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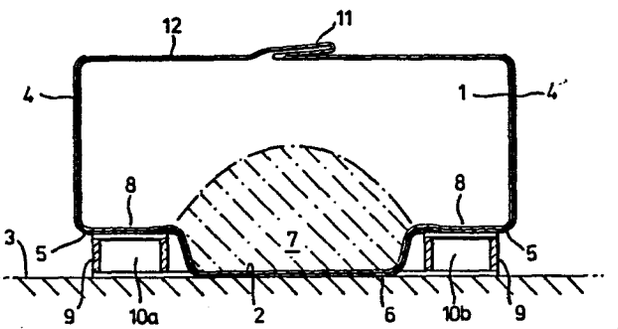
(54) Intermediate bulk containers.

(57) An intermediate bulk container is provided with a supporting cradle (9), the container comprising a bag (1) having a flexible reinforcing sleeve (4).



EP 0 180 379 A2

Intermediate bulk containers

This invention relates to intermediate bulk containers, and in particular to flexible intermediate bulk containers, and to such containers in combination with a supporting cradle. Such flexible containers, which typically have a capacity of 0.5 to 3 m^3, are generally in the form of sacks or bags and are widely used for the packaging, for transport and storage, of particulate materials, e.g. chemicals and fertilizers in bulk quantities. Typically, when filled, the bag has a cylindrical configuration of diameter 0.8 to 1.5 m and height 0.5 to 1.5 m.

In EP-A-80839 there is described an arrangement consisting of a flexible intermediate bulk container and a cradle therefor to support outer portions of the base of the intermediate bulk container above the surface on which the base of the intermediate bulk container rests. The cradle enables the tines of a fork-lift truck to be inserted beneath the outer portions of the base of the intermediate bulk container so that the latter, preferably together with the cradle, can be lifted.

By the use of such an arrangement it is possible to stack several cradle/filled bag combinations one above another.

In use, particularly when so stacked, the bags have to withstand considerable hoop stresses to enable a stable stack to be made. Also it is generally desirable that the bags are essentially impervious in order to protect the bag contents from the weather.

These requirements have heretofore necessitated that the bag is made of a tough waterproof material: one construction that has been employed is to manufacture the bag from a laminate of an impermeable film of a plastics material and a fabric woven from tapes of a plastics material e.g.

oriented polyolefin, such as polypropylene or high density polyethylene, tapes.

Bags fabricated from such laminates are relatively expensive because such laminates are difficult to make and this adds significantly to the cost of the bag.

We have now found that if a particular construction is adopted, lighter and cheaper bags can be employed for this application.

Accordingly the present invention provides a flexible intermediate bulk container suitable for use in conjection with a cradle as aforesaid comprising a bag formed from an impervious film of plastics material and having a closed end and assuming a generally cylindrical configuration when filled with a particulate material with said closed end resting on a surface, wherein said bag is provided with a flexible reinforcing sleeve round substantially all of the portion of said bag that corresponds to the cylindrical surface when filled.

The reinforcing sleeve is preferably a fabric woven from fibres or tapes of a natural or synthetic material, for example of fabric weight 100 to 200 gm^{-2}, such as a polyolefin tape, for example a high density polyethylene or oriented polypropylene. Alternatively, although the sleeve need not be impervious, it may comprise a film of a plastics material, preferably an oriented film. In the latter case the direction of maximum orientation in the film should be parallel to the hoop direction of the bag. Preferably the sleeve is fastened to the bag, e.g. by means of an adhesive, during the manufacture of the bag in order to ensure accurate positioning of the sleeve. The fastening need not be overall: indeed the sleeve may simply be held in place by a line, or spots, of an adhesive.

The supporting cradle suitable for use with the

intermediate bulk containers of this invention generally comprises a pair of supporting members disposed beneath the base of the container so that the container can sag into the space between the supporting members to a depth substantially equal to the height of the cradle, the supporting members being connected so that the maximum spacing between said supporting members, and their height, is sufficient to permit the interaction of the tines of a fork-lift truck with the supporting members to permit lifting.

When the bag, provided with the sleeve, is filled and resting on a cradle as aforesaid, the bulk of the weight of the bag contents, and of any bag/cradle combinations stacked on top thereof, is borne through the base of the bag directly on to the surface on which the bag and cradle are resting. However, upon lifting the bag, either alone or together with the cradle, by fork-lift truck tines disposed under the outer portions of the base of the bag, the bulk of the load is transmitted directly to the parts of the base supported by the fork-lift truck tines as a result of frictional forces between the particles of the material within the bag. Because of the inter-particle friction, the film material forming the base of the bag does not have to withstand tensile forces corresponding to supporting the whole load, and so does not have to be of particularly robust construction. However, as mentioned below, the base has to withstand tensile forces corresponding to supporting a portion of the load. The bag may thus be made from an unreinforced plastics film of, for example low density polyethylene, linear low density polyethylene, blends and co-extrusions thereof, of thickness 50 to 350 μm, preferably 100 to 250 μm.

When filled with particulate material the top of the bag is usually flattened to form a generally cylindrical shape. Suitably the reinforcing sleeve extends around the

cylindrical bag and from the top of the cylinder wall portion (the level of particulate material) to the bottom of the cylinder wall portion. Preferably the reinforcing sleeve extends to cover part of the base of the container, that is the sleeve is positioned to be contact with the cradle and, optionally, the surface on which the container is supported. This construction provides extra strength and support at the base of the container minimising outward bulge and enhancing stability of a stack of containers. In addition the possibility of abrasion and snagging of that part of the bag is minimised by the protection of the reinforcing sleeve.

In a preferred aspect, to further minimise the possibility of snagging and abrasion, a reinforcing patch may be applied to the base of the container. This patch may be of the same, or different, material as that of the reinforcing sleeve. Conveniently it is of the same material. As stated hereinbefore the reinforcing sleeve preferably extends to cover part of the base of the container. Thus generally there is part of the base not covered by the sleeve. Preferably the reinforcing patch covers and protects this latter part. Conveniently this patch is attached to the sleeve and the base in conventional manner, for example by adhesive.

In addition, in one aspect the reinforcing sleeve extends to cover part of the top of the container, that is the sleeve is folded over to minimise the possibility of the snagging and abrasion of that top part of the container. Furthermore a reinforcing patch may be applied to the top of the container. This patch may be of the same or different material as that of the sleeve. Preferably this patch covers the part of the top of the container that is not covered by the folded over reinforced sleeve. Conveniently the patch is attached to the sleeve and top in conventional manner, for example by adhesive.

Lifting straps can be fastened to the container of the present invention or can be made integral therewith. However, preferably there are no such lifting straps, thus giving substantial cost savings. In general the containers of this invention are designed to be handled by means of the supporting cradle. However, in some cases the end user may wish to lift the container from the supporting cradle prior to emptying or during emptying. Therefore in another aspect of this invention there is provided a container wherein the reinforcing sleeve extends in generally cylindrical form around the cylindrical bag, when filled, from the bottom of the cylindrical wall portion to the level of particulate filling material and at least part of the sleeve extends above this level. The part of the sleeve above this level is not attached to the bag, or is readily detachable from the bag, so that, in use, the top of the bag is flattened leaving the top of the sleeve as a protruding extension. This extension may be mechanically gripped in a number of ways, for example with clamps which form part of the end user's lifting gear. Preferably this extension is formed all the way around the upper end of the sleeve, that is, there is an upstanding collar.

In an alternative, in the embodiment wherein the reinforcing sleeve is folded over to cover part of the top of the container, the end-user's lifting gear may mechanically pinch the folded over portion in order to lift the bag.

It is preferred that the extension to the sleeve is formed of the same material as the rest of the sleeve and is integral therewith.

In another aspect of this invention, suitably the material of the sleeve extension has at least one area having reinforcing threads woven in it. More suitably there is a plurality of such areas. These areas having reinforcing threads provide additional strength and facilitate the

lifting from above of the container by the end-user's lifting gear. Conveniently these areas having reinforcing threads are provided in the form of bands running in the warp direction of the sleeve, that is from top to bottom. In use the end user would direct the clamps or the like of lifting gear to grip the upstanding sleeve extension or, in an alternative embodiment to pinch the folded over portion of the sleeve, at the position of the bands of reinforcing threads.

As stated hereinbefore it is preferred that the extension to the sleeve is formed of the same material as the rest of the sleeve and is integral therewith. Therefore, in such a case, the bands of reinforcing threads run the length of the sleeve and provide additional resistance to the hoop stresses of the container.

The reinforcing threads are conveniently of any synthetic polymer, such as a polyester, polyolefin or polyamide.

By way of Example only, one embodiment of the invention is illustrated by reference to the accompanying drawings wherein:

Figure 1 is a cross-sectional view of a filled bag supported on a cradle.

Figure 2 is a perspective view of the cradle employed in Figure 1.

Figures 3 to 6 show diagrammatically the various stages in the formation of the lower closed end of the bag. Figures 3a to 6a show one minor variation of Figures 3 to 6; Figures 5b, 6b show a preferrred variation of Figures 5a and 6a, and Figure 6c shows another minor variation of Figure 6.

In Figure 1 there is shown a flexible intermediate bulk container comprising a bag 1, filled with a particulate material, the bag having a base 2 supported by a surface 3. Extending around the bag 1 is a reinforcing sleeve 4 adding

strength to the generally cylindrical configuration of the bag and to a portion 5 of the base of the bag. This sleeve 4 is fastened to the bag in conventional manner, for example by a line of spots of a hot melt adhesive. The base 2 of the bag has a reinforcing patch 6 positioned beneath the area of sag 7. This reinforcing patch 6 is attached, for example by glue, to the bag 1 and the reinforcing sleeve 4. The outer portions of the container base 8 are supported from surface 3 by a wooden cradle 9, shown in perspective in Figure 2. The dimensions of the cradle 9 are such that the tines of a forklift truck can be inserted in the openings 10a, 10b of the cradle.

The intermediate bulk container is preferably filled whilst positioned on the cradle as this enables the requisite amount of 'sag' to be achieved and, by using conventional vibratory filling devices the top of the particulate filling material can be rendered subtantially flat. It may then be advantageous, after filling to substantially eliminate the air within the bag and to fold down the top 11 of the bag material.

When the bag and cradle are lifted, the bulk of the weight is transmitted directly to the fork-lift truck tines by inter-particle reaction. Only a relatively small proportion of the load, i.e. that corresponding approximately to the hatched area 7 has to be transmitted to the fork-lift truck tines via tensile forces in the material of the base of the bag 1. The size of the hatched area 7 for any given intermediate bulk container/cradle combination will depend on the nature of the particulate material within the bag.

The bag 1 is conveniently formed from a lay-flat tube of impervious plastics film, e.g. polyethylene of thickness 200 µm by folding operations as shown in Figures 3 to 6, to give a base region of generally hexagonal configuration ABCDEF in the lay-flat state. The reinforcing

sleeve 4, e.g. a fabric of weight 150 gm^{-2} woven from oriented high density polyethylene tapes, may be fastened, e.g. by a hot melt adhesive, to the bag 1 before or after the folding operations giving the base configuration.

The base is formed in conventional manner by folding corners I, J of the bottom of the tube along lines AG, AH and DG, DH respectively into the lay-flat tube to given the configuration shown in Figure 4. The upper triangular flap AGD is folded upwards about line AD to give the configuration of Figure 5. The corners G, H are then folded, about lines BC and ER respectively towards each other to give the hexagonal configuration of Figure 6.

The folds AG, AH and DG, DH are preferably positioned to give some overlap, as shown in Figures 3a to 6a, to enable the overlapping portions GHIJ to be fastened together e.g. by welding or by an adhesive.

The overlapping portions GHIJ may form a lap joint as shown in Figure 5a, or, alternatively and preferably, may be fastened together, e.g. welded, to form a butt joint giving an upstanding portion which is ~~then~~ folded flat and fastened down, e.g. by an adhesive to give the configuration of Figure 5b, which, after folding along lines BC and EF gives the configuration of Figure 6b.

If desired, the folds along lines BC and EF may be positioned to give some overlap of the corners G and H, as shown in Figure 6c, particularly where the folds AG, AH and DG, DH are positioned such that there is no overlap of I and J.

To the rectangular portion BCEF of the base, a reinforcing patch is preferably fastened e.g. by means of an adhesive.

In this form of construction, at the bottom of the bag the reinforcing sleeve 4 preferably extends at least to the line AD forming the longitudinal axis of the hexagonal

base ABCDEF, but generally need not extend below line B^1C^1.

The sleeve 4 preferably extends sufficiently beyond line AD such that when the bag is filled and supported on a cradle as aforesaid, the lower end of the sleeve 4 is trapped between the bag 1 and the cradle 9, as can be seen in Figure 1. This not only gives a neater appearance but also gives a more secure support to the bag by eliminating the possibility of an outwards bulge between the bottom of the sleeve and the portion of the bag supported by the cradle.

After filling, the top of the bag will normally be closed in similar fashion. In this embodiment the reinforcing sleeve extends to the level of filling of the bag.

In a further embodiment of the present invention, by way of Example only, there is provided an intermediate bulk container as shown in the accompanying drawings wherein:

Figure 7 is a cross-sectional view of a filled bag supported on a cradle, and

Figure 8 is a perspective view of a filled bag supported on a cradle,

wherein reference numerals 1-11 have the same meaning as in relation to Figures 1 and 2.

In Figure 7 it is shown that the reinforcing sleeve 4 extends above the level 12 of the particulate filling material in the filled bag 1 forming a sleeve extension 13.

The sleeve extension 13 is of sufficient height to permit lifting apparatus to be engaged therewith without snagging or fouling the bag and contents.

As can be seen from Figure 8 the reinforcing sleeve 4 is formed of material having bands 14 of reinforcing threads running in the warp direction, that is not in the hoop direction. In use lifting apparatus may be engaged with those portions of the sleeve extension 13 that consist of

reinforcing threads.

PA/PMD/AM/L302
30 September 1985

1. A combination comprising:
   i) a flexible intermediate bulk container comprising a bag formed from an impervious film of plastics material and having a closed end and assuming a generally cylindrical configuration when filled with a particulate material with said closed end resting on a surface wherein said bag is provided with a flexible reinforcing sleeve round substantially all of the portion of said bag that corresponds to the cylindrical surface, when filled, and
   ii) a supporting cradle for said container said cradle supporting outer portions of the base of the container above the surface on which the container rests and said cradle enabling tines of a fork-lift truck to be inserted beneath said outer portions of said container base for lifting purposes.
2. A combination according to claim 1 wherein the reinforcing sleeve is a fabric woven from an oriented polyolefin tape.
3. A combination according to claim 1 wherein the reinforcing sleeve is a fabric woven from fibre or tapes of a natural or synthetic material.
4. A combination according to any one of claims 1 to 3 wherein the reinforcing sleeve extends to cover part of the base of the container and is positioned between the supporting cradle and the outer portions of the container base.
5. A combination according to any one of claims 1 to 4 wherein a reinforcing patch is applied to the base of the container.
6. A combination according to any one of claims 1 to 5 wherein the reinforcing sleeve extends, and is folded over, to cover part of the top of the container and a reinforcing patch is applied to the top of the container.

7. A combination according to any one of claims 1 to 6 wherein the reinforcing sleeve is formed of material having a plurality of bands of reinforcing threads running in the warp direction.

8. A flexible intermediate bulk container comprising a bag formed from an impervious film of plastics material and having a closed end and assuming a generally cylindrical configuration when filled with a particulate material with said closed end resting on a surface wherein said bag is provided with a flexible reinforcing sleeve round substantially all of the portion of said bag that corresponds to the cylindrical surface, when filled, suitable for use with a supporting cradle as described in claim 1.

9. A container according to claim 8 wherein the reinforcing sleeve has an extension above the level of particulate material, when filled, and said extension being of sufficient height to enable lifting apparatus to be engaged therewith.

10. A container according to either claim 8 or 9 wherein the reinforcing sleeve is formed of material having a plurality of bands of reinforcing threads running in the warp direction.

Fig. 1.

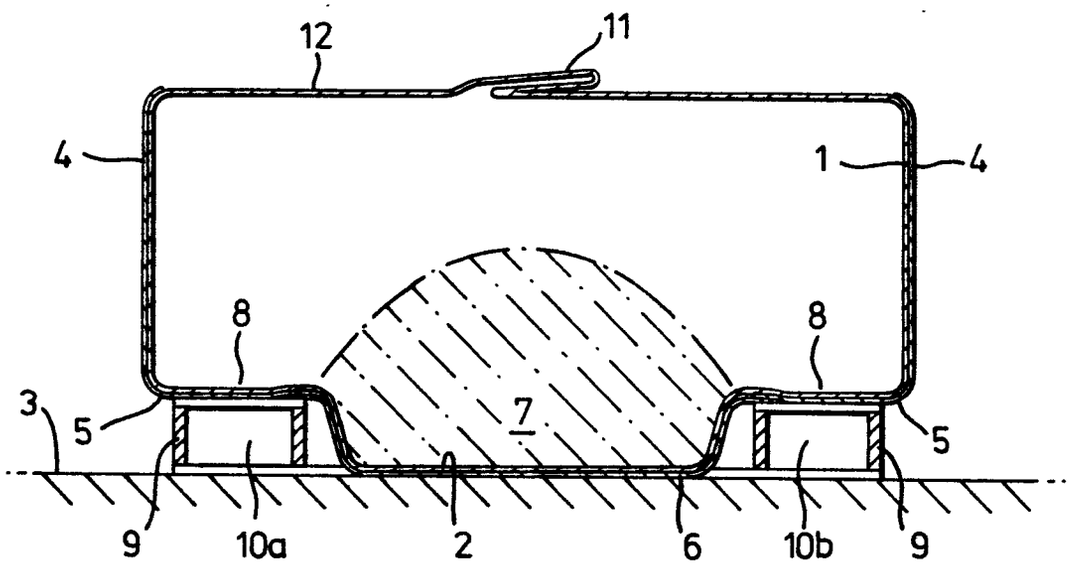


Fig. 2.

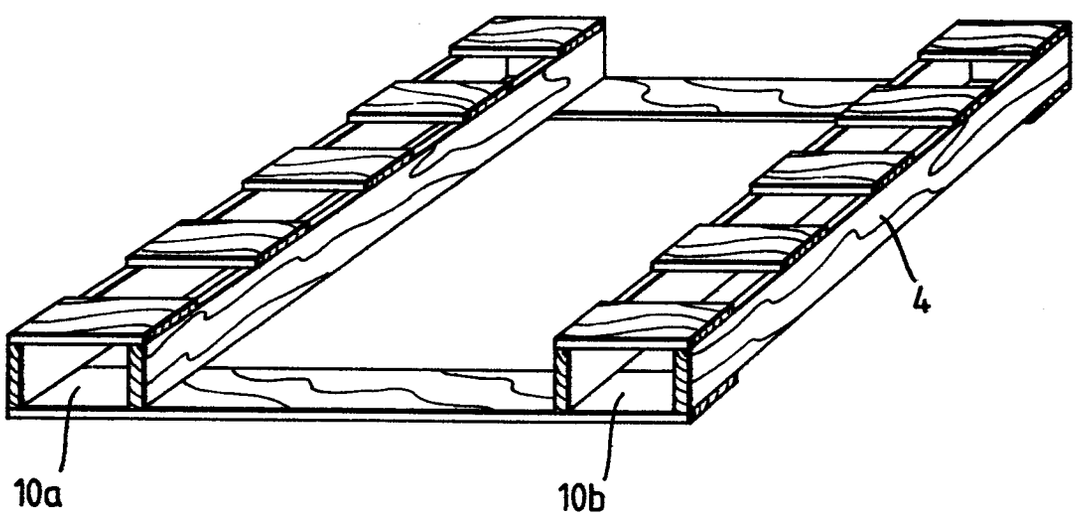


Fig.3.

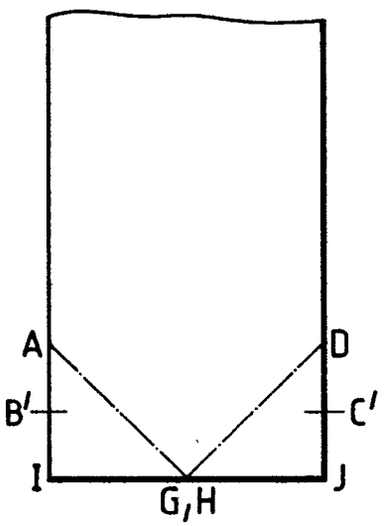


Fig.4.

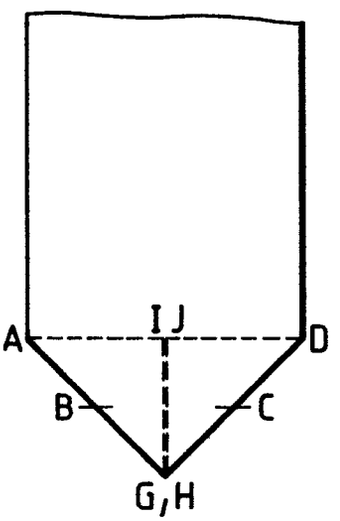


Fig.5.

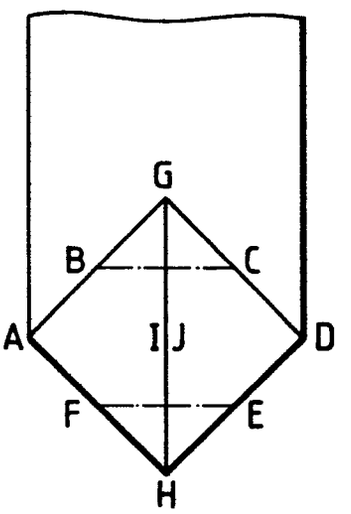


Fig.6.

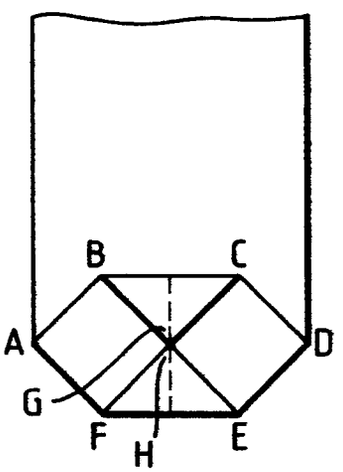


Fig.3a.

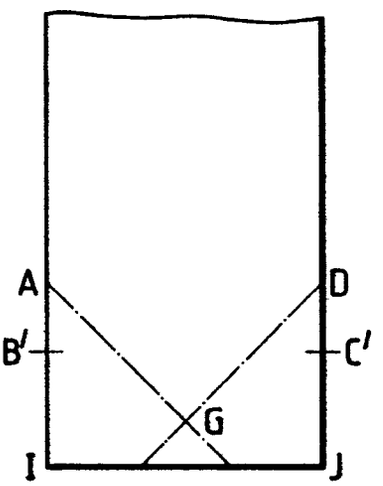


Fig.4a.

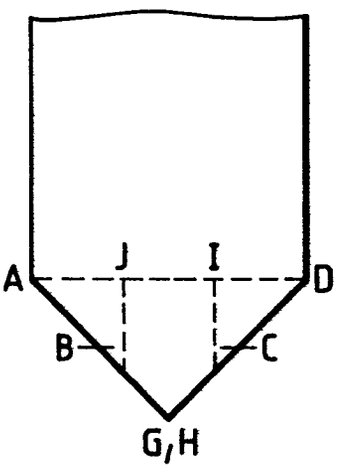


Fig.5a.

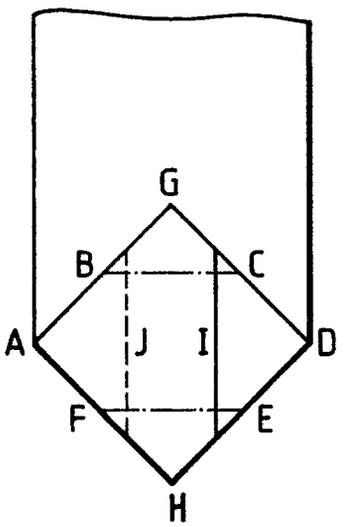


Fig.6a.

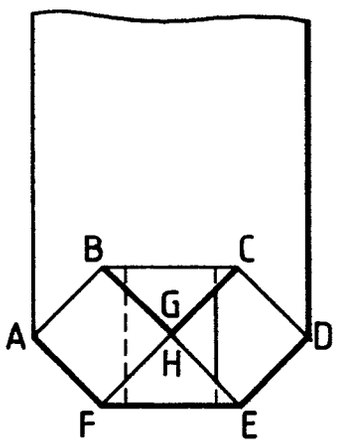


Fig.6c.

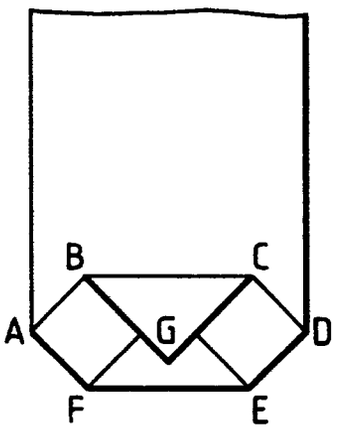


Fig.5b.

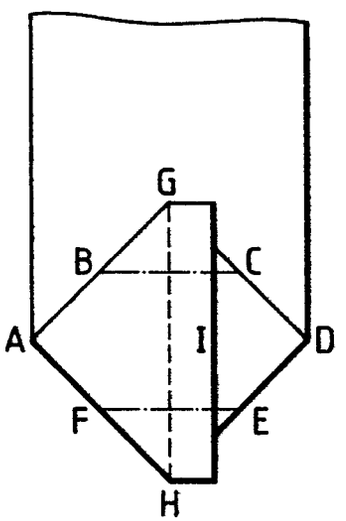


Fig.6b.

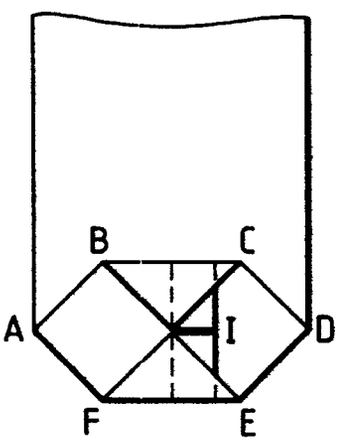


Fig.7.

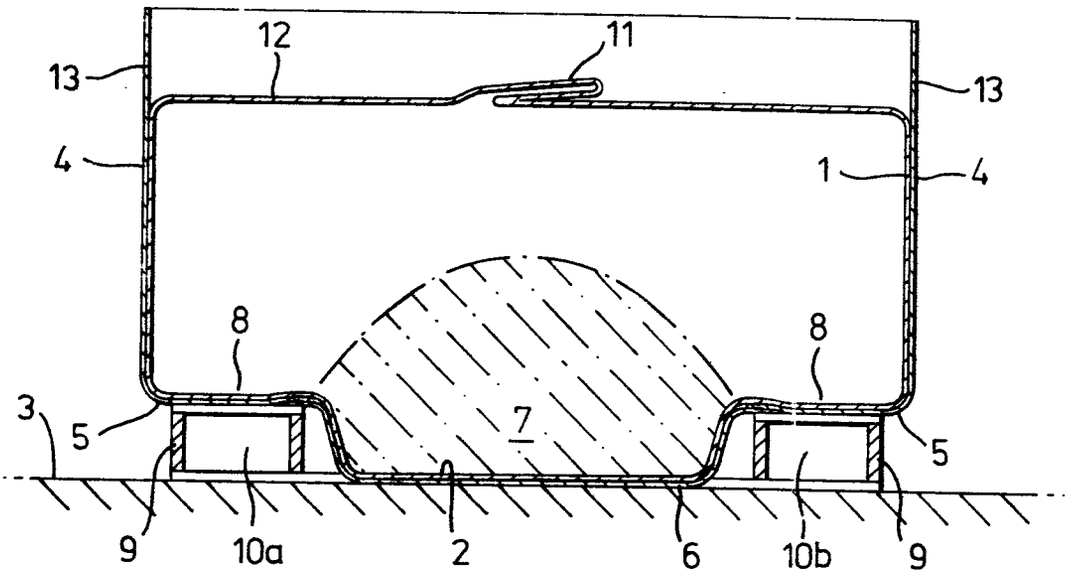


Fig.8.