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GB 1120066 **EP A2 0158361** **EP A2 0132340**
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(58) Field of search
B8K
B8C
Selected US specifications from IPC sub-classes B65D B65B

(54) **Container assembly**

(57) A container arrangement comprises a sheath (20) of tubular flexible fabric, and a plurality of empty, flexible containment sections (2, 3, 2a, 3a) retained within the sheath. Each containment section has a filling opening 14, 15, 14a, 15a, and all the sections are filled simultaneously with flowable particulate material to a degree whereat the expansion of the sections within the sheath cause the sheath to be placed in tension around its periphery along a substantial part of the length of the sheath.

FIG.3.

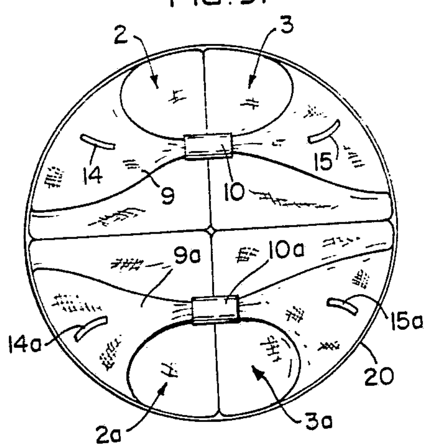

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FIG.1.

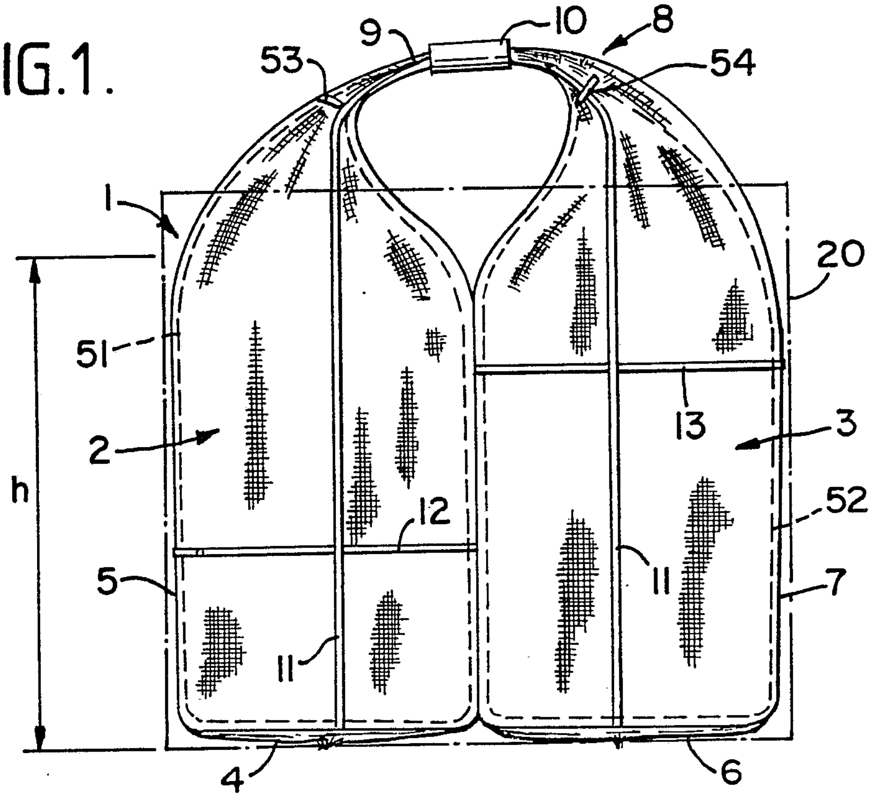


FIG.2.

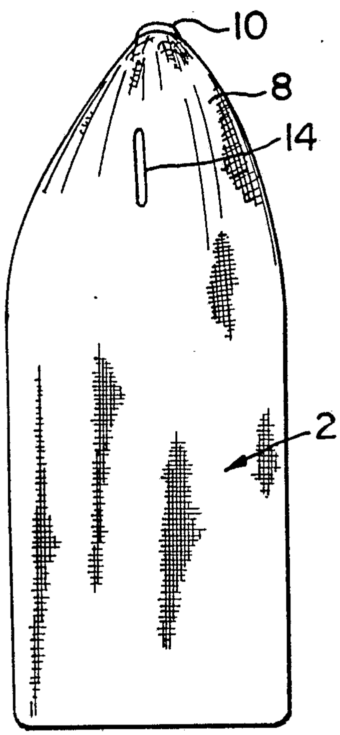


FIG.3.

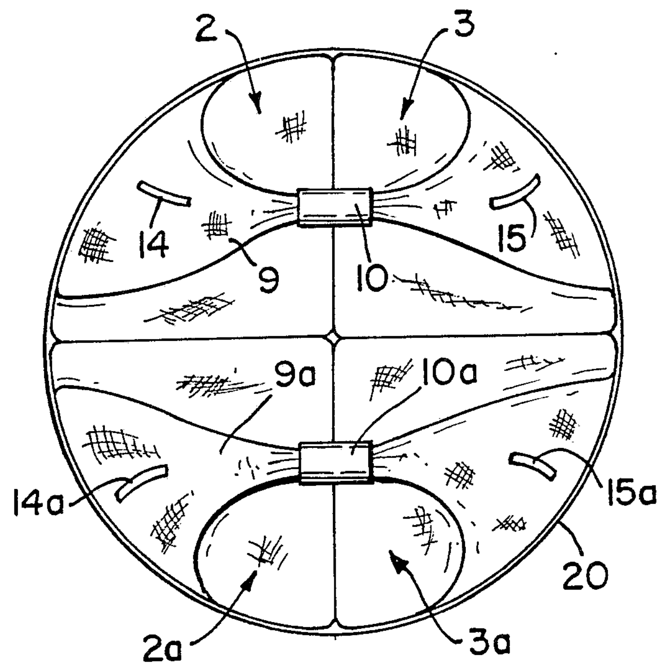


FIG.4.

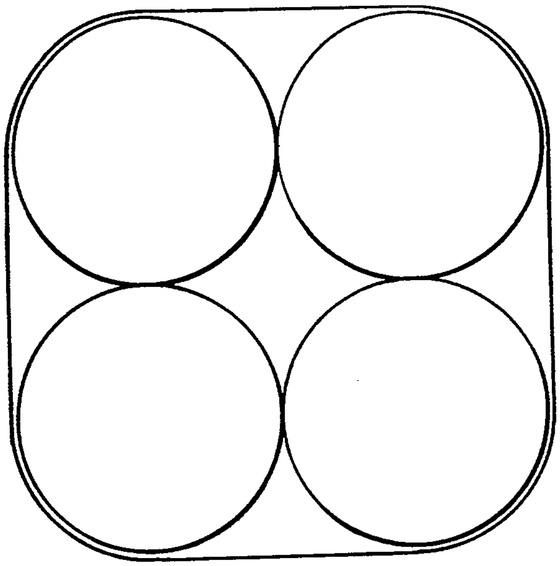
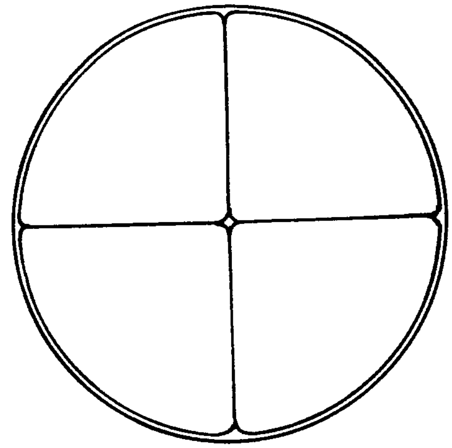


FIG.5.



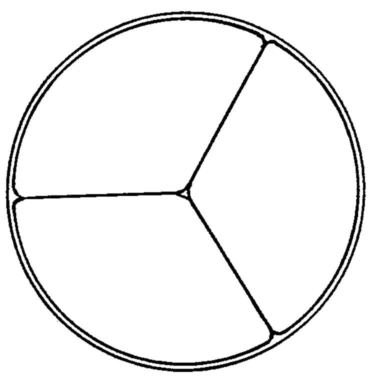


FIG.6.

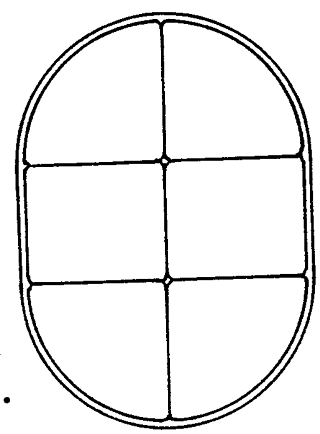


FIG.7.

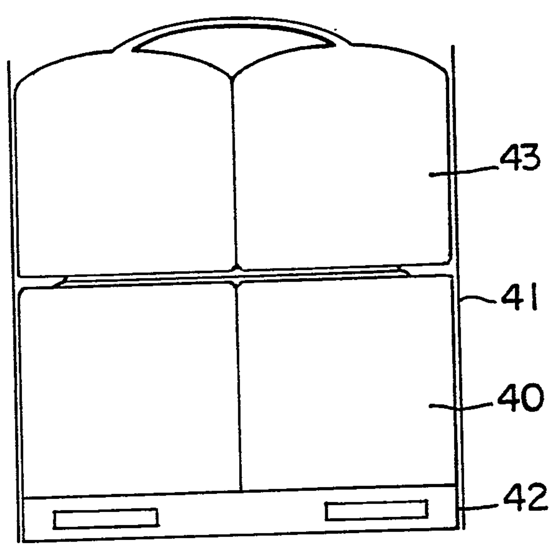


FIG. 8.

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CONTAINER ASSEMBLY

This invention relates to container assemblies.

Flexible bulk containers are now well known in the storage and transport of materials in granular, powder and other particulate forms. Such containers are generally in the form of large bags or sacks, designed to carry loads in the range of 0.5 to 2 tonnes, in each case with considerable safety margin above the rated load. The containers are commonly made from woven fabric, particularly woven polypropylene or other suitable synthetic material.

There have in the past been many proposals for the manufacture of such containers, and the common features thereof have been a wall structure closed at a lower end by a base, with lifting means being provided at the upper end of the wall structure. The containers are thus filled and handled individually, being capable of lifting by a forklift truck, crane or other lifting mechanism.

Users of small quantities of the materials generally carried by such containers do not require the larger container sizes, but often require half tonne containers, and ideally may prefer smaller containers if they were available. However, exactly the same amount of handling is required for the small containers as well as the large containers, and the labour costs by weight of material are thus significantly higher for smaller containers. The invention seeks to provide a container assembly that will mitigate these difficulties.

According to the invention a method of preparing a container assembly of filled flexible containment sections comprises the steps of arranging a plurality of empty containment sections one substantially adjacent to another within an elongate outer sheath of tubular flexible fabric, each containment section having means by way of which it may be filled, and simultaneously filling all the containment sections with flowable particulate material to a degree whereat the expansion of the sections within the sheath causes the sheath to be placed in tension around its periphery along a substantial part of the length of the sheath.

The resultant assembly is one of a number of separate, filled containment sections within an outer sheath, the sections being held together by the tension in the sheath. After filling, therefore, all the containment sections may be handled together as a single package, for example by using a pallet on which the assembly stands or by lifting the assembly using lifting means provided at an upper end of each individual containment section. In the latter case such lifting means should desirably lie at similar levels within the sheath. It is also preferred that the means by way of which each section may be filled lies at the upper end of the section, so that all sections can simply be filled by inserting a suitable multiple spout arrangement into the upper end of the sheath, one spout being directed into each individual section.

It is preferred that along the aforesaid substantial part of the length of the sheath, the substantially full area of each containment section wall is in contact either with the wall of at least one other containment section or with the sheath. Thus, substantially the whole of the volume enclosed within the substantial part of the sheath length is filled, and the resultant assembly is a compact and firm package of optimally small sectional area.

The invention also relates to a container assembly for filling by the aforesaid method, the assembly containing a sheath of tubular flexible fabric, and a plurality of empty, flexible containment sections retained within the sheath. Retention may be effected simply by appropriate folding of the assembly, which can then be partially unfolded if required prior to filling, and/or may be effected by positive retaining means between one or more of the containment sections and the sheath, for example by localised stitching or adhesive patches.

The invention also extends to a container assembly after filling by the aforesaid method.

Although the tube which forms the sheath may be formed from a plurality of sections that are stitched or otherwise secured together transversely of the tube, maximum advantage is gained if the sheath is a continuous single length of tubular material. That material will preferably be a woven fabric, particularly a tubular woven fabric so that the tube is free from any seams whatsoever. However, it is also envisaged that the tubular material may be formed from one or more lengths of flat woven fabric, joined by a seam or seams extending longitudinally of the tube.

Each containment section may also be formed in any of the ways suggested in the preceding paragraph although of course each section will be smaller than the sheath. As with the sheath, it is preferred that each containment section be formed from a tubular woven fabric free from any seams.

The fabric of the sheath and of the containment sections may be the same or different. Preferably it is a woven polypropylene fabric as conventionally used in flexible bulk containers.

The array of containment sections within the sheath is not critical, and in theory any number of containment sections from two upwards may be used. The presently preferred number of sections is four.

The assembly is particularly suitable for formation using two or more containers as described in our co-pending application number 8712075. That application describes a container that comprises first and second side-by-side containment sections, each containment section having a base and a wall structure extending upwardly from the base, and a lifting band joining together upper regions of the two wall structures, the lifting band and both wall structures being formed from a single tube of flexible material. With two such containers placed side-by-side it will be seen that there is a substantially square array of four containment sections, that is particularly suitable for restraint within an outer sheath. The lifting bands of the two containers will be aligned and can readily be engaged by the single tine of a forklift truck or by a hook or other lifting mechanism so that the whole assembly can be lifted and handled as a unit. At the point of end use, however, the sheath may simply be cut so that each container becomes available for use independently of the other. However, the assembly is not limited to the use of containers as described in the aforesaid application, but finds general application with containment sections that may be made in any one of a number of different ways.

In order that the invention may be better understood, specific embodiments thereof will now be described in more detail, by way of example only, with reference to the accompanying drawings in which:-

Fig. 1 is a front elevation of a pair of filled containment sections that may form part of a first embodiment of the assembly;

Fig. 2 is a side elevation of the contianment sections of Fig. 1;

Fig. 3 is a plan view of an assembly according to the invention, utilising four containment sections as shown in Fig. 1;

Figs. 4 and 5 are diagrams for assisting in the explanation of optimum design of the container assembly;

Figs. 6 and 7 are schematic plan views of alternative assemblies; and

Fig. 8 is a schematic side elevation, partly cut away, of a further embodiment of container assembly.

Referring to Figs. 1 and 2 there is shown a container 1, comprising first and second side by side containment sections 2 and 3, filled with flowable particulate material. The containment section 2 comprises a base 4 and a wall structure 5 extending upwardly from the base. The containment section 3 comprises a base 6 and a wall section 7 extending upwardly from the base. The upper regions of the two wall structures 5 and 7 are joined together by a lifting band 8, which is gathered together into the form of a handle 9 and held in its gathered position by a sleeve 10 loosely fitted over the central part of the lifting band.

The lifting band and both wall structures are formed from a single tube of flexible material, and the bases 4 and 6, although they could be stitched into the ends of the tubular material, are preferably formed by suitable folding and securing of parts of the tubular material.

The flexible material is desirably woven polypropylene or other suitable synthetic material, and is preferably tubular woven polypropylene interwoven in any appropriate weaving pattern, usually smooth woven, although twill, basket and rib weaves may alternatively be used. Whatever the weave, it is preferred that for maximum strength the warp yarns of the fabric extend upwardly in both wall structures and through the lifting band as indicated by the typical warp thread indicated at 11 in Fig. 1. The weft threads will then extend around the wall structures, as indicated by typical wefts 12 and 13 in Fig. 1, and correspondingly weft threads will extend around the lifting band 9. If desired, reinforcing bands comprising warp threads of higher tensile strength may be integrally woven into a base fabric utilising lower strength warp threads, but generally it will suffice for all warp threads to be of the same nominal strength.

When tubular woven fabric is used, it is desirably folded longitudinally into a gussetted formation in order to assist folding during formation of the bases and to assist the tube to fall into the required configuration when the containment sections are filled.

Each containment section has a filling slit 14, 15 respectively, formed in the region of the outwardly facing shoulder in the transition region between the wall structure and the lifting band. The slits extend parallel to the warp thread of the fabric, so that the load-carrying capacity is not impaired. Filling spouts may simply be inserted through each of the slits in order to fill the containment sections. After filling, each slit may be closed by stitching or by an adhesive patch if required.

It will readily be appreciated that the filled container may be lifted by engagement of the lifting loop 9 onto the tine of a fork-lift truck, onto a hook or similar device of a crane or other lifting means. It will be seen that the lifting forces are transmitted directly from the lifting band into the whole of the wall area of each containment section and, if the bases are integrally formed from the same material, downwardly through each wall section and into the base thereof. The container is thus extremely strong and is free from any stitched connections and transverse joints that will tend to weaken it in any direction tranversely of the applied lifting load.

Fig. 3 shows two of the containers of Fig. 1 arranged side-by-side and assembled into a container assembly according to the invention. In order to form the assembly two empty containers are arranged within a sheath 20, formed from a further single tube of flexible material that is desirably woven polypropylene or other suitable synthetic material, and is preferably tubular woven polypropylene interwoven in any appropriate weaving pattern, usually smooth woven, although twill, basket and rib weaves may alternatively be used. In order to fill the assembly it is unfolded as necessary, in particular to make the filling slits 14, 15 and 14a, 15a accessible and to dispose the lifting bands 9 and 9a of the two containers uppermost and at similar levels within the sheath. A multi-spout filling means is then introduced into the open upper end of the sheath, one spout being positioned within each of the four filling slits. Flowable particulate material is fed through the spouts simultaneously into all four containment sections 2, 3, 2a and 3a so that these are each filled with material at substantially the same rate. Pressure equalisation that occurs during filling causes the individual containment sections to take up substantially the shapes shown in Fig. 3, and to constrain the sheath 20 to take up a substantially circular configuration, with the sheath being placed in tension around its periphery. Accordingly, a very firm, compact package results, with substantially the full area of each containment section wall lying in contact with the walls of adjacent containment sections and with the sheath. The periphery of the sheath is in tension along at least that part of the length of the sheath which corresponds to the filling height within each containment section, e.g. the height shown as h in Fig. 1. Any part of sheath material lying above that height may not be tensioned, but this will not detract from the efficiency of the container assembly.

From Fig. 3 it will be seen that the handles 9 and 9a will lie substantially parallel one to the other so that they may readily be engaged simultaneously by one tine of a forklift truck or by a hook or other lifting means. The assembly may thus be lifted as a unit, so retaining its integrity. The handles 9 and 9a may lie above the uppermost level of the sheath 20 as shown in Fig. 1, or the sheath material could be extended upwardly above the handles and folded inwardly to give some protection to the upper part of the containment sections.

Fig. 3 is a somewhat idealised view of the final shape of the container assembly, although the assembly will often approximate to that shape. The peripheral length of the sheath must, of course, bear a required relationship to the peripheral length of each individual containment section, and desirably this relationship of peripheral lengths is optimised to produce substantially the results shown in Fig. 3. The limiting conditions are illustrated schematically in Figs. 4 and 5. Fig. 4 shows four theoretically circular containment sections enclosed within a circular sheath. If all the containment sections are filled to that circular form, then it can be shown that the peripheral length of the sheath should not be greater than $(1 + \sqrt{2})$ i.e. 2.414 times the peripheral length of each containment section. As the peripheral length of the sheath is reduced from that shown in this figure the sheath will act to constrain the individual containment sections more and more so that they are prevented from taking up the ideal circular configurations. In the optimum configuration shown in Fig. 5 it can be calculated that the peripheral length of the sheath is $\frac{4\pi}{4+\pi}$ times the peripheral length of each containment section, i.e. 1.76 times that length. In this condition the whole of the volume within the tensioned length of the sheath is filled. It is thus preferred that in the embodiment of the invention that utilises four containment sections as shown, the peripheral length of the sheath equals 1.76 times the peripheral length of each containment section within a tolerance of $^{+\ 0\%}_{-\ 10\%}$

If the sheath periphery is less than the 1.76 figure then there will be some wrinkling of the fabric of the containment sections, but this will not have any deleterious effect on the assembly.

Figs. 6 and 7 show theoretical configurations similar to that shown in Fig. 5 utilising respectively three containment sections and six containment sections to form the assembly. When three containment sections are used each section may in itself be a separate container with its own separate lifting means, or any two of the sections may be grouped together as a pair as shown in Fig. 1, the third then being a separate section with its own lifting means. The assembly of Fig. 7 can readily be formed by arranging three of the containers of Fig. 1 side-by-side so as to form six containment sections within the sheath. From these Figures it will be understood that the numbers and configurations of containment sections within the sheath may vary considerably and may be chosen so as to suit the requirements both of those filling and handling the assembly, and of the end users of the assembly.

Fig. 1 shows an assembly wherein there is a single layer of containment sections within the outer sheath. Fig. 8 shows schematically an assembly incorporating two layers, each of four containment sections, the assembly being shown supported by a pallet. In forming this assembly a first pair of containers 40 as shown in Fig. 1 are placed within the sheath 41 to stand on the pallet 42, and the four containment sections are then simultaneously filled in the manner that has already been described. After filling, a second pair of containers 43 are then inserted into the sheath to stand on top of the already filled lower layer, and the four upper containment sections are then simultaneously filled. The sheath is thus placed in tension firstly around the lower layer of containment sections, and then around the upper layer of containment sections. The resulting assembly can be handled by means of a forklift truck or other means lifting the pallet, and can be delivered in such fashion to the end user. That user may then use material as required simply by cutting the upper section of the sheath so that he is able to remove at will a pair of upper containment sections. When both upper pairs have been used then the remainder of the sheath may be cut in order to give simple access to the lower pairs of containment sections.

For some loads in the container assembly the protection afforded by the flexible tubular material of the containment sections and of the sheath may be sufficient. Other loads may require more protection against the ingress of moisture, and this can be given in either or both of two ways. The first way is to incorporate in each containment section an inner liner of impervious material as indicated at broken lines 51 and 52 in Fig. 1. Each impervious liner extends up to the respective filling slit, and has an open mouth into which the filling tube passing through the slit may be inserted. After filling, the open mouth of the liner may be closed off and secured by a tie such as 53, 54. If more protection is required then a weatherproof top may be fitted over the assembly and secured in any suitable manner to the sheath. Additionally, or as an alternative, a weatherproof tubular jacket may be fitted around the sheath, or the sheath itself may be formed of weatherproof material.

It will be appreciated that the container assembly may be made in various different sizes, and that any assembly may include any number of containment sections which may be themselves of the same or of different sizes. Any containment section may have its own lifting means of any suitable form, or a plurality of containment sections may have a common lifting means. Materials other than woven polypropylene may be used both for the containment sections and for the sheath if required.

CLAIMS

1. A method of preparing a container assembly of filled flexible containment sections comprising the steps of arranging a plurality of empty containment sections one substantially adjacent to another within an elongate outer sheath of tubular flexible fabric, each containment section having means by way of which it may be filled, and simultaneously filling all the containment sections with flowable particulate material to a degree whereat the expansion of the sections within the sheath causes the sheath to be placed in tension around its periphery along a substantial part of the length of the sheath.

2. A method according to claim 1 in which each containment section includes lifting means provided at an upper end thereof, and the containment sections are filled so that all the lifting means lie at similar levels within the sheath.

3. A method according to claim 1 or claim 2 in which the filling means of each containment section lies at an upper part of the respective containment section, and the containment sections are filled by inserting a multiple spout filling arrangement into the upper end of the sheath, with one spout directed into the filling means of an individual one of the containment sections.

4. A method according to any one of the preceding claims in which the containment sections are filled so that substantially the full side wall area of each containment section lies in contact partly with part of the side wall of one other containment section and partly with part of the side wall of at least one further containment section and/or part of the sheath.

5. A method of preparing a container assembly of filled flexible containment sections, substantially as herein described with reference to figures 1 to 3 and to any one of figures 6 to 8 of the accompanying drawings.

6. A container assembly when filled by a method according to any one of the preceding claims.

7. A container arrangement for filling by a method according to claim 1, the arrangement comprising a sheath of tubular flexible fabric, and a plurality of empty, flexible containment sections retained within the sheath, each containment section having filling means by way of which it may be filled.

8. A container arrangement according to claim 7 in which the sheath is a continous single length of tubular woven fabric, and each containment section is a further continous single length of tubular woven fabric, smaller than the length forming the sheath.

9. A container arrangement according to claim 7 or claim 8 in which four containment sections are retained within the sheath, each containment section has substantially the same periphery length, and the peripheral length of the sheath is $1.76 {}^{+0\%}_{-10\%}$ times the peripheral length of a containment section.

10. A container arrangement according to any one of claims 7 to 9 in which four containment sections are retained within the sheath, the sections being arranged in two pairs, each pair comprising first and second side by side sections each having a base and a wall structure

extending upwardly from that base, upper regions of the wall structures being joined together by a lifting band and the wall structures and lifting band being formed from a single tube of flexible material.

11. A container arrangement substantially as herein described with reference to figure 1 to 3 and to any one of figures 6 to 8 of the accompanying drawings.

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