APPLICATION FOR PATENT

Title: FOOD CONTAINER

CROSS REFERENCE TO RELATED APPLICATIONS

This patent application claims priority under 35 USC §119(a)-(d) and (f), §172, §365(a) and (b), §386(a) and (b), and/or 37 USC CFR 1.55 to UK Patent Application No. 1816909.4, filed October 17, 2018, and European Patent Application No. 18275163.6, filed October 17, 2018, which are hereby incorporated by reference in their entirety.

FIELD AND BACKGROUND OF THE INVENTION

The present invention relates to a food container suitable for both liquid and solid food products.

The packaging industry is well developed throughout the industrialised world and is subject to general norms and practices. On the whole, in the case of food or beverage packaging, this needs to be able to hold food or beverages in a food safe and hygienic condition, and to withstand storage and transportation; specifically to provide physical and barrier protection to the contents, to prevent contamination and agglomeration, to provide security including tamper control, and to be convenient. In recent years, there have been moves to reduce the amount of packaging material used and also to focus on more environmentally friendly packaging, such as by use of recyclable and biodegradable materials. Lightweighting is a concept that has been prevalent in the industry for some time, which aims to reduce the amount of packaging material utilised, its weight and also the energy required for its manufacture.

In the case of packaging for liquid or other flowable materials, it is common to use bottles, cans, cartons, bags and the like. Generally, such packaging has either a generally cylindrical form, such as a drinks can or bottle, or a cuboidal form, such as milk or juice cartons of the type commonly sold under the ElopakTM or Tetra PakTM brands. This packaging is typically constituted by a smooth walled structure, often of multi-layered form, which minimises surface area and optimises the usable volume of the packaging. The contents of the packaging are often relied upon to maintain the form and integrity of the packaging, particularly during transportation and storage. For instance, a beverage container will often rely on the pressure of the beverage within the container to keep the container in its original shape. This enables the walls of the container to be made very thin, to the point that often once the container has been opened the walls become flimsy and are easy to collapse.

Food products are often sold in multiple units, such as cans and bottles, in which case it is common to tie these together with additional packaging, such as a sleeve, ring or yoke. This additional packaging also serves to stop individual packages from falling loose during transportation or storage, thereby reducing spoilage. However, such additional packaging adds further cost, both monetary and environmental.

The smooth nature of such packaging reduces a person's grip and it is not uncommon, particularly for large packages, for a person to struggle to handle the package without squashing it and causing spillage of the contents. This is particularly the case with large plastics drinks bottles.

SUMMARY

The present invention seeks to provide an improved container for food products. The invention is particularly suitable for, but not limited to, containers for liquids, such as beverages, and other flowable products.

According to an aspect of the present invention, there is provided a food or beverage container comprising: a wall defining an internal chamber of the container, the wall having interior and exterior surfaces and being of substantially uniform thickness; wherein the wall has a fractal profile with corresponding convex and concave fractal elements on corresponding ones of the interior and exterior surfaces; and wherein the convex and concave fractal elements form pits and bulges in the profile of the wall.

The present invention provides a food or beverage container having a container wall of different form than known in the art. The form taught herein provides a number of practical advantages over known packaging products.

Preferably, at least some of said pits and bulges have heads of a greater width than bases thereof.

Advantageously, the fractal profile of the wall permits coupling by inter-engagement of a plurality of said containers together. This feature can provide a number of practical advantages, including being able to do away with separate and additional tie elements to hold together a plurality of containers, as is necessary with currently available packages that rely on sleeves or yokes.

Preferably, the wall of the container is flexible, thereby permitting flexing of the fractal profile thereof. The flexibility of the wall permits disengagement of containers coupled together, by appropriate squashing of one or more of the containers to alter the fractal shape of the containers at the point of inter-engagement.

Advantageously, the corresponding convex and concave fractal elements provide for increased surface area of both the interior and exterior surfaces of the container relative to a volume of the chamber. An increased surface area can assist in the transfer of heat into and out of the container, for example for heating or cooling the contents thereof.

In preferred embodiments, the container is generally cylindrical. It may have other shapes in other embodiments, such as generally spherical, oval and so on.

The container wall may be formed of metal, plastics, elastomeric material or glass. It may also be made from flexible or potentially flexible food products.

The fractal form of the container wall can also contribute to improved holding of the container, whereas known packages with a smooth surface can be slippery particularly when wet such as when condensation forms on the outside as a result of the contents being cold.

It is to be understood that although the main focus of this disclosure is to a food or beverage container, the teachings are not limited to such applications and could be used for containers for a wide variety of other uses.

BRIEF DESCRIPTION OF THE DRAWINGS

Embodiments of the present invention are described below, by way of example only, in which:

Figure 1 is a schematic view in axial cross-section of a container according to an embodiment of the present invention;

Figures 2 and 3 are schematic axial partial cross-sectional views of an embodiment of two fractal containers in the process of being coupled together;

Figures 4 and 5 are schematic axial partial perspective views of the two fractal containers of Figures 2 and 3 in the process of being coupled together;

Figure 6 shows various views of another embodiment of fractal container;

Figures 7 to 9 show the coupling and uncoupling of two containers as per the embodiment of Figure 6; and

Figures 10 and 11 show, respectively, the coupling together of two further embodiments of fractal container.

DESCRIPTION OF THE ILLUSTRATIVE EMBODIMENTS

The description that follows and its accompanying drawings disclose in broad terms the teachings herein. Elements that are common in the art are omitted for the sake of clarity, such as but not limited to the specific materials that the container may be made of, typical volumes for the container and so on. Furthermore, the drawings are not to scale.

The concept disclosed herein makes use of a fractal profile for the wall of the container, which has been found to provide a number of advantageous characteristics when applied to a container particularly for food and beverage products. The skilled person will appreciate that the profile of the wall will not be of pure fractal form but will have a form dictated by practical considerations such as the minimum practical or desirable size of its fractal components. Nevertheless, the relationship between elements of the profile is fractal in nature. In practical embodiments, the fractal container may exhibit a fractal interpretation over two or more size scales.

Referring to Figure 1, this shows in schematic form a transverse cross-sectional view of an embodiment of container **10** for use, for example, for beverages. The container has a wall **12** with an external surface **14** and an internal surface **16**. Wall **12** has a substantially uniform thickness.

As with known containers, especially for food products, wall **12** is preferably made of a food safe material or otherwise provided with a food safe inner lining. For this purpose, and as known in the art, the wall may be a single layer material or may be made as a laminate of different materials. The wall may be made of or comprise a plastics material, a metal or metal alloy, an elastomeric material, and may even be made of glass. It is also envisaged that in some embodiments the wall may be made from flexible or potentially flexible food product (for example pasta, dough, licorice and so on).

Wall **12** has a fractal profile which provides a series of fractal elements **18-28** on interior and exterior surfaces **14**, **16**. It is to be understood that fractal elements **18-28** have fractal characteristics within practical considerations determined for example by the limits of the chosen manufacturing/forming process, the material chosen for wall, the thickness the wall and so on. In practice, fractal elements **18-28** will typically reach a minimum practical dimension determined by such constraints.

Fractal elements **18-28** of the wall create, as a result of wall **12** having a generally uniform thickness, a series of pits **40** and bulges **42** in the profile of the wall, in which a pit 40 as seen from one of exterior or interior surfaces **12** or **14** forms a corresponding bulge **42** on the other of exterior or interior surfaces **12** or **14**, and vice versa. This characteristic is exhibited both on a large scale, for instance with pits **40** and bulges **42** identified by the reference numerals in Figure 1, but also with the smaller ones of fractal elements **18-28**. The pits **40** and bulges **42** could be described as opposite images of one another on exterior **14** and interior **16** sides of walls **12**. Repeating features (for instance pits and bulges) across a variety of scales creates the fractal form or profile on the container surfaces. The fractal profile may extend across the entire area of the container surfaces or only over selected surfaces or surface portions. Thus, the fractal profile may in some embodiments extend over the entire container, while in other embodiments the majority of the container can be smooth with only the contact areas between containers having fractal formations.

It will be appreciated that Figure 1 is an axial cross-sectional view only. Fractal elements **18-28** may in some embodiments extend in linear fashion along the length of wall **12**, but in other embodiments elements **18-28** may be of pure fractal form of a type akin, so to speak, to cauliflower or broccoli florets, so as to create an array of distinct nodules, both circumferentially and also longitudinally along wall **12**.

Container **10** may be of generally cylindrical form, such that the cross-section shown in Figure 1 extends into and/or out of the plane of the paper. In such embodiments, container **10** will include a top and a base, typically of any type known in the art. In other embodiments, container **10** may have any suitable non-cylindrical form, examples of which the person skilled in the art will be familiar with.

Container **10** of this embodiment, and of the other embodiments described and contemplated herein, provides a number of practical advantages. One such advantage can be seen with reference to the embodiment shown in Figures 2 to 5.

Referring first to Figures 2 and 3, these are axial cross-sectional views of two containers **100**, **110** similar to the view of Figure 1 but in which only a part of the circumference of the wall of each container can be seen. Each container **100**, **110** has, as with the embodiment of Figure 1, a wall **12** having exterior **14** and interior **16** surfaces and fractal elements **18-28** formed in the wall and present in the exterior and interior surfaces **14**, **16**.

Containers **100**, **110** have the same shapes and fractal profiles, which are also symmetrical as will be apparent from the Figures. This correspondence in shapes enables pits **40** and corresponding bulges **42** in the walls of two containers **100**, **110** to engage into one another so as to interlock along a portion of their circumferences, as can be seen in particular in Figure 3. In this embodiment, pits **40** and bulges **42** have the same, but opposite, shapes such that they are able to fit snugly into one another. This can be achieved, in some embodiments, by creating two identical fractal sheets and curving them in opposite directions such that one surface of one the sheet becomes the outer surface of one container and the same surface of the other sheet becomes the inner surface of the other container.

Furthermore, in the embodiments of Figure 1 to 3, pits **40** and bulges **42** have what could be described as enlarged heads with narrower neck portions, in which the fractal elements extend to a smaller width or diameter d at or close to their bases compared to a larger width or dimeter D further from their bases. This characteristic of enlarged heads may be prevalent in all of pits **40** and bulges **42** but in other embodiments may be exhibited in only a portion of the fractal formations in wall **12**.

As can be seen in Figure 3 in particular, the coupling of two containers **100**, **110** occurs, in this example, because the containers have a generally curving or rounded form, in which case the containers will only touch, and inter-engage, at their tangents.

In other embodiments that have different general overall shapes, such as square or polygonal, the coupling of the fractal formations of two containers may occur across an entire side wall or a portion of one or more of the side walls of the containers.

When used for packaging, this characteristic enables multiple containers to be coupled together without the need for any other tie mechanism of the types commonly used in the art. In other words, two or more containers **100**, **110** may be joined together solely by inter-engagement of some of the fractal formations of container walls **12**. The containers need not have tessellating shapes, as it is only necessary for one or more of the fractal formations of each of the containers to inter-engage in order to achieve coupling.

Figures 4 and 5 show a view of another embodiment similar to that of Figures 2 and 3, in which the fractal formations of containers **100**, **110** extend generally linearly for at least a short distance longitudinally, in other words in two-dimensional manner rather than in a three-dimensional manner as a floret would. In this embodiment, the same fractal elements of containers **100**, **110** shown in Figures 4 and 5 will inter-engage longitudinally along their length, and if they extend along the entire length of the containers they will then inter-engage equally along the length of the containers. In the case of three-dimensional fractal elements, of what could be described as floret form, inter-engagement of two or more containers along a tangent thereof will involve the coupling of multiple fractal formations along the lengths of the containers.

The containers can be uncoupled by squeezing containers **100**, **110**, for example from either side of the coupling zone, to cause engaged pits **40** and bulges **42** to deform and open out. A user can in this manner separate containers **100**, **110** with relative ease.

Referring now to Figure 6, this shows another embodiment of a fractal container **200** having a fractal form similar to that of the embodiments of Figures 1 to 5. In this embodiment, the fractal formations extend in linear manner along the length of container **200**, as can be seen in particular in the perspective view of Figure 6. Container **200** can have any of the characteristics described elsewhere herein.

With reference to Figure 7, in this embodiment pits **240** and bulges **242** are not the same shape or size to fit one within the other precisely, as is the case with the embodiments shown in Figures 2 to 5. Nevertheless, pits **240** and bulges **242** are still able to engage partially, as will be apparent in the Figure. The two containers can be tied to one another by adhesive posited into an interstice or pocket **244** between partially engaged pits **240** and bulges **242**. More than two containers may be coupled together in this manner, in a fully or partially tessellating manner depending upon the shapes of the containers.

Containers **200** can be separated from one another by applying pressure to one or both of the containers, as shown In Figure 8. In the example shown in this Figure, the pressure may be applied diametrically opposite adhesive coupling **244**, as per the arrow in the Figure. This pressure will cause deformation of walls **12** of the containers and, as a consequence, apply shear stress (and typically also compressive and tensile forces) to the adhesive in pocket **244**, which will break or loosen. It will be appreciated that the containers could be squeezed from other directions and achieve the same result.

Once the adhesive coupling has been released, the containers **200** can be separate from one another as shown in Figure 9.

Referring now to Figure 10, this shows in schematic form partial wall profiles of two fractal containers **300**, **300'** according to another embodiment of the present invention. In this embodiment, the wall has what could be described as a fractal random walk profile, with zig-zag wall elements of different lengths l_1-l_n.

The two container profiles **300**, **300'** preferably have substantially identical reversed or replicated profiles in at least a part of their extent, such that they can couple together in a precise nesting arrangement, as shown in Figure 10B. The two fractal elements **300**, **300'** can thus be coupled together, typically by a combination of mechanical inter-engagement and friction. The skilled person will appreciate that in this embodiment, as with the following embodiment shown in Figure 11, the profile does not include any fractal elements having bulges or pits with enlarged heads, as occurs with the embodiments of Figures 1 to 9, although it is not excluded that in some embodiments they may have such characteristics.

Figure 11 shows another example, in which the profiles of the two containers **400**, **400'** only partially nest one into the other. It will be appreciated that the degree of coupling of the containers together can be altered by adjusting the fractal profiles of the two inter-engaging surfaces to one another.

In the preferred embodiments, the lengths $\boldsymbol{l_1}$-$\boldsymbol{l_n}$ of the zig-zag wall elements are advantageously determined as statistical fractals whose dimensions may be tuned via random walk parameters to optimize the interlocking of two or more fractal containers. Bonding between containers can be relatively strong with an increased number and size of capture points and weaker with fewer capture points.

In the embodiments of Figures 10 and 11, inter-engagement can be provided by the profiles themselves and optionally, as per the above described embodiments, assisted by the use of adhesive between adjacent containers.

The forms of container disclosed herein provide a number of other advantages in addition to an increased ability to couple multiple containers together.

First, the fractal nature of the outer surface of the container provides a better grip of the container compared to a container having a smooth outer surface. This can be advantageous particularly with larger or heavier containers, in respect of which a good grip can be obtained with less holding pressure on the container wall.

Moreover, the corresponding convex and concave fractal elements provide for increased surface area of both the interior and exterior surfaces of the container relative to a volume of the chamber. This can be useful in increasing the heat transfer characteristics of the container, for instance to cool or heat its contents.

The skilled person will appreciate that the teachings herein can provide other advantages and characteristics not exhibited in containers known in the art.

While the present invention has been described with respect to a limited number of embodiments, it will be appreciated that many variations, modifications, equivalent structural elements, combinations, sub-combinations, and other applications of the present invention may be made.

WHAT IS CLAIMED IS:

1. A food or beverage container comprising:

(a) a generally cylindrical wall defining an internal chamber of the container, said wall having interior and exterior surfaces and being of uniform thickness; and

(b) a top and a base disposed at either end of said generally cylindrical wall;

wherein said wall has a fractal profile with corresponding convex and concave fractal elements on corresponding ones of said interior and said exterior surfaces;

wherein said convex and said concave fractal elements form pits and bulges in said profile of said wall; and

wherein said wall of the container is flexible, permitting flexing of said fractal profile thereof, said fractal profile of said wall permits coupling by inter-engagement of a plurality of the containers together, and flexibility of said wall permits disengagement of said or any coupling of a plurality of the containers.

2. The food or beverage container of claim 1, wherein at least some of said pits and bulges each have heads and bases, wherein said heads are of a greater width than said bases thereof.

3. The food or beverage container of claim 1, wherein at least some of said pits and said bulges have inter-engaging or corresponding shapes and sizes such that a bulge of one container can fit within a pit of an identical container, thereby to couple two containers together.

4. The food or beverage container of claim 3, wherein said pits and said bulges of said two containers fit precisely within one another.

5. The food or beverage container of claim 3, wherein said pits and said bulges of said two containers fit partially within one another.

6. The food or beverage container of claim 1, wherein two or more said containers can be coupled together by an adhesive disposed between facing pits and bulges of adjacent containers.

7. The food or beverage container of claim 1, wherein said corresponding convex and said concave fractal elements provide for increased surface area of both said interior and said exterior surfaces of the container relative to a volume of said chamber.

8. The food or beverage container of claim 1, wherein said wall is formed of a material selected from the group consisting of: a metal, a plastic, and an elastomeric material.

9. The food or beverage container of claim 1, wherein said wall is formed from a flexible food product.

ABSTRACT OF THE DISCLOSURE

A container for use, for example, for beverages, has a wall with and external surface and an internal wall of substantially uniform thickness. The wall has a fractal profile which provides a series of fractal elements on the interior and exterior surfaces, forming pits and bulges in the profile of the wall and in which a pit as seen from one of the exterior or interior surfaces forms a bulge on the other of the exterior or interior surfaces. The profile enables multiple containers to be coupled together by inter-engagement of pits and bulges on corresponding ones of the containers. The profile also improves grip, as well as heat transfer into and out of the container.

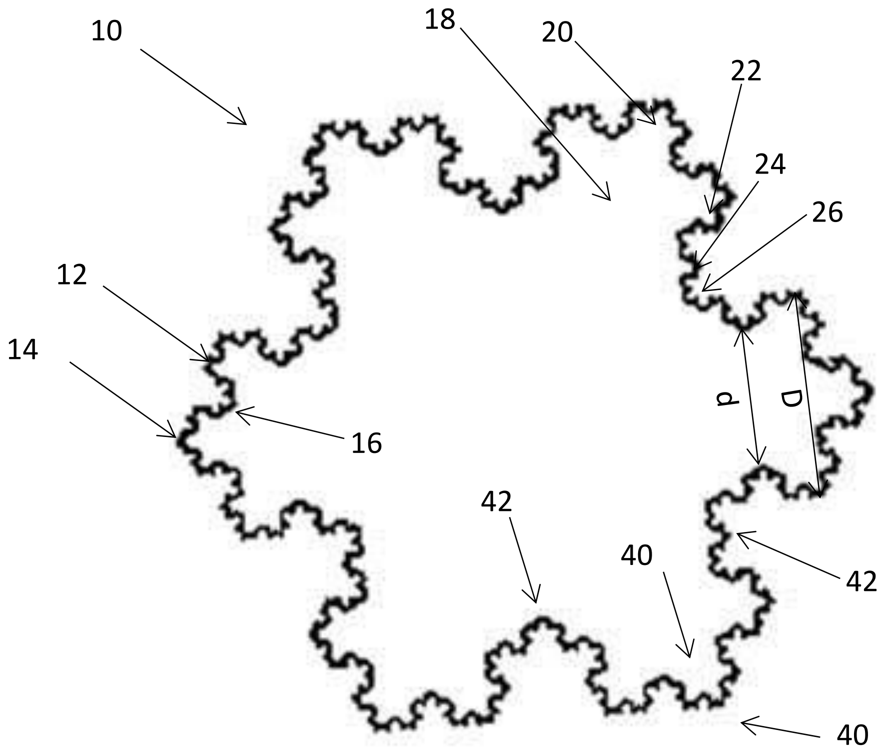

Fig. 1

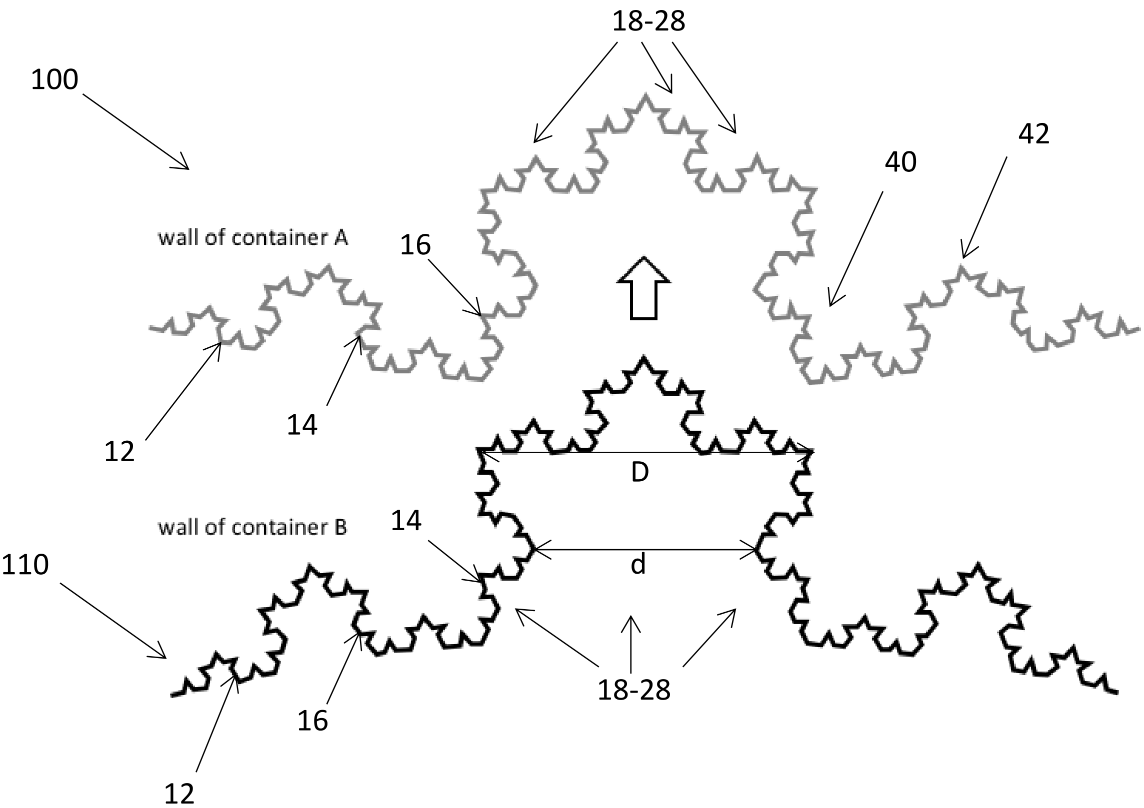
18-28
100
42
40
wall of container A
16
12
14
D
wall of container B
14
110
d
18-28
16
12

Fig. 2

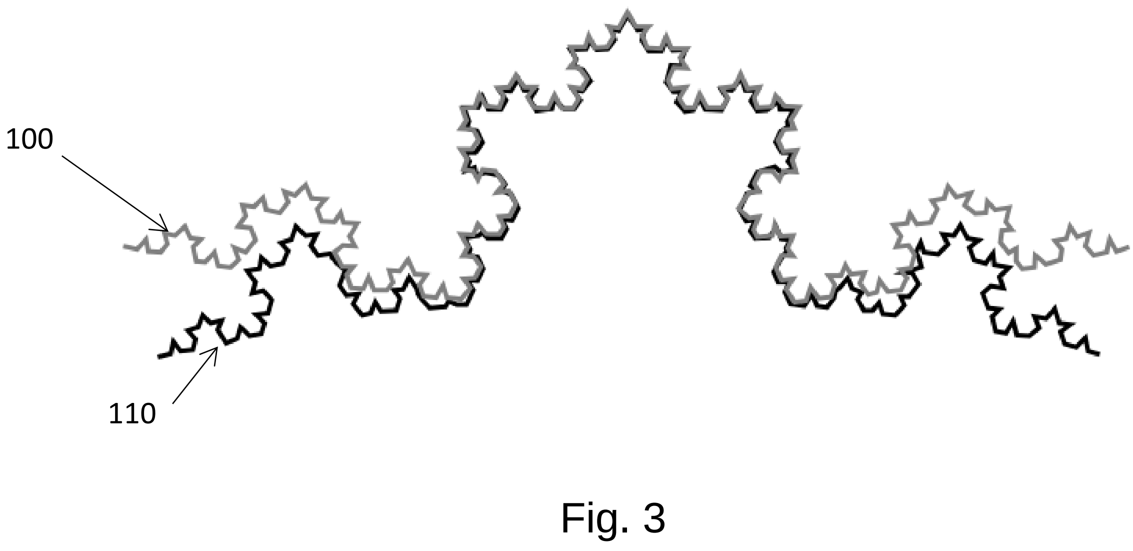
100
110

Fig. 3

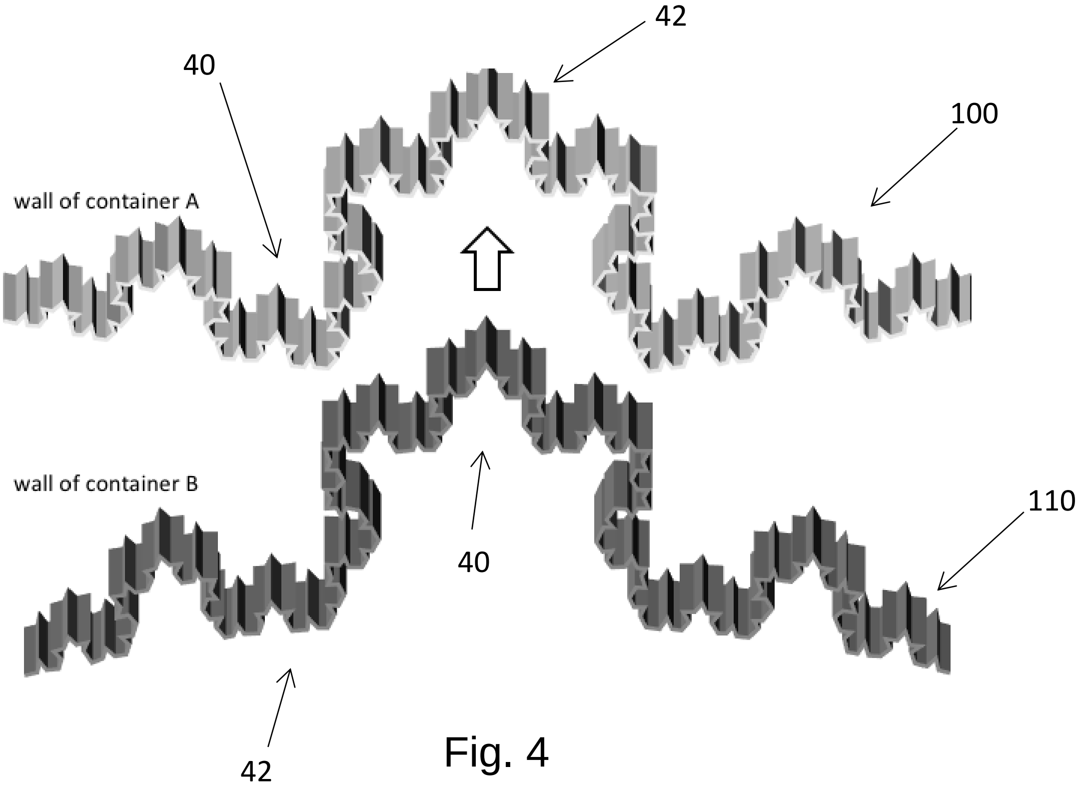
42
40
100
wall of container A
wall of container B
40
110
42

Fig. 4

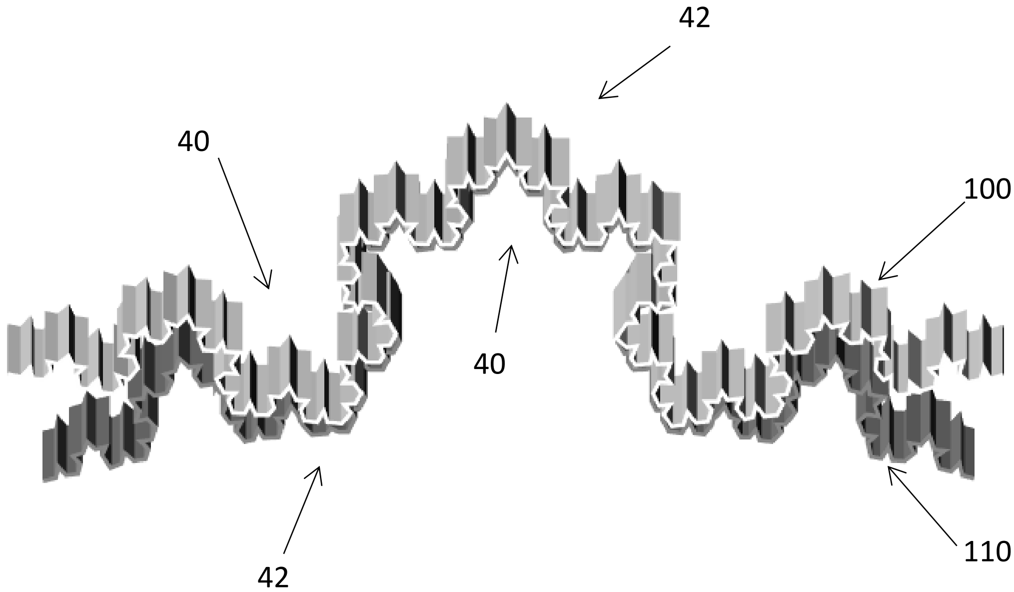
42
40
100
40
42
110

Fig. 5

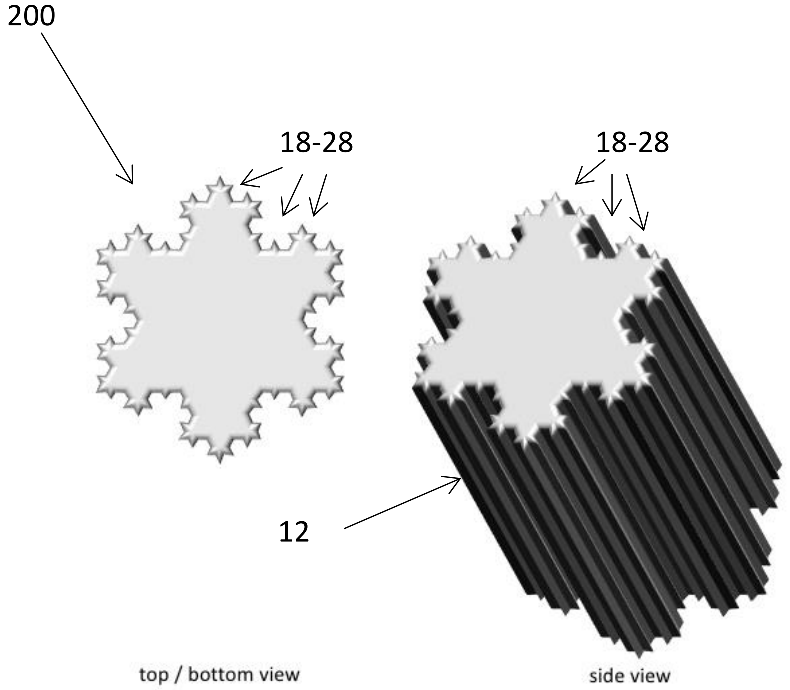
200
18-28
18-28
12
top / bottom view
side view

Fig. 6

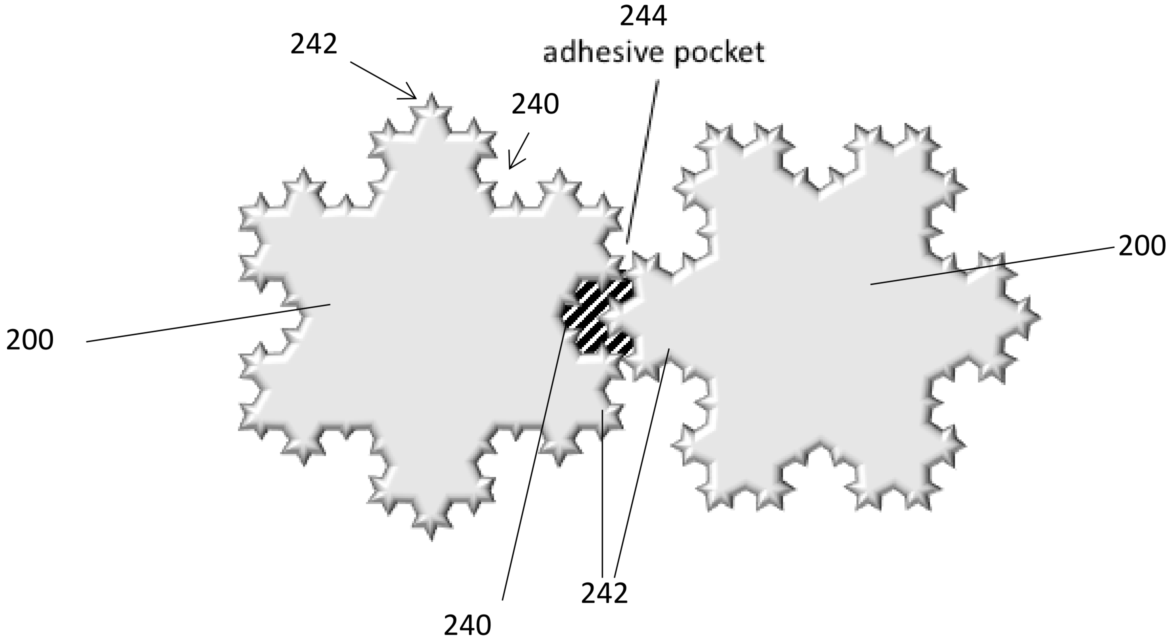
244
adhesive pocket
242
240
200
200
242
240

Fig. 7

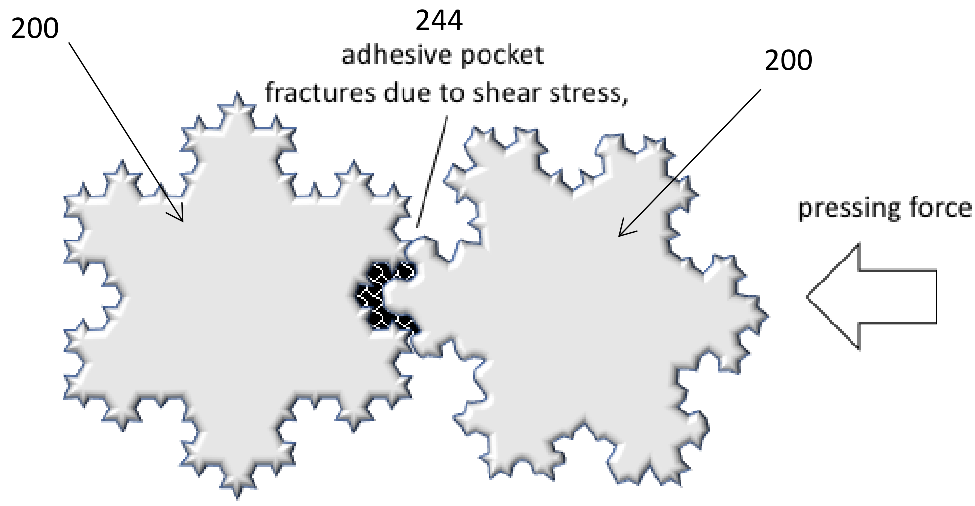
200
244
adhesive pocket
fractures due to shear stress,
200
pressing force

Fig. 8

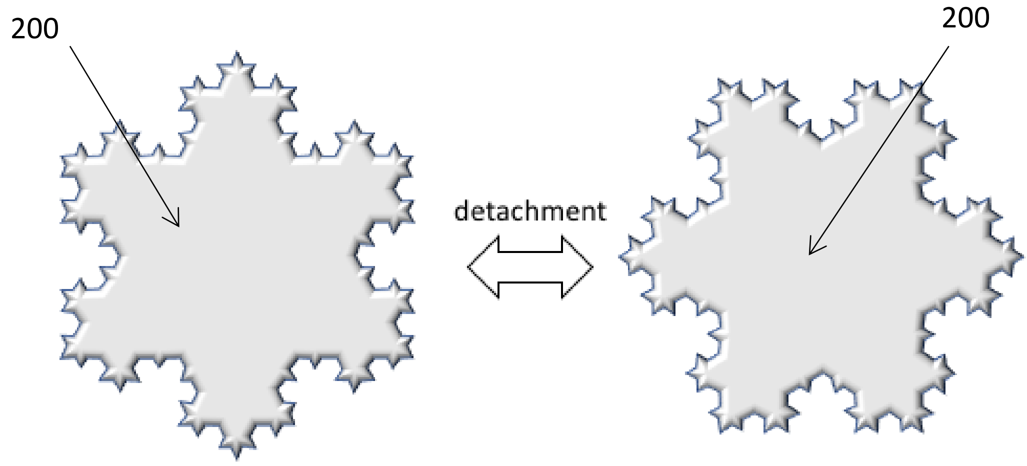
200
200
detachment

Fig. 9

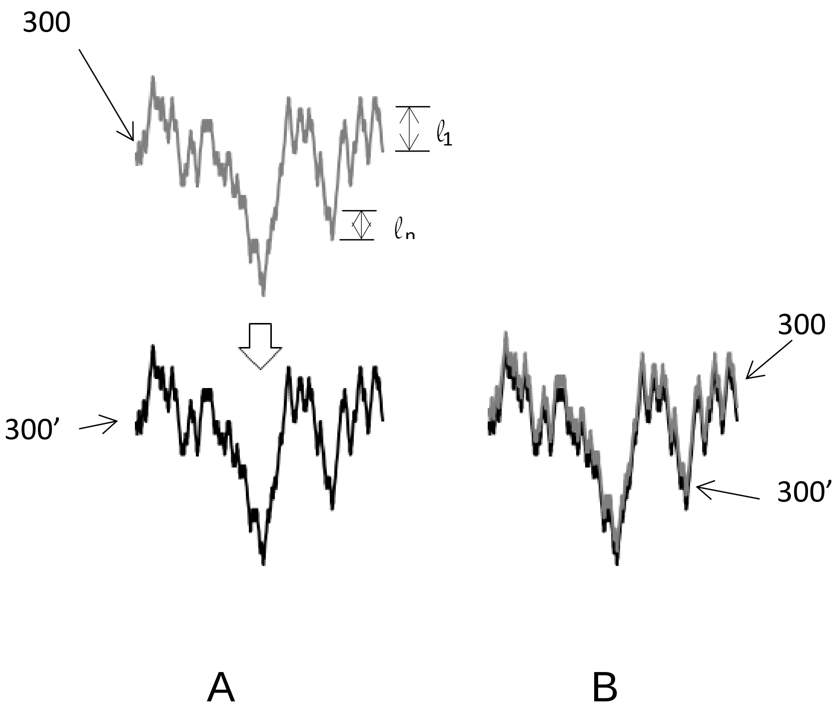

Fig. 10

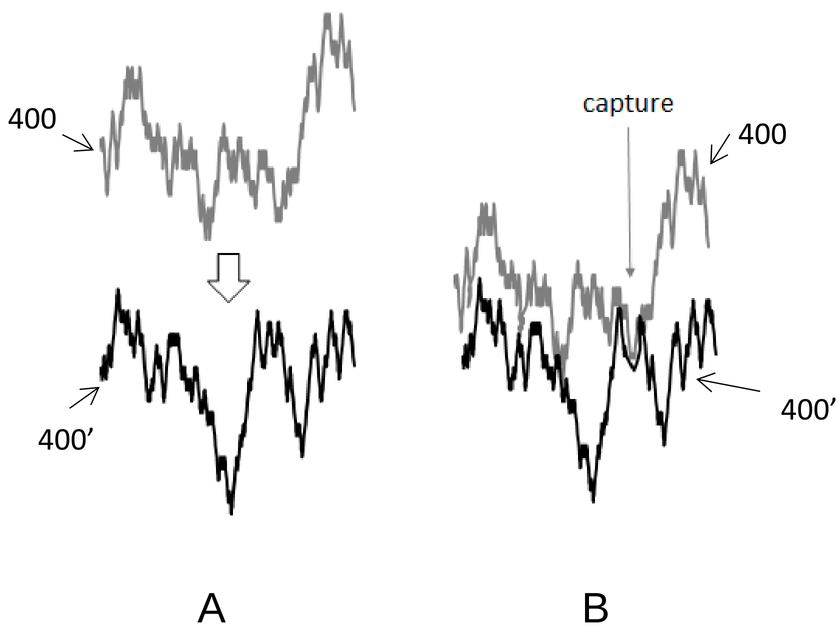

Fig. 11