April 5, 1966 P. WASYLUKA 3,244,274

CONTAINER FOR AND FILLED WITH ELONGATED TETRAHEDRON PACKAGES

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Fig.1

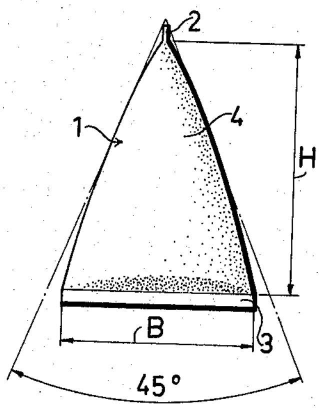


Fig.2

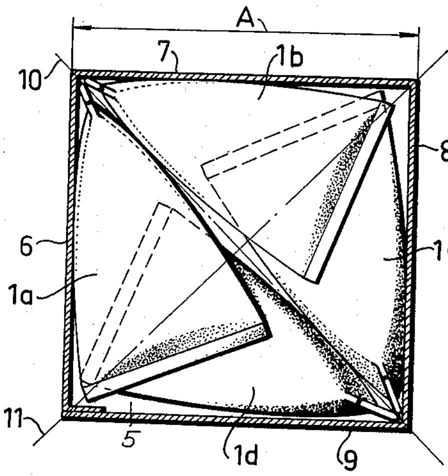
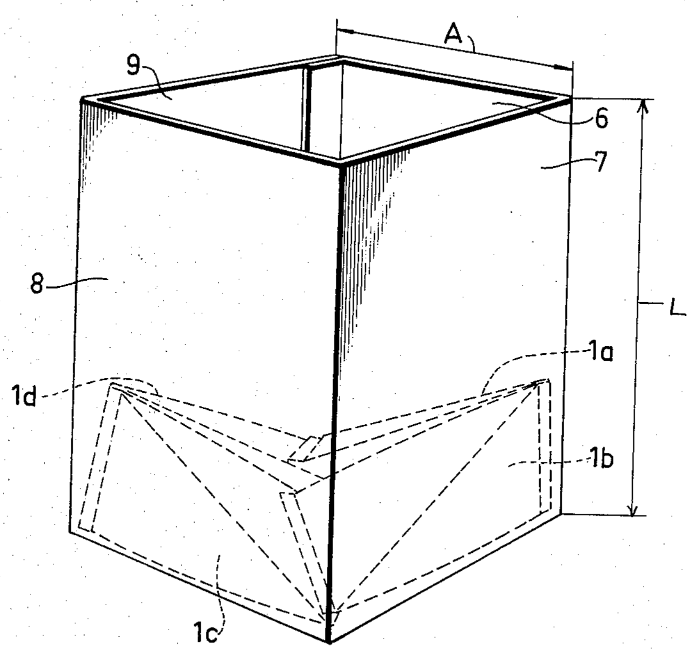


Fig.3



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CONTAINER FOR AND FILLED WITH ELONGATED TETRAHEDRON PACKAGES

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This invention relates to containers for and filled with a plurality of packages having the configuration of a tetrahedron and it is the general object of the invention to provide a new and improved construction which makes it possible to provide a container having a simple four-sided prismatic configuration which has a square cross-section, this container holding a plurality of layers of tetrahedron packages, each layer of which is constituted by a compact arrangement of four tetrahedrons, and the several layers being superimposed each upon the other, to the end of filling the interior of the container with a minimum loss of unstable space, thereby not only making it possible to use a simply configured container but also to establish an extremely efficient packing factor for a package of this somewhat unusual configuration.

More particularly, the novel container and packages packed therein are constituted by an elongated container having a four-sided prismatic configuration and which is square in transverse section, the packages being substantially congruent and constituted by elongated tetrahedrons each of which is defined by four substantially congruent isosceles triangular sides and having two opposite end edges substantially perpendicular to each other, each two triangular tetrahedron sides meeting respectively along each of said opposite edges at an included angle of about 45°. To establish an optimum filling factor in the container, each side of the square defining the transverse section of the container has a length approximately 1.6 times the length of each of the two opposite tetrahedron edges, and the quotient of the length of each said tetrahedron edge divided by the distance between such edges is preferably from about .75 to .85.

Containers for and filled with tetrahedron packages are not broadly new, reference being made in particular to U.S. Patent No. 2,919,800 granted January 5, 1960 to Harry S. V. Jarund, but container structure according to this patent is of more complex configuration and involves use of packages having a regular tetrahedron configuration only. It cannot be used to efficiently stack or pack tetrahedrons which are elongated as distinguished from regular, i.e. in an elongated tetrahedron, the triangular sides would be isosceles triangles whereas in a regular tetrahedron, the triangular sides would be equilateral triangles. In the Jarund patent, the bottom wall of the container is also required to be at least a truncated portion of a substantially regular pyramid having six sides coordinated respectively to the six sides of the container which is hexagonal in transverse cross-section as compared with a more simple flat bottom wall for a four-sided container in accordance with the present invention.

The invention will hereinafter be described more in detail with reference to the accompanying drawing which, by way of example, rather than in a limiting sense, illustrates an embodiment of the container and packages therein in accordance with the invention and which is defined more particularly in the appended claims. In the drawing:

FIG. 1 is a view in side elevation of an elongated tetrahedron package which is to be stacked, or packed in a container according to the invention;

FIG. 2 is a top plan view of the container showing one layer of four tetrahedron packages and illustrating the stacking pattern involved; and

FIG. 3 is a perspective view of the container shown in FIG. 2 having a bottom layer of elongated tetrahedron packages stacked therein.

With reference now to the drawings, the tetrahedron package **1** illustrated in FIG. 1 is of the kind which is produced from a length of a tubular flexible packaging material by flat-pressing and sealing transversely the ends of the tube length along narrow end zones to form two end sealing fins **2**, **3** substantially perpendicular to each other. The body of the tetrahedron package is constituted by four substantially congruent isosceles triangular sides **4**. The base edges of two opposite triangular sides meet along the inner line of one sealing fin **2** at an included angle of about 45° and the base edges of the other two opposite triangular sides meet along the inner line of the other sealing fin **3** also at an included angle of about 45°. Due to the contents of package **1** which may be a liquid such as milk, and also because of the inherent flexibility of the package walls, the shape of the package body may depart slightly from a true geometrical tetrahedron, the package walls bulging slightly outwards as seen on the drawing. As indicated in FIG. 1, the distance H between the inner lines of the two end sealing fins **2**, **3** is greater than the length B of the end seals, i.e. greater than the length of the base of each of the four triangular sides of the tetrahedron. More about this will be said later in the description.

Referring now to FIGS. 2 and 3, these two views show a container in which a bottom layer of four elongated tetrahedron packages each as illustrated in FIG. 1, are stacked or packed in accordance with the invention. This container comprises a square flat bottom wall **5** and four side walls **6**, **7**, **8** and **9** extending upwardly from the bottom wall, these side walls defining substantially a straight prism of square transverse section. In the container, the bottom layer comprises two oppositely directed, overlapping tetrahedron pairs **1***a*, **1***b* and **1***c*, **1***d* respectively, all of which rest upon the bottom wall **5**.

In each such pair, the two tetrahedron packages **1***a* and **1***b*, and **1***c*, **1***d* are aligned and symmetrical to a diagonal plane indicated at **10**, common to both pairs, passing through the longitudinal axis and diagonally opposite corners of the container, and engage each other in such plane **10**. Moreover, sides of the tetrahedron packages of each pair opposite to the plane **9** engage adjacent side walls of the container. Thus, the sides of one pair of tetrahedron packages **1***a*, **1***b* engage adjacent container side walls **6** and **7**, while the sides of the other pair of tetrahedron packages **1***c*, **1***d* engage the other adjacent container side walls **8** and **9**. Each pair of tetrahedron packages **1***a*, **1***b* and **1***c*, **1***d*, respectively, is thus accommodated in a wedge-like manner in an individual one of two diagonally opposite inner side wall corners of the container, the upright one of the two mutually perpendicular edges of each tetrahedron package of each pair extending substantially along the adjacent container side wall corner edge. The tetrahedron edge angle along this upright edge being substantially 45° as previously described, each pair of tetrahedron packages will have a snug wedge fit in the inner side wall corner of the container which encloses an angle of 90°, i.e. about twice the tetrahedron edge angle. Hence, each one of the two tetrahedron packages of each pair **1***a*, **1***b* and **1***c*, **1***d* which constitute the bottom layer in the container will be firmly supported by the bottom wall **5** of the container and the adjacent side walls as well as by the other tetrahedron package of that pair.

Dependent upon the flexibility of the package wall material and the nature of the package contents and/or the degree of filling, the tetrahedron edge angle, or rather the quotient of the tetrahedron edge length B and the spacing H between end seals **2**, **3** may vary somewhat yet ensuring a satisfactory stacking of packages in accordance with the invention. In practice, it is preferred to establish the value of the aforesaid quotient between limits of .75 and .85. When determining this dimensional relationship, as well as others which are to be later discussed, sealing zones or fins **2**, **3** of the above-mentioned type have been taken into consideration. These sealing fins project from the body of the tetrahedron package and are an inevitable result in most methods of producing tetrahedron packages.

As is apparent from the drawing, the two oppositely directed pairs of tetrahedron packages of the bottom layer are placed within the container in overlapping relationship. Preferably, one pair **1***a*, **1***b* rests in part on the other pair **1***c*, **1***d* but one tetrahedron package of a first pair might as well rest in overlapping relationship upon that tetrahedron package of the second pair situated on the same side of said diagonal plane **10** common to both pairs, the other tetrahedron package of the second pair resting in overlapping relationship upon the other tetrahedron package of the first pair.

As with the bottom layer of tetrahedron packages in the container, the second layer to be inserted in the container in accordance with the stacking pattern of the invention will also comprise two oppositely directed, overlapping pairs of tetrahedron packages. The pairs of tetrahedron packages of the second layer will rest upon the upwardly facing triangular sides of the tetrahedron packages of the bottom layer, and in each such pair the two tetrahedron packages will be aligned and symmetrical to a diagonal plane **11** common to both pairs through the other diagonally opposite corners and longitudinal axis of the container, the plane **11** thus being perpendicular to the symmetry plane **10** associated with the bottom layer of four tetrahedron packages. The two tetrahedron packages of each pair which constitute the second layer, like those packages of the bottom layer, thus will engage each other in the second diagonal plane **11** and triangular sides of the packages opposite from the diagonal plane **11** will engage adjacent side walls of the container. Hence the general stacking configuration of the second layer of tetrahedron packages will be generally the same as that of the bottom layer of packages, the only difference being that the respective planes of symmetry **10** and **11** are perpendicular to one another.

If the container is to hold still a third, fourth or even more layers, the third layer will have the same orientation as the bottom layer, i.e. its plane of symmetry will coincide with plane **10** of the bottom layer. Any fourth layer will have the same orientation as the second layer, its plane of symmetry coinciding with the symmetry plane **11** of the second layer. Hence the stacking pattern according to the invention has the feature that each layer of four tetrahedron packages has the same general stacking configuration, and that the various layers are placed each upon the other in such manner that the planes of symmetry of successive layers are alternately one and the other of two diagonal planes through the corners and longitudinal axis of the container.

In order to obtain the closest possible stacking, i.e. to obtain the optimum filling factor for the interior volume of the container, it is preferred that the two overlapping tetrahedron pairs of superimposed layers having coinciding planes of symmetry, i.e. layers one, three and five, or layers two, four and six, etc. have alternatively one or the other of two overlapping arrangements. Thus, according to one arrangement, in one layer, two tetrahedron packages adjacent one side wall corner of the container may partly overlie the other pair, while in the next succeeding layer, that tetrahedron pair adjacent the same side wall corner of the container may underlie the other tetrahedron pair of the latter layer. According to the other and alternative arrangement, with respect to the tetrahedron pairs of one layer, the overlapping arrangement of equipositioned layers may alternate similarly, so that each tetrahedron of one layer overlies or underlies another tetrahedron of that layer, while the corresponding tetrahedron of the second next layer underlies, or overlies, respectively, the corresponding other tetrahedron thereof.

In accordance with the invention, the width A of one side of the squarely configured container should exceed the distance H previously referred to in order to permit insertion of the tetrahedron packages **1** in the container in the improved stacking pattern. Optimum stacking results have been obtained by dimensioning of the container in such a way as to yield a transverse container side width A equal to 1.6 times the length B of the base of each triangular side of the tetrahedron.

In practice, an even number of tetrahedron layers according to the present stacking pattern will yield the most advantageous use of the interior volume of the container. This is best illustrated in the following Table 1 which lists the container height L for various numbers of layers, the height L being expressed in terms of the length B.

Table 1

Number of layers	Number of tetrahedrons	Container height L in length B
1	4	1×B
2	8	1.3×B
3	12	2.3×B
4	16	2.6×B
5	20	3.6×B
6	24	3.9×B

From the above Table 1 it will be apparent that a container having stacked therein multiples of two layers in accordance with the invention will have its interior volume or capacity well utilized. However, for practical reasons, it is preferred that the number of layers of four tetrahedrons each should not exceed four for the reason that use of a greater number of layers will result in a container whose height L will be excessively great as compared with the dimensions of its squarely configured bottom wall.

I claim:

1. A container for and filled with congruent packages in the form of elongated tetrahedrons each defined by four substantially congruent isosceles triangular sides and having two opposite edges substantially perpendicular to each other, the two triangular tetrahedron sides meeting along each of said opposite edges enclosing an edge angle of about 45°, said container comprising a bottom wall and four side walls connecting thereto and arranged so as substantially to define a straight prism the cross section of which is a square having a side approximately 1.6 times the length of each of said two opposite tetrahedron edges, a bottom layer of two oppositely directed overlapping pairs of said tetrahedrons resting upon said container bottom wall and a second layer of two oppositely directed overlapping pairs of said tetrahedrons supported upon said bottom layer, the two tetrahedrons of each such pair of said bottom layer being symmetrical to one diagonal plane common to both pairs of the layer through the container axis and engaging each other in said plane while each by a triangular tetrahedron side opposite thereto engages an individual one of two adjacent container side walls, said two pairs of tetrahedrons of said second layer being similarly disposed with respect to the other diagonal plane through the container axis as well as to the container side walls.

2. A package for and filled with tetrahedron packages as defined in claim **1**, wherein the quotient of the length of each of said two opposite tetrahedron edges and their distance apart is from about .75 to .85.

3. A package for and filled with tetrahedron packages as defined in claim 1, comprising a multiple of two further layers of said tetrahedrons, the two pairs of tetrahedrons of each of said further layers being disposed similarly to those of said bottom layer and said second layer, said diagonal planes through the container axis alternating for successive layers.

4. A package for and filled with tetrahedron packages as defined in claim 1 wherein, in each layer of tetrahedrons, one tetrahedron of one of said pairs in overlapping relationship rests upon that tetrahedron of the other pair situated on the same side of said diagonal plane common

to both pairs, the other tetrahedron of said other pair in overlapping relationship resting upon the other tetrahedron of said first mentioned pair.

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