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 [33] **Italy**  
 [31] **19148A/68 and 12454A/69**

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[54] **LEAKPROOF BAG**  
**12 Claims, 13 Drawing Figs.**

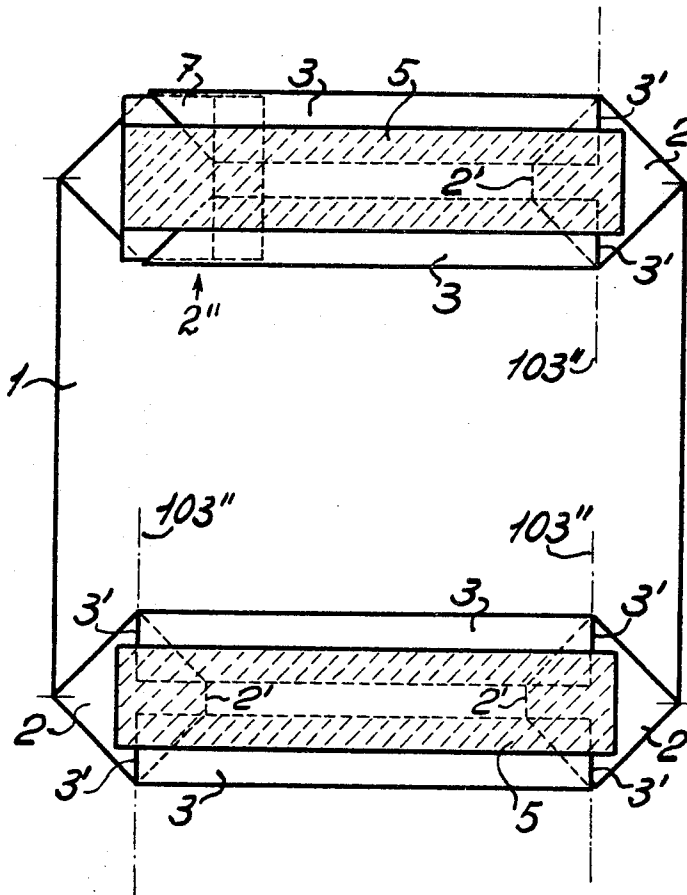
[52] U.S. Cl. .... 229/62.5,  
 229/55, 229/51  
 [51] Int. Cl. .... B65d 33/02,  
 B65d 31/14  
 [50] Field of Search. .... 229/62.5,  
 53, 55, 66, 51 AS

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**ABSTRACT:** A bag, which may be provided with a valve or other discharge or filling member, is made from a flat tube of sheet material having a pair of faces joined together at opposite sides. A pair of coplanar and similar trapezoidal flaps of the sheet material are formed on the faces with each flap having a broad base joined to the respective face along a respective junction line running transverse to and between the sides. The flaps each further have a narrow base which defines a fold line with a respective rectangular lip of the sheet material, both of the lips extending inwardly toward each other and serving as the eventual bottom or top surface of the bag. The tube is further provided with two inwardly bent corner portions which bridge between the flaps and is divided by an imaginary line into a triangular and a trapezoidal region. The triangular region has two sides coextensive with and joined to two respective confronting sides of the two flaps while its base coincides with the broad base of the trapezoidal region. Between each side of each trapezoidal region and the adjacent side of each lip is a small gore of the sheet material which lies between the lip and the trapezoidal region in the finished bag. A tape is glued over the free edges of the lips and extends beyond them onto the triangular corner regions to hold the bag tightly shut.



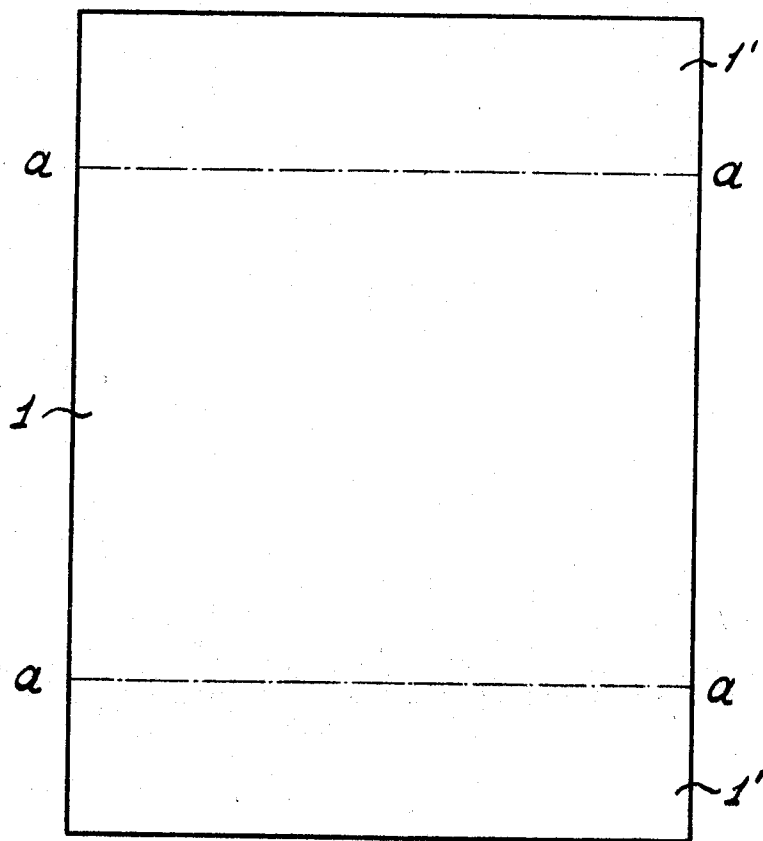


FIG. 1

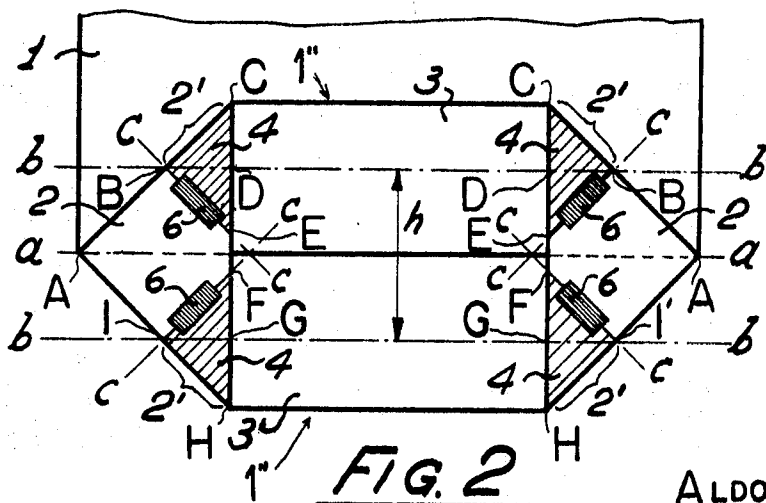
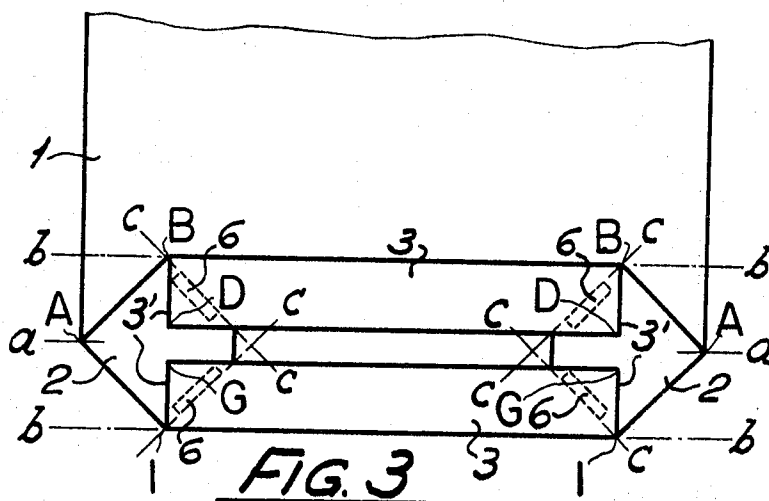
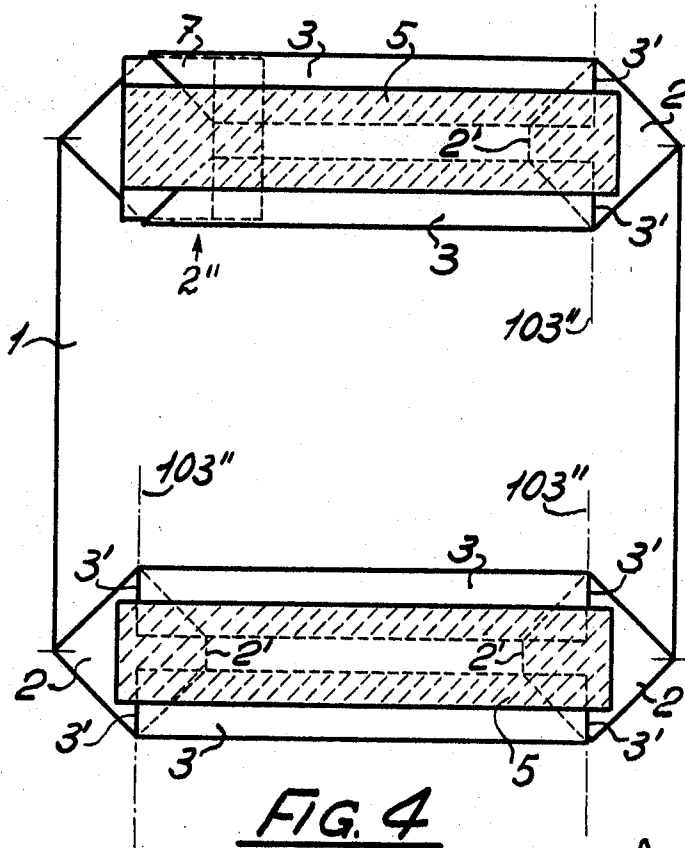


FIG. 2

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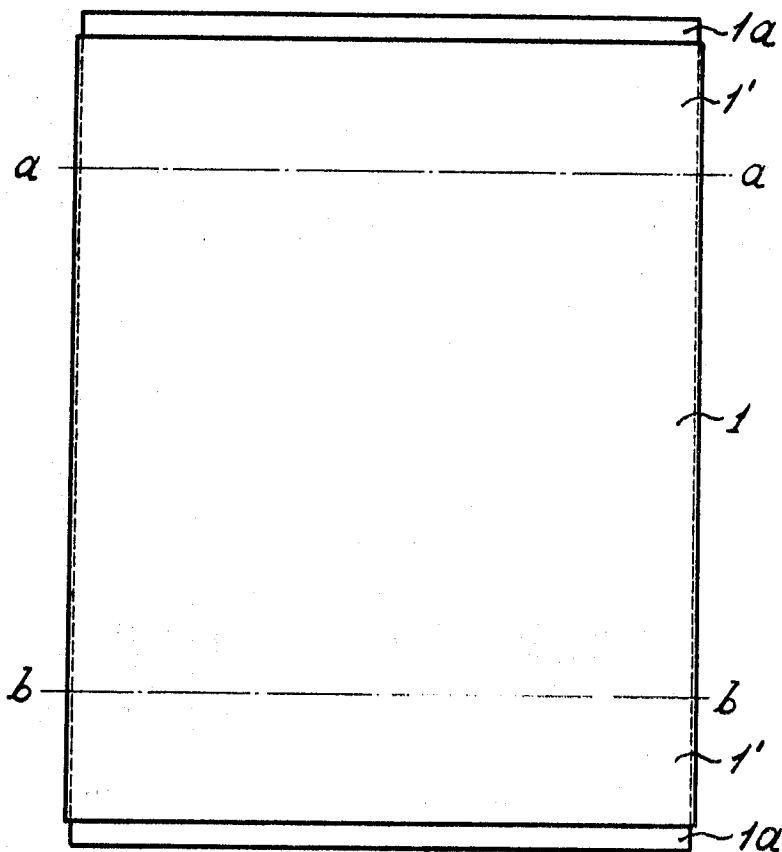


FIG. 5

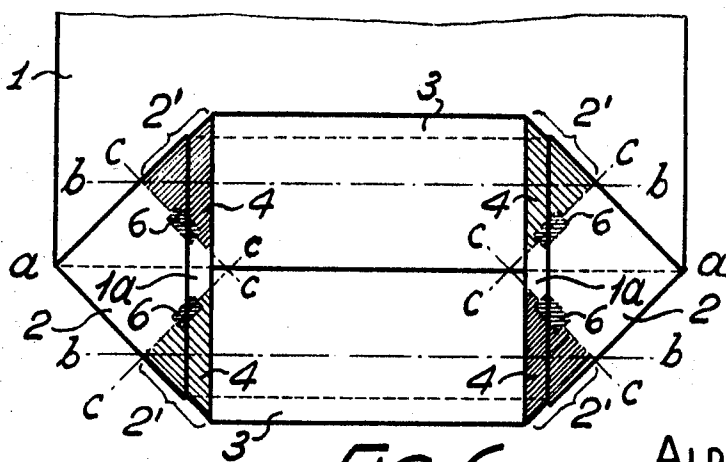
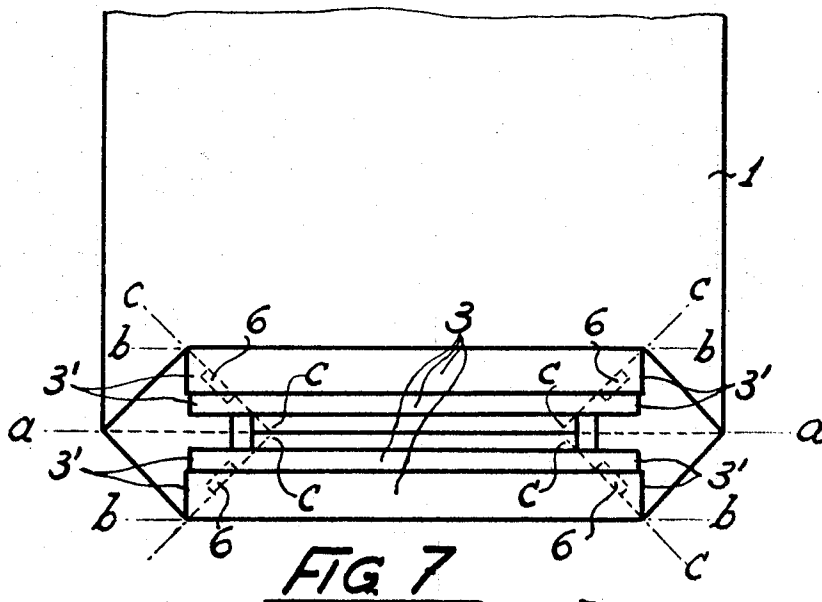
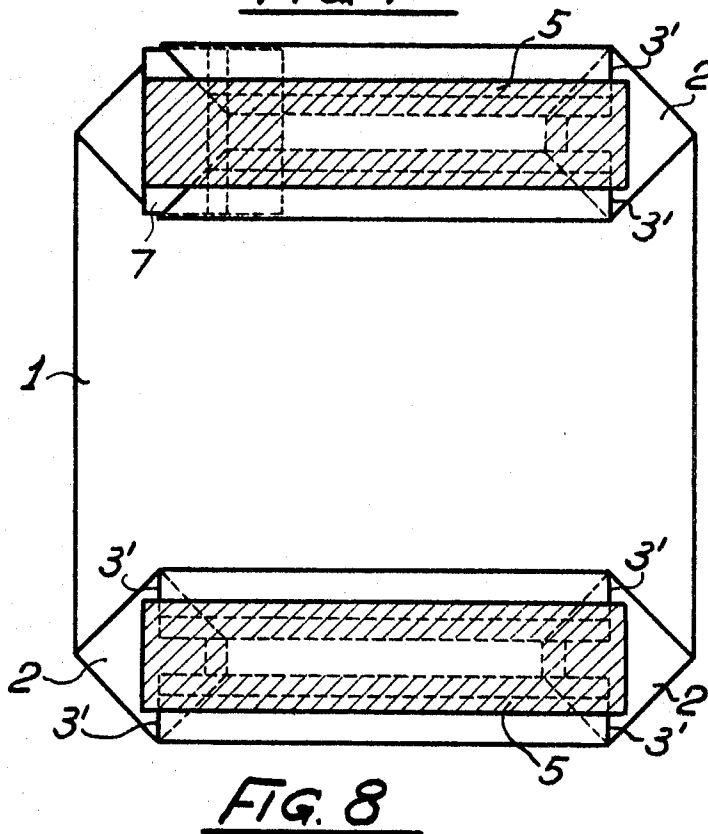


FIG. 6

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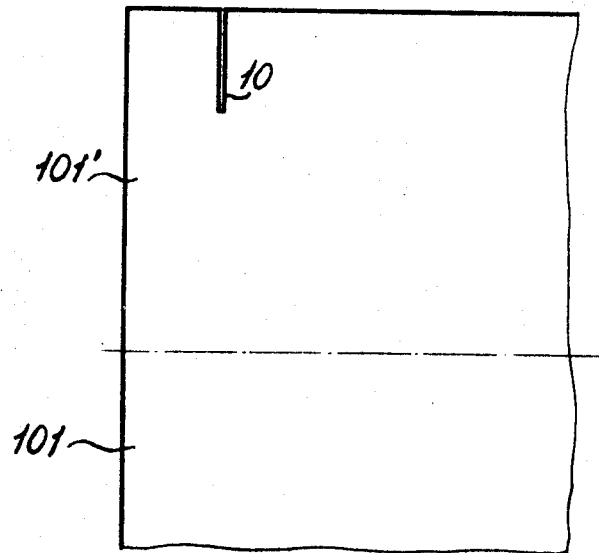


**FIG. 9**

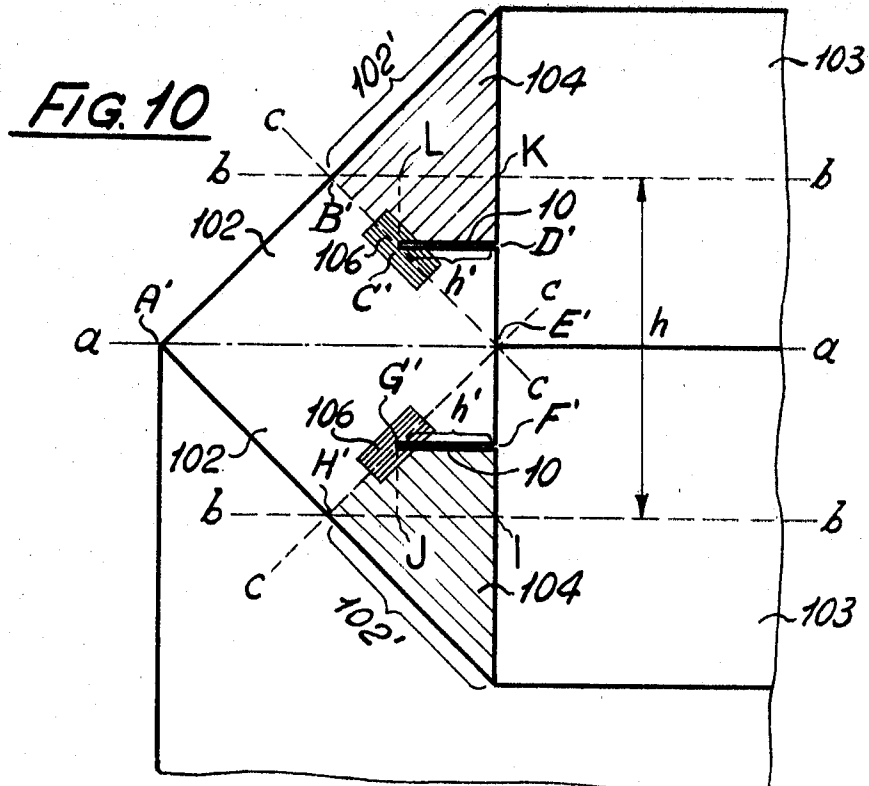


**FIG. 10**

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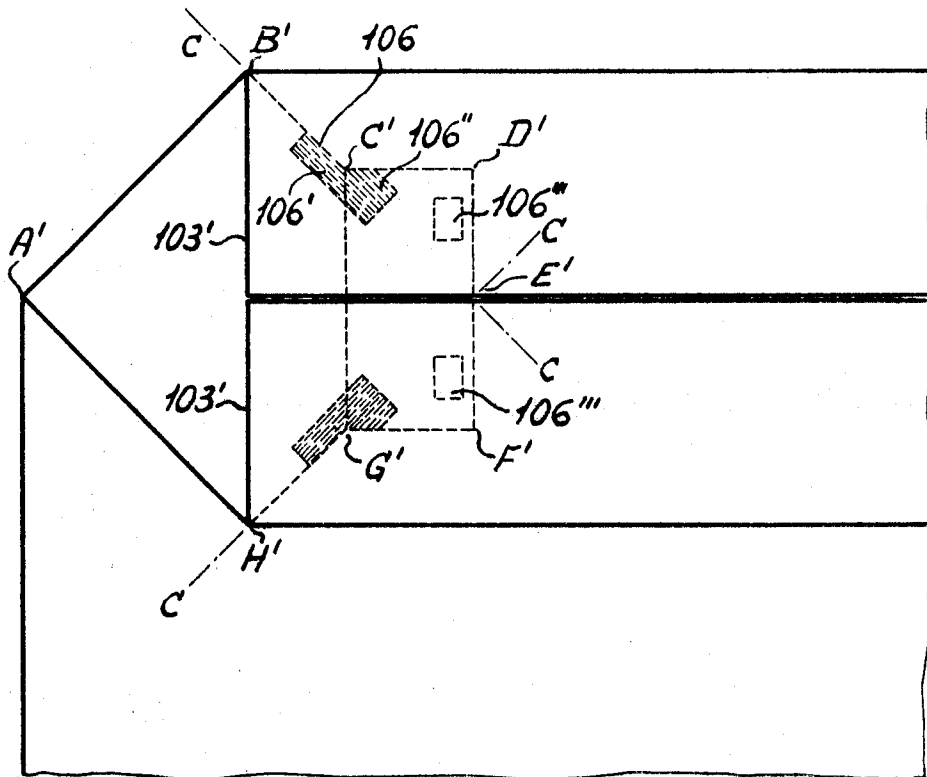


**FIG. 11**

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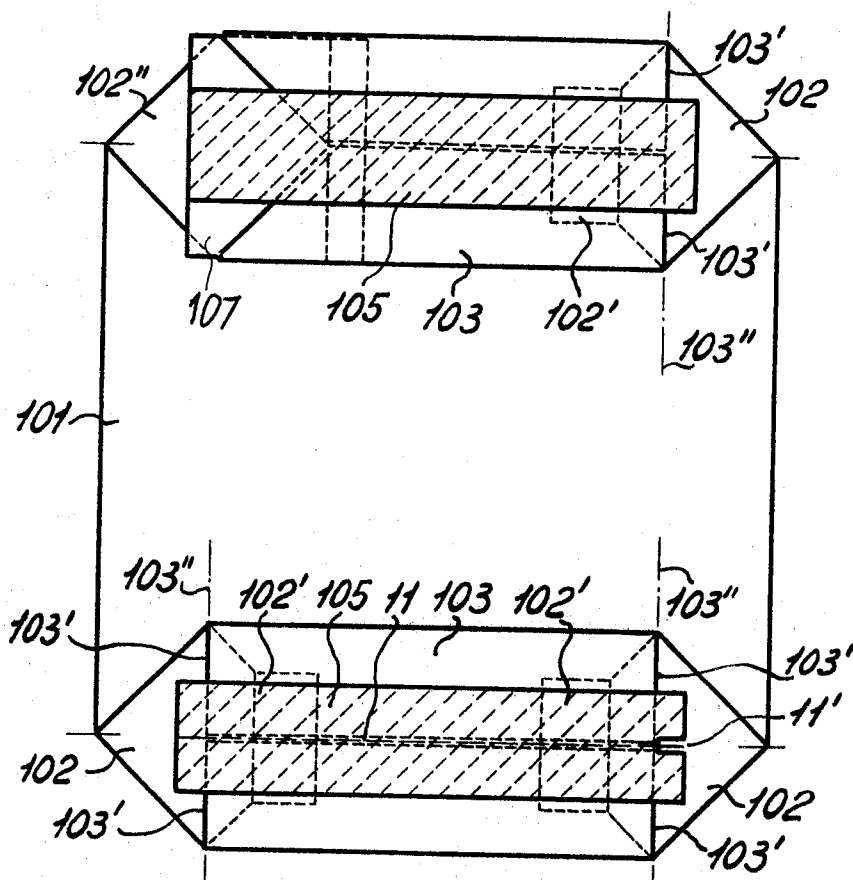


FIG. 12

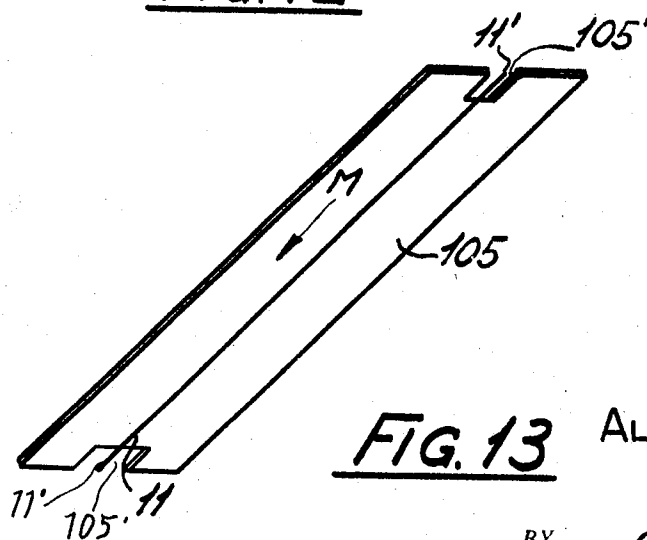


FIG. 13

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## LEAKPROOF BAG

The present invention relates to a bag made of foldable sheet material such as paper, synthetic resin (plastic film), or the like.

A bag provides an extremely convenient and inexpensive method of packaging many relatively durable commodities. In particular, the packaging of flowable substances such as sand, concrete, and liquids in bags is particularly advantageous.

It is of primary importance in such packaging that no path be present along which the commodity may lead out. It is furthermore necessary that the bag be capable of withstanding relatively large amounts of strain without rupturing. Most prior art systems with inturned flaps leave escape paths parallel to the main flap folds and are unsatisfactory for this reason.

It is, therefore, the general object of the present invention to provide an improved bag and bag-closure arrangement which is both very strong and effectively leakproof.

A more specific object of the present invention is to provide such a bag which can be inexpensively and easily produced.

Another object is to provide a bag of the above-mentioned type which is easy to open, in spite of its sturdy construction.

Another object of the invention is to provide a lowcost, tightly closed valved bag with the attributes set forth above.

The above objects are attained, in accordance with the present invention, by a bag made from a flat tube of sheet material having a pair of faces joined together at opposite sides. A pair of coplanar and similar trapezoidal flaps of the sheet material are formed on the faces with each flap having a broad base joined to the respective face along a respective junction line running transverse to and between the sides. The flaps each further have a narrow base which defines a fold line with a respective rectangular lip of the sheet material, both of the lips extending inwardly toward each other and serving as the eventual bottom surface of the bag. The tube is also provided with two inwardly bent corner portions which bridge between the flaps and is divided by an imaginary line into a triangular and a trapezoidal region. The triangular region has two sides coextensive with and joined to two respective confronting sides of the two flaps while its base coincides with the broad base of the trapezoidal region. Between each side of each trapezoidal region and the adjacent side of each lip is a small gore of the sheet material which lies between the lip and the trapezoidal region in the finished bag. A tape is glued over the free edges of the lips and extends beyond them onto the triangular corner regions to hold the bag closely shut.

Such a construction completely blocks all exit paths for the commodity in the bag without increasing the bag's production cost. This leakproof feature stems from the fact that there are no seams along which the powder or other commodity can seep, to ultimately escape from the bag. All of the outwardly leading seams terminate in blind creases which permit no escape while the tape utterly seals all other potential passages even though it does not cover the whole closed end of the bag.

According to a further feature of the invention, adhesive is applied between the gores and trapezoidal regions to further make the often problematic corner region hold together.

In accordance with yet another feature of the invention the free edges of the rectangular lips do not meet or overlap but define a gap extending across the bottom of the bag. This gap allows the tape to also adhere to the above-mentioned trapezoidal region thereby giving the corners great strength and ability to absorb stress.

Should a double-wall bag be desired, it can be made particularly strong, according to another feature of the present invention, by making it from two coaxial tubes, one of which extends slightly beyond the other so that both tubes are attached and present at the seams.

According to a further feature of the present invention, the free edges of the lips do just meet. In this case the so-called trapezoidal region is provided with a rectangular tab which extends inwardly and is glued up to the inside of the lips. This tab is advantageously formed by simply giving the tube two slits

which extend parallel to the tube sides up to the crease line defining the edge of the trapezoidal region. Such slits form small rectangular regions having one side joined to the side edge of one of the lips and an adjacent side coextensive with the side of the corresponding gore.

The invention is particularly advantageous when applied to so-called valved bags.

The above and other objects, features, and advantages of the present invention will be more fully described in the following, reference being made to the accompanying drawing, in which:

FIG. 1 is a plan view of a flat tube used to make a bag according to the present invention;

FIG. 2 is a similar plan view of the end of the tube at a first folding stage;

FIG. 3 is a similar view showing the bag at a later stage;

FIG. 4 is yet another plan view showing the finished bag according to the present invention;

FIGS. 5, 6, 7 and 8 are plan views corresponding to FIG. 1, 2, 3, and 4, respectively, showing a second embodiment in its several steps of production;

FIGS. 9, 10, 11 and 12 are further plan views corresponding to FIGS. 1, 2, 3 and 4, respectively, showing a third embodiment of the bag according to the present invention in its several steps of production; and

FIG. 13 is a detail of FIG. 12, in perspective view.

FIGS. 1-4 show a flat tube 1 of paper having two end portions 1' defined by lines *a-a* extending between the two sides of the faces of the tube 1.

In order to make a bag of this tube 1, one of the end portions 1' is folded away from the other and the tube corners are folded inwardly, toward each other, as shown in FIG. 2. This forms a pair of trapezoidal wings 1'' having outlines ACCA and AHHA each of which has a broad base AA lying on the line *a-a* and a narrow base CC or HH. A pair of corner areas 2 are also formed having the shape of right isosceles triangles ACH with their vertices A at the sides of the tube 1, their sides AC and AH coextensive with the sides of the wings, and their bases CH extending between these wings 1''.

Thence, as shown also in FIG. 3, the wings 1'' are bent along the lines *b-b* having a distance *h* between them and hatched regions 4 are folded outwardly along lines BD, B'D', IG, and I'G' to form a pair of rectangular lips 3 having outlines BDDB and IGGI. In order to give these lips 3 their rectangular form, and not the customary leak-prone trapezoidal form, the lines BD and GI are folded outwardly so that the lines EB and FI (corresponding to line *c-c*) eventually fall under the lines BC and HI, or 2'. Thus, the lines BD and GI define the side edges 3 of the lips 3.

In this manner, the near-finished bag has a corner portion defined by an imaginary GG which isosceles triangle ABI and by a trapezoid BEFI. The original small triangles BCD and GHI, which formed the corners of the triangle ACH, become part of the rectangular lips on folding and gores BDE and FGI are formed under the lips 3.

As clearly illustrated in FIG. 3, the lips 3 have free edges DD and GG which define a gap between them. This allows, as shown in FIG. 4, a tape 5 to be applied over these edges DD and GG. This tape 5 then adheres to the edge portions of the lips 3 and to the corner portions 2. It is of importance that it adhere to the corner portion 2 between the lips 3 so that any force acting outwardly on this corner can easily be absorbed by the tape.

The tape 5 overlaps the ends of the lips 3 and extends beyond an imaginary line 103'' defined by the tape side edges 3' to hold the bottom of the bag together firmly. Also, since it is closely bonded along the line 2', and since the creases are formed transversely of the tape and not parallel thereto, there is absolutely no avenue of escape for the commodity in the bag.

In order to further prevent any leaks at this end of the bag, the corner sections are provided with zones of adhesive 6 which glue the gores BDE and FGI to the trapezoidal regions

BEFI. The glue can be applied just along the fold line *c-c* or over the entire area of the gores BDE and FGI.

FIG. 4 also shows how a tubular spout 7 or valve is fitted to the bag by forming a conventional corner 2'' where the lips 3 are right trapezoids instead of rectangles.

In the finished bag the distance *h* between the lines *b-b* determines the width of the base while its length is equal to that of the lips 3.

FIGS. 5-8 show a further bag made exactly as the bag of FIGS. 1-4, with the exception that a second flat tube or sheath fits within the tube 1 and protrudes at the ends at 1a. In all other respects the construction of this bag is identical, and the reference numerals appearing in FIGS. 5-8 agree completely with those of FIGS. 1-4.

It is worth noting that, with the way in which the bag according to the present invention is taped, a double-walled bag as shown in FIGS. 5-8 would be extremely sturdy since both walls are bonded to the tape 5 at all critical points.

FIGS. 9-12 show a further embodiment of the present invention, using principles in common with the embodiments of FIGS. 1-8.

As shown in FIG. 9, a tube 101 is used having an end portion 101' defined by a line *a-a*. The pair of slits 10 of height *h'* is cut in the end of the tube 101 and extends parallel to the sides of the tube.

FIG. 10 shows the first step of making a bag of the tube 101. This corresponds almost exactly to FIGS. 2 and 5, since here at each side of the tube 101 a corner section 102 is formed while a trapezoidal wing 103 is formed between the sides by bending back the edges of the tube 101 along the line *a-a*. The slits 10 extend up to points C' and G' lying on the fold lines *c-c*. In this manner, as the wings are folded along lines *b-b* only the hatched portions 104 are folded out such that lines 102' overlie the lines *c-c*.

This folding leaves a corner portion A'B'C'D'E'F'G'H' which is composed of a right isosceles triangle A'B'H' having a base B'H' in common with a trapezoidal region B'C'G'H' from whose narrow base C'G' extends a rectangular tab C'D'E'<F'G' or 102. In addition, the sides 103' of the rectangular lips 103 are formed by lines H'IJ and B'LK. Thus, instead of a simple right triangle, under the corner of each lip 103 is a right trapezoid B'LKD'C' or IJH'G'F'.

In order to still provide excellent stress-resisting properties to the corners of the bag, glue regions 106 having a portion 106' along the crease *c-c* and a portion 106'' on the tab 102 are provided in the vicinity of the regions C' and G' and, if desired, other glue spots 106''' are provided on the tab 102' (or C'D'F'G').

Here, as illustrated best in FIGS. 11 and 12, the free edges of the lips 103 just meet. This of course makes it more important to glue the tab at 106'' and 106''', since the tape 109 cannot hold here.

Once again, the tape 105 extends beyond a line 103'' formed by the side edges 103' of the lips 103. In addition, a corner 102'' is made and provided with a spout or "valve" 107 as described above for FIG. 4.

FIG. 13 shows the tape 105 in detail. This tape is formed at each end with notches 105' from which ends 11' of a filament 11 extend. Simple pulling of the end 11' in, for example, the direction M, cuts the tape in two and simply and quickly opens the bag, allowing it to be readily emptied.

The tape in all embodiments is preferably applied with an adhesive of relatively high mechanical strength while it itself need not be of a material substantially stronger than that used to make the bag. The glue spots used to reinforce the corner areas can be of a lower strength adhesive.

A combination of the embodiments of FIGS. 5-8 and FIGS. 9-12 is also particularly advantageous since it provides, in many regions, three layers for added protection. Such an embodiment would closely resemble that of FIGS. 9-12, where the inner tube, corresponding to the tube 1a, would have its lips meet and the outer tube would come somewhat short of the line which is covered by the tape.

I claim:

1. A bag comprising:

a flat tube of sheet material having a pair of faces joined together at opposite tube sides;

a pair of substantially coplanar and geometrically similar trapezoidal flaps of said sheet material each defined by a broad flap base joined to one of said faces along a respective junction line transverse to and extending between said sides, a narrow flap base defining a fold line, and a pair of flap sides extending between said broad and narrow flap bases;

a pair of substantially coplanar and geometrically similar rectangular lips of said sheet material each joined to one of said flaps along said fold line, said lips extending toward each other and each having a free edge and two opposite side edges;

a respective inwardly bent corner portion of said sheet material at each of said tube sides bridging said flaps each of said corner portions including a triangular region having two sides coextensive with and attached to the corresponding flap sides and defining a vertex at the respective tube side and a corner base running substantially orthogonally between said narrow flap bases, and a trapezoidal region having a broad base coextensive with and joined to the corresponding corner base, and an opposite narrow base, each of said triangular regions and the respective trapezoidal region being flat and coplanar;

a respective triangular gore of said sheet material having a first side attached to one of the sides of one of said trapezoidal regions and forming therewith a first crease inclined to the respective narrow base and a second side attached to the corresponding side edge of one of said lips and forming therewith a second crease extending orthogonally to said fold line each of said gores being sandwiched between one of said lips and one of said trapezoidal regions; and

a tape strip of greater length than said free edges and bonded to said lips over said free edges and to said triangular portions.

2. The bag defined in claim 1, further comprising another flat tube of sheet material within the first-mentioned tube and protruding therefrom whereby a marginal portion of said other tube projects beyond said lips and is secured by said tapes.

3. The bag defined in claim 1 wherein said free edges of said lips are spaced apart to define a gap between them and said tape is also bonded to said trapezoidal regions between the free edges of said lips.

4. The bag defined in claim 1 wherein each of said gores is at least partially bonded flat against a confronting portion of the respective trapezoidal region overlain thereby.

5. The bag defined in claim 1, further comprising a tear-facilitating filament extending longitudinally under said tape.

6. The bag defined in claim 5 wherein said tape has at least one end formed with a notch in the vicinity of said filament, said filament having an end projecting in said notch.

7. The bag defined in claim 1 wherein said tube further comprises respective rectangles of said sheet material each having one side attached to one of the side edges of one of the lips, each of said gores having a third side coextensive with and joined to another side of said rectangle adjacent said one side of said rectangle, said corner portions each further including a rectangular tab of said sheet material substantially coplanar with the respective triangular and trapezoidal regions and having one side coextensive with and joined to said narrow base of the respective trapezoidal region.

8. The bag defined in claim 7 wherein said tab is bonded to said lips.

9. The bag defined in claim 7 wherein the lips are substantially contiguous.

10. The bag defined in claim 7 wherein said rectangular tab has a pair of opposite sides adjacent said one side thereof and of a length equal to that of the side of said rectangle opposite said one side thereof.

11. The bag defined in claim 1 wherein said triangular region is isosceles right triangle.

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## 12. A valved bag comprising:

- a flat tube of sheet material having a pair of faces joined together at opposite tube sides;
- a pair of substantially coplanar and geometrically similar trapezoidal flaps of said sheet material each defined by a broad flap base joined to one of said faces along a respective junction line transverse to and extending between said sides, a narrow flap base defining a fold line, and a pair of flap sides extending between said broad and narrow flap bases;
- a pair of substantially coplanar and geometrically similar lips of said sheet material each joined to one of said flaps along said fold line, said lips extending toward each other and each having a free edge and two opposite side edges;
- a respective inwardly bent corner portion of said sheet material at each of said tube sides bridging said flaps, each of said corner portions including a triangular region having two sides coextensive with and attached to the corresponding flap sides and defining a vertex at the respective tube side and a corner base running substantially orthogonally between said narrow flap bases and a trapezoidal region having a broad base coextensive with

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- and joined to the corresponding corner base, and an opposite narrow base, each of said triangular regions and the respective trapezoidal region being substantially flat and coplanar;
- a pair of triangular gores of said sheet material at one end of said flaps and each having a first side attached to one of the sides of one of said trapezoidal regions and forming therewith a first crease inclined to the respective narrow base, and a second side attached to the corresponding side edge of one of said lips and forming therewith a second crease extending substantially orthogonally to said fold line, each of said gores being sandwiched between one of said lips and one of said trapezoidal regions;
- a valve tube at the other end of said flaps and overlain by said lips; and
- a tape strip of greater length than said free edges and bonded to said lips over said free edges and to said triangular portion at said one side of said flaps and to said valve tube at said other side of said flaps.

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