depth of said upper and lower arms (15B and 15C) of the U-shaped closing strip (15) is unequal.

- 20 In a further embodiment, the upper and lower bag end guides (25, 24) are linear members. These can be in the shape of plate, rods or bars and having a collection surface at their upstream end.

25 In a still further embodiment, the first end (20A) of the folder body (20) is provided with an entry loop through which said flat closing strip (15) is guided onto said folder body (20).

In yet another embodiment, a support bracket (21) is provided to affix said folding means (19) to the main frame (7).

In a still further embodiment, guide rod (10) with a collar-1 (11) mounted on it is positioned in the path of seam opening strip (9).

In another embodiment, a guide-1 (12) is provided, which is in the form of a loop  
5 through which said seam opening strip (9) passes before it passes through said guide-2 (13).

In still another embodiment, the seaming means (32) are selected from a group comprising a sewing machine, a strip stitching machine, a zip lock forming  
10 machine, a strip welding machine or a pasting machine.

The invention also discloses a method of making bags with easily openable seams using the apparatus as disclosed herein. The method comprises the steps of:

- 15 a. supplying on a conveyor table (3) bags (2) with one end (1A') to be sealed,
- b. supplying a flat closing strip (15) and a seam opening strip (9)
- c. passing said flat closing strip (15) through the folding means (19) to form U-shaped closing strip (15A) having upper and lower arms (15B and 15C),
- 20 d. passing the bags (2) with open end (1A') through the guiding space (G) formed between the pair of upper and lower bag end guides (25, 24) before entering the U-shaped closing strip (15A),
- e. passing the seam opening strip (9) through the guide-2 (13) located over the planar second end (20B) to align said seam opening strip (9)  
25 within the depth of upper arm (15B) of said U-shaped closing strip (15), to form a composite open end (33) formed by said seam opening strip (9), said U-shaped closing strip (15A) and said open end (1A'),
- f. making a seam through the composite open end (33) using the seaming means (32) so as to provide a bag with easily openable seam.

30

In an embodiment of the method disclosed here, the depth of said upper and lower arms (15B and 15C) in the aforementioned step c is unequal.

5 In another embodiment of the method disclosed here, the upper and lower bag end guides (25, 24) are linear members in the shape of plate, rods or bars and having a collection surface at their upstream end.

10 In yet another embodiment of the method, the first end (20A) of the folder body (20) is provided with an entry loop through which said flat closing strip (15) is guided onto said folder body (20).

In a still further embodiment of the method of invention, a support bracket (21) is provided to affix said folding means (19) to said main frame (7).

15 In a further embodiment of the method, guide rod (10) with a collar-1 (11) mounted on it is positioned in the path of seam opening strip (9).

20 In another embodiment of the method, a guide-1 (12) is provided, which is in the form of a loop through which said seam opening strip (9) passes before it passes through said guide-2 (13).

25 In a yet another embodiment of the method, the seaming means (32) are selected from a group comprising a sewing machine, a strip stitching machine, a zip lock forming machine, a strip welding machine or a pasting machine.

30 The invention also discloses a bag made using the apparatus and the method disclosed herein. It is evident from the foregoing discussion that the bag has the characterising feature that it has an easy-to-open seam. In particular, the bag has an open end (1A') sealed with an easily openable seam. The easily openable seam comprises a seam made through a composite open end (33A). The composite open

end (33A) is formed at said end (1A') by overlaying least one seam opening strip (9) overlaid onto a U-shaped closing strip (15A) having an upper arm and lower arm (15B and 15C) and wherein the open end (1A') is placed between the said upper arm (15B) and the lower arm (15A) of the U-shaped closing strip (15). The  
5 bag of the invention may be made from coated woven polypropylene fabric which may be in the form of two layered structure on which third layer of bi-oriented polypropylene film. Further, the bag may be of block-bottom type.

While the above description contains much specificity, these should not be  
10 construed as limitation in the scope of the invention, but rather as an exemplification 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,  
15 but by the appended claims and their legal equivalents.

**Claim:**

1. An apparatus for sealing open ends of a bag with an easily openable seam, said apparatus affixed to a main frame (7) and provided on a bag making production line, characterised in that said apparatus comprises:
  - 5 - a first roll (8) for rolling out a seam opening strip (9) and a second roll (14) to roll out a flat closing strip (15),
  - a conveyor table (3) to convey bags (2) with open end (1A'),
  - a set of vertical rollers (18) changing the orientation of the flat closing strip (15) into a vertical plane,
  - 10 - a folding means (19) to convert the vertically positioned flat closing strip (15) into a U-shaped closing strip (15A) of predetermine depth of its upper and lower arms (15B, 15C), wherein said folding means (19) has a folder body (20) having a planar first end (20A) which receives said flat closing strip (15), and a second end (20B) that is shaped in a U-shape, a transition area (20C) that transitions from planar shape at said first end (20A) to the U-shape at the second end (20B) and an upper lip (22) and a lower lip (23) leading to said second end (20B) that are formed by folding of the longitudinal edges (20D, 20E) of said folder body (20),
  - 15 - a pair of upper and lower bag end guides (25, 24) forming between them a guiding space (G) through which said bag end (1A') travels before entering the U-shaped closing strip (15A),
  - a guide-2 (13) located over the second end to align said seam opening strip (9) within the depth of upper arm (15B) of said U-shaped closing strip (15), to form a composite open end (33A) formed by said seam opening strip (9), said U-shaped closing strip (15A) and said open end (1A'),
  - 20 - a seaming means (32) to form a seam through the composite open end (33A).

2. The apparatus as claimed in claim 1, wherein the depth of said upper and lower arms (15B and 15C) is unequal.
3. The apparatus as claimed in claim 2, wherein said upper and lower bag end guides (25, 24) are linear members in the shape of plate, rods or bars and having a collection surface at their upstream end.
4. The apparatus as claimed in claims 1 to 3, wherein said first end (20A) is provided with an entry loop through which said flat closing strip (15) is guided onto said folder body (20).
5. The apparatus as claimed in claims 1 to 4, wherein a support bracket (21) is provided to affix said folding means (19) to said main frame (7).
6. The apparatus as claimed in claims 1 to 5, wherein a guide rod (10) with a collar-1 (11) mounted on said guide rod (10) is positioned in the path of seam opening strip (9).
7. The apparatus as claimed in claims 1 to 6, wherein a guide-1 (12) is provided, said guide-1 (12) being a loop through which said seam opening strip (9) passes before passing through said guide-2 (13).
8. The apparatus as claimed in claims 1 to 7, wherein said seaming means (32) is selected from a group comprising a sewing machine, a strip stitching machine, a zip lock forming machine, a strip welding machine or a pasting machine.
9. A method of sealing open end of a bag with easily openable seam using the apparatus as claimed in claims 1 to 8, characterised in that said method comprising the steps of:

- a. supplying on a conveyor table (3) bags (2) with one end (1A') to be sealed,
  - b. supplying a flat closing strip (15) and a seam opening strip (9)
  - c. passing said flat closing strip (15) through the folding means (19) to form  
5 U-shaped closing strip (15A) having upper and lower arms (15B and 15C),
  - d. passing the bags (2) with open end (1A') through the guiding space (G) formed between the pair of upper and lower bag end guides (25, 24) before entering the U-shaped closing strip (15A),
  - 10 e. passing the seam opening strip (9) through the guide-2 (13) located over the planar second end (20B) to align said seam opening strip (9) within the depth of upper arm (15B) of said U-shaped closing strip (15), to form a composite open end (33A) formed by said seam opening strip (9), said U-shaped closing strip (15A) and said open end (1A'),
  - 15 f. making a seam through the composite open end (33A) using the seaming means (32) so as to seal the open end of said bag with an easily openable seam.
10. The method as claimed in claim 9, wherein the depth of said upper and lower  
20 arms (15B and 15C) in said step c is unequal.
11. The method as claimed in claims 9 and 10, wherein said upper and lower bag  
end guides (25, 24) are linear members in the shape of plate, rods or bars and  
having a collection surface at their upstream end.  
25
12. The method as claimed in claims 9 to 11, wherein the first end (20A) is  
provided with an entry loop through which said flat closing strip (15) is  
guided onto said folder body (20).

13. The method as claimed in claims 9 to 12, wherein a support bracket (21) is provided to affix said folding means (19) to said main frame (7).
14. The method as claimed in claims 9 to 13, wherein a guide rod (10) with a collar-1 (11) mounted on said guide rod (10) is positioned in the path of seam opening strip (9).
15. The method as claimed in claims 9 to 14, wherein a guide-1 (12) is provided, said guide-1 (12) being a loop through which said seam opening strip (9) passes before passing through said guide-2 (13).
16. The method as claimed in claims 9 to 15, wherein said seaming means (32) is selected from a group comprising a sewing machine, a strip stitching machine, a zip lock forming machine, a strip welding machine or a pasting machine.
17. A bag (2) characterised in that said bag (2) has an end (1A') sealed with an easily openable seam formed using the apparatus as claimed in claims 1 to 8, wherein said openable seam comprises a seam made through a composite open end (33A) formed at said end (1A'), said composite open end (33A) being formed with at least one seam opening strip (9) overlaid onto a U-shaped closing strip (15A) having an upper arm and lower arm (15B and 15C) to have said end (1A') placed within them.
18. The bag as claimed in claim 17, wherein said seam is made using seaming means (32) selected from a group comprising a sewing machine, a strip stitching machine, a zip lock forming machine, a strip welding machine or a pasting machine.

19. The bag as claimed in claims 17 and 18, wherein said bag is made from coated woven polypropylene fabric which are in the form of two layered structure on which third layer of bi-oriented polypropylene film.
- 5 20. The bag as claimed in claims 17-19, wherein said bag is of block-bottom type.
21. The bag as claimed in claims 1-20, wherein the said two layers have a first layer made of a woven polymer or optionally non-woven polymeric web and  
10 a second layer made of adhesive coating or extrusion coating which is made from any material such as polypropylene, polyethylene, polyethylene terephthalate, polyamide, or any combination thereof, or paper.

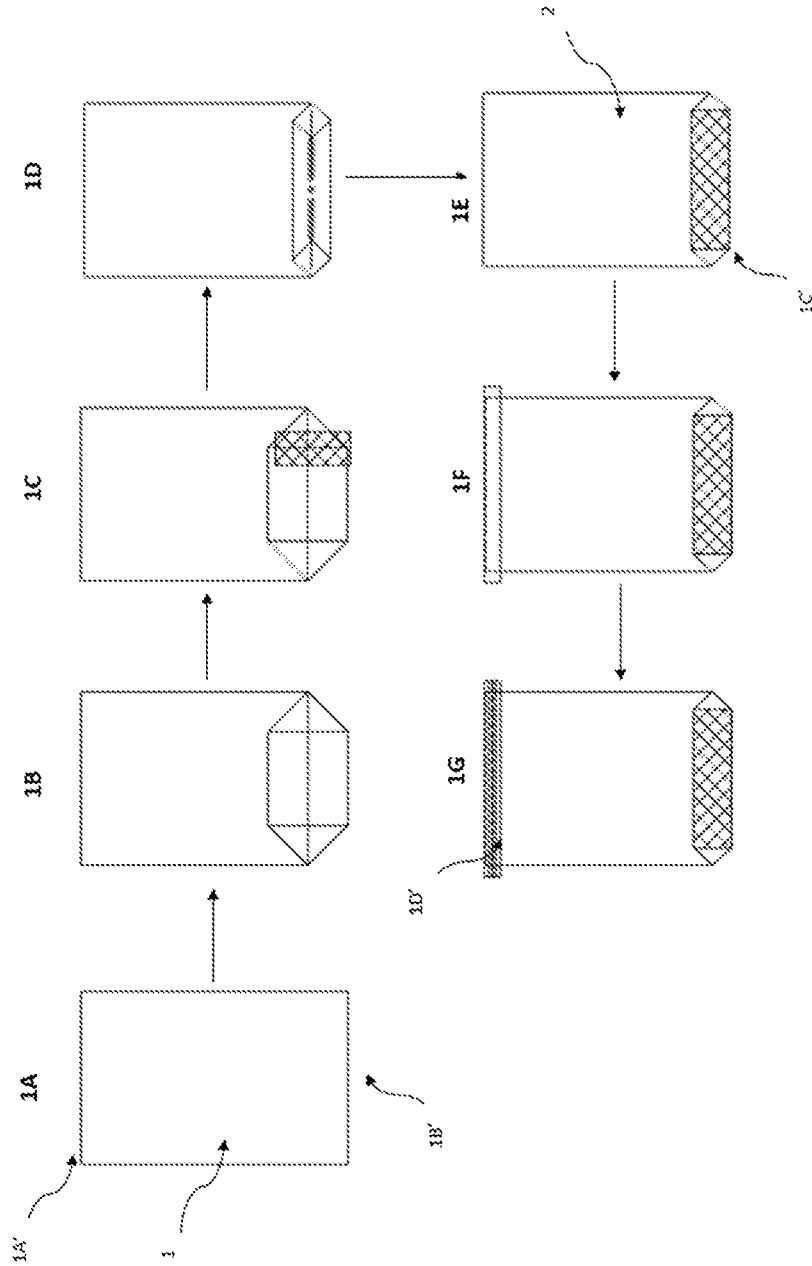


Figure 1

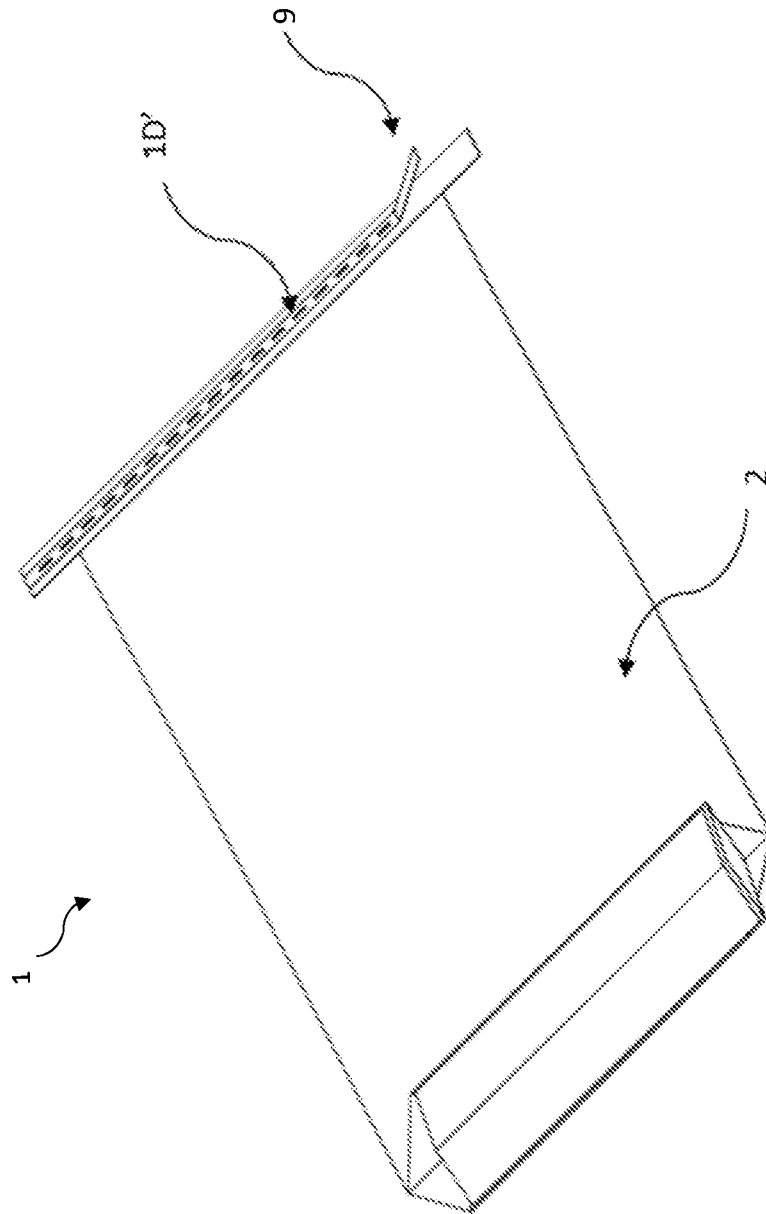


Figure 2

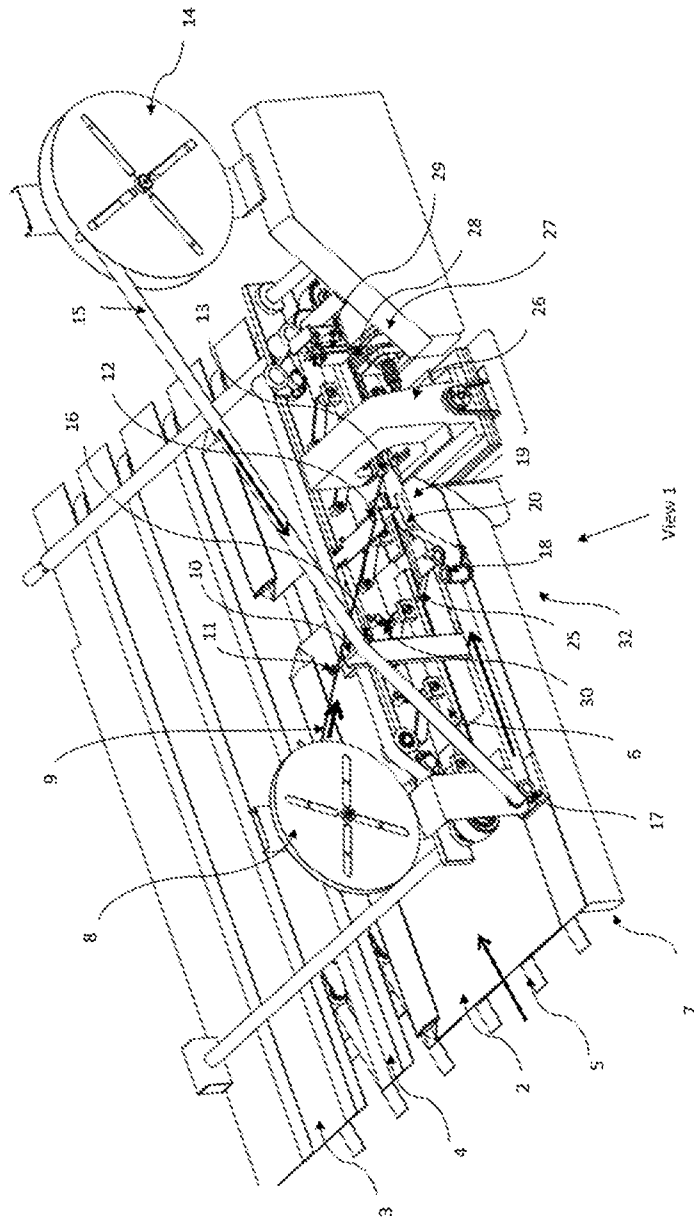


Figure 3

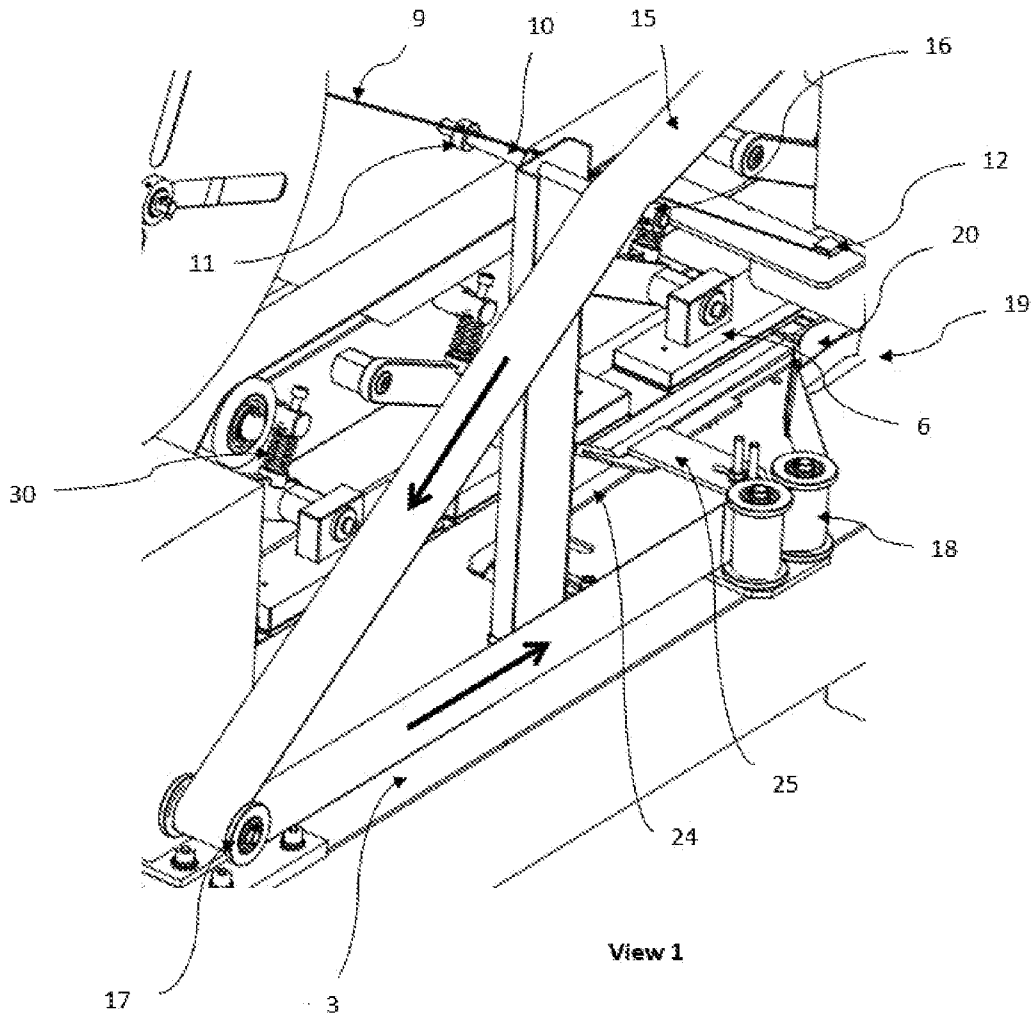


Figure 3A

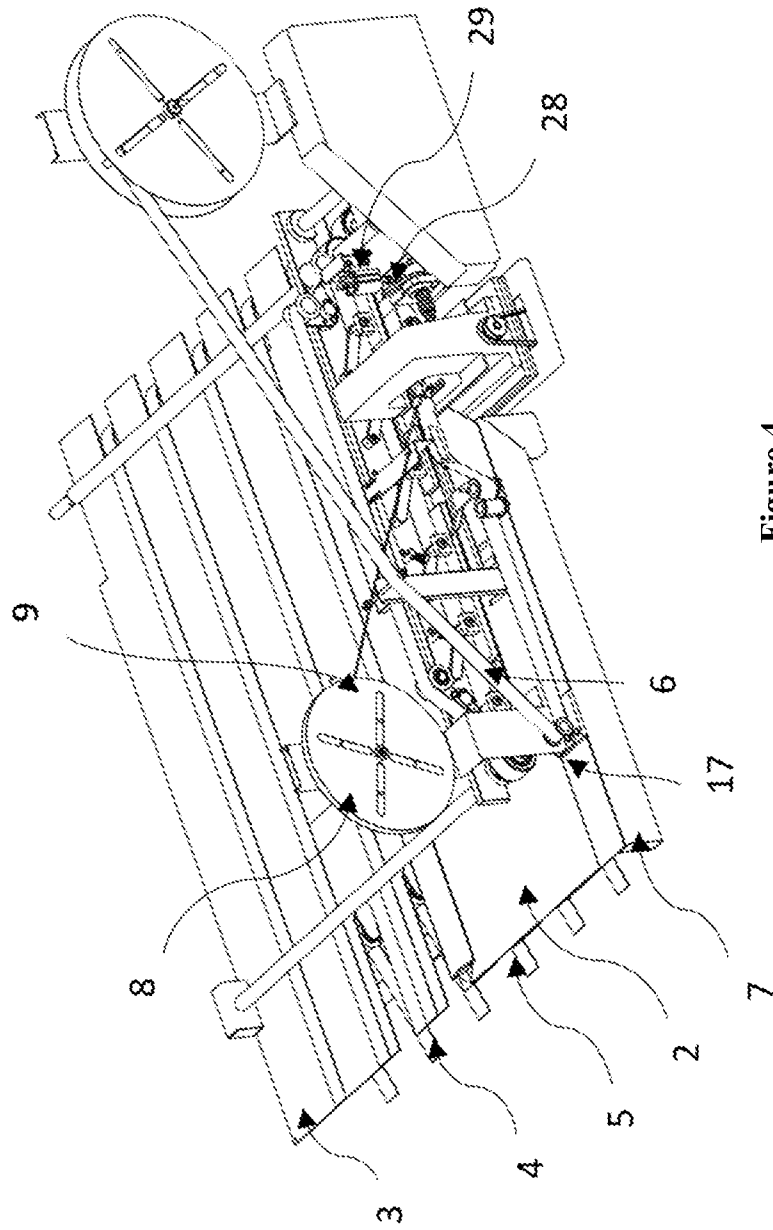


Figure 4

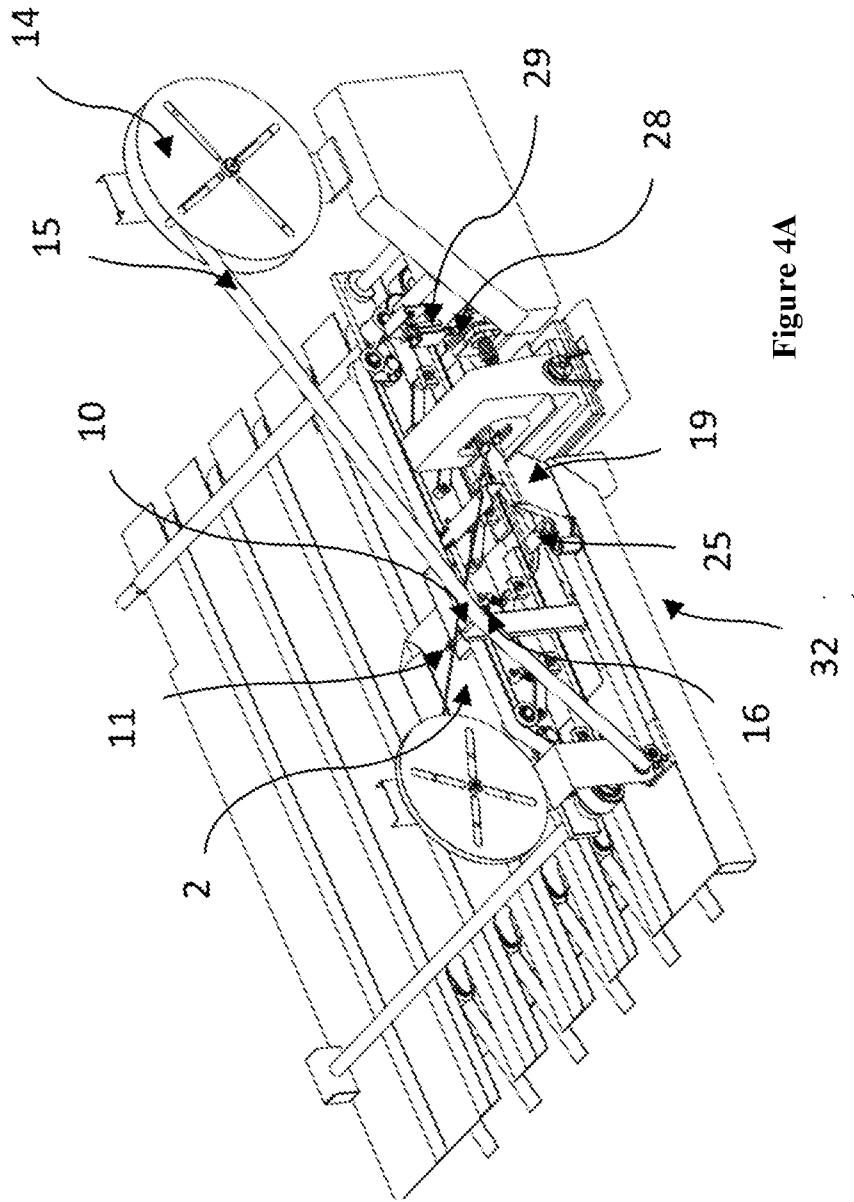


Figure 4A

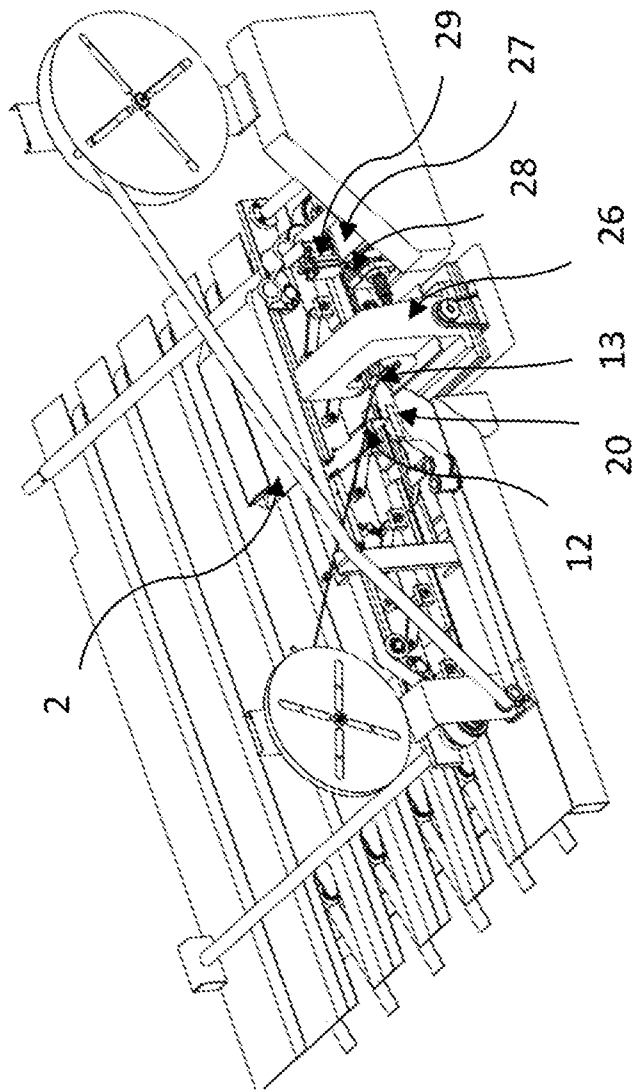


Figure 4B

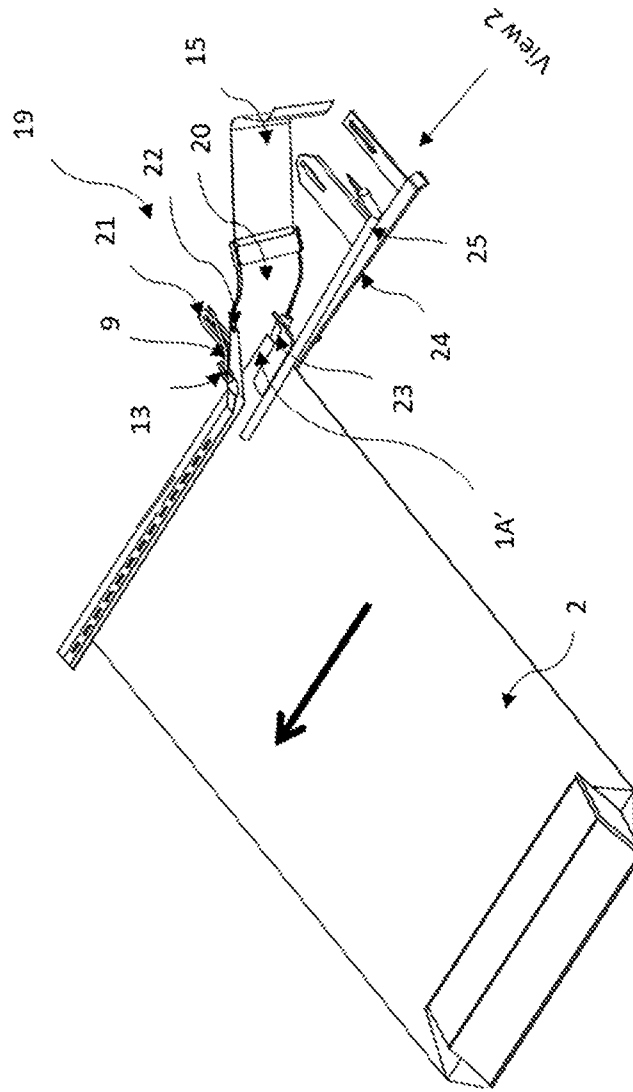


Figure 5

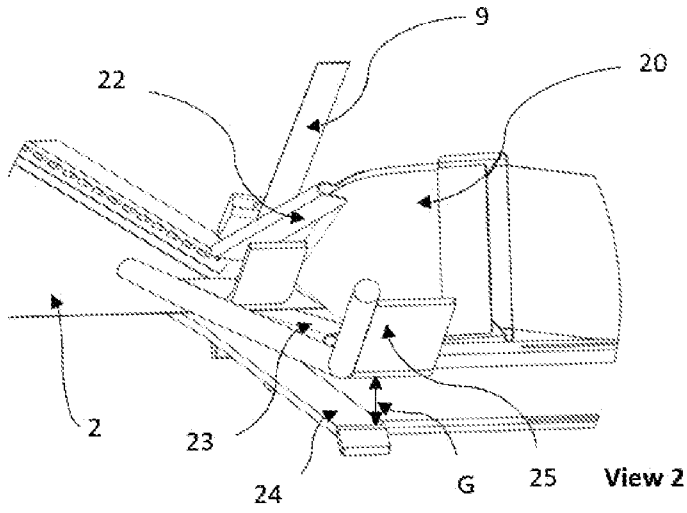


Figure 5A

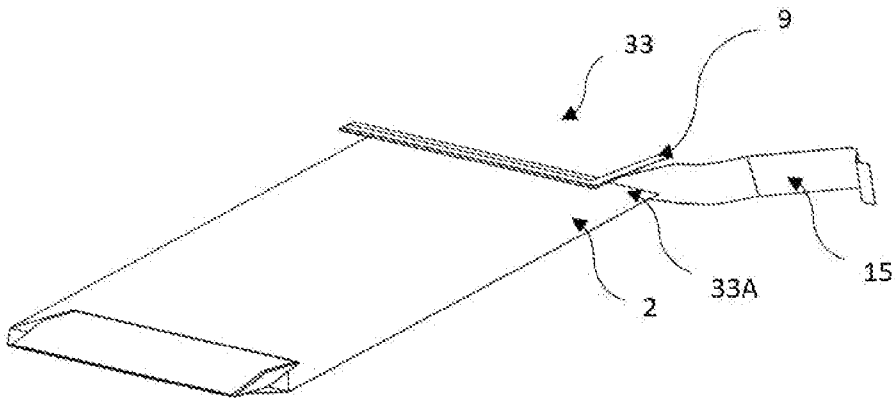


Figure 5B

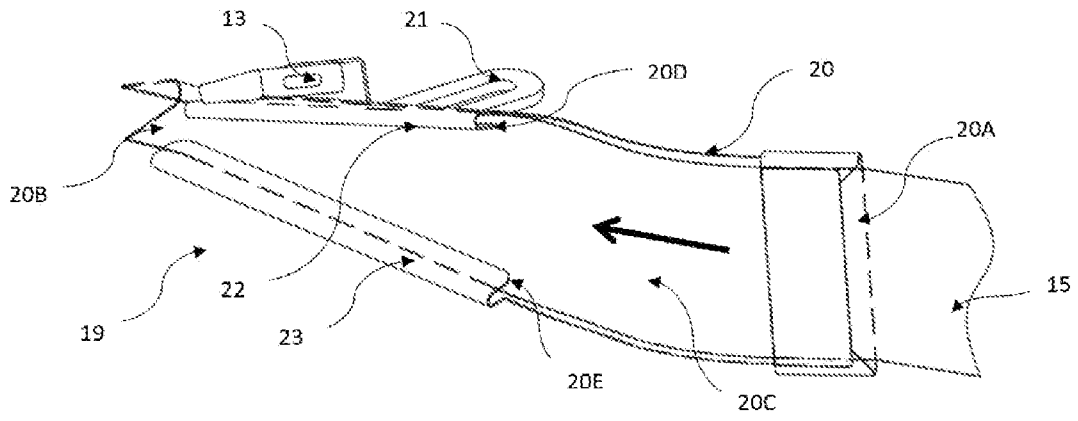


Figure 6

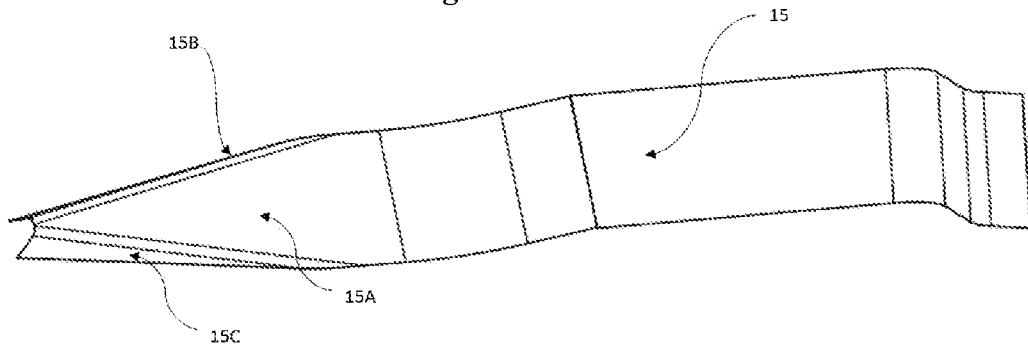


Figure 6A

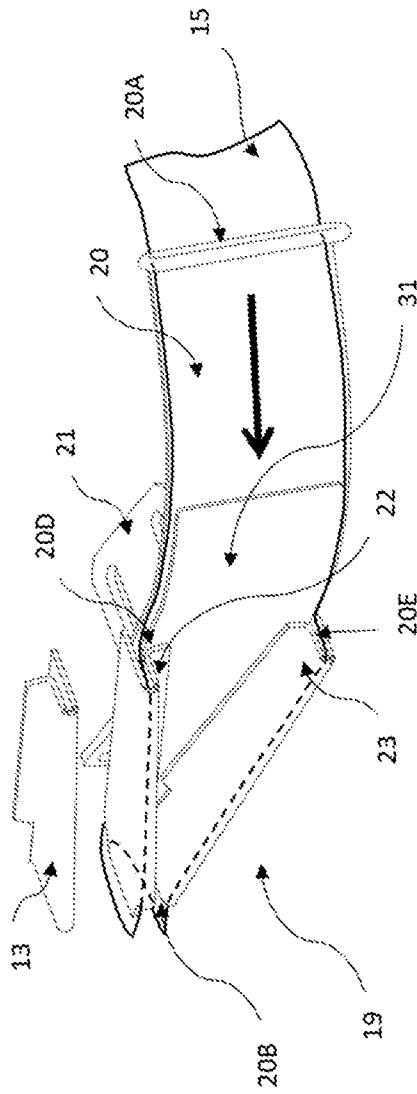


Figure 6B

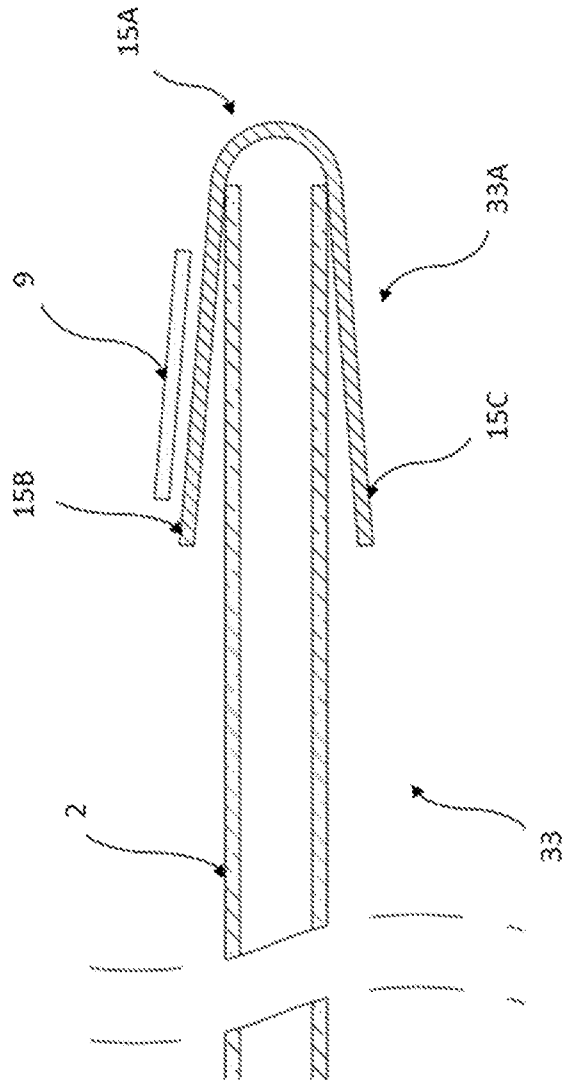


Figure 6C

## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/IB2021/052254

A. CLASSIFICATION OF SUBJECT MATTER B65B51/07, B65B61/18, B31B70/00, B31B70/81 Version=2021.01		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED		
Minimum documentation searched (classification system followed by classification symbols) B65B, B31B		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) TotalPatent One, IPO Internal Database		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	CA 2829265 A1 (STATEC BINDER GMBH) 13 SEPT 2012 (13.09.2012) Page 12 line 20- Page 20 line 03; Figures 1-11;	1-21
Y	US 4812074 A (MINIGRIP INC) 14 MAR 1989 (14.03.1989) Col.3 lines 5-23; Col.4 lines 44-60; Figure: 7;	1-21
Y	US 5826401 A (FLEXICO FRANCE) 27 OCT 1998 (27.10.1998) Col.3 lines 10-67; Figures: 1, 8b;	1-21
<input type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" type="checkbox"/> See patent family annex.		
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "D" document cited by the applicant in the international application "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search 03-05-2021		Date of mailing of the international search report 03-05-2021
Name and mailing address of the ISA/ Indian Patent Office Plot No.32, Sector 14, Dwarka, New Delhi-110075 Facsimile No.		Authorized officer Sreedhar Panchumarthi Telephone No. +91-1125300200

INTERNATIONAL SEARCH REPORT  
Information on patent family members

International application No.  
PCT/IB2021/052254

Citation	Pub.Date	Family	Pub.Date
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		BR 112013022393 A2	06-12-2016
		EP 2683617 A1	15-01-2014
		ES 2525836 T3	30-12-2014
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		DE 69724680 T2	22-07-2004
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		FR 2745263 A1	29-08-1997