(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 630 344 B1

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
04.06.1997 Bulletin 1997/23

(21) Application number: **93907681.6**

(22) Date of filing: **16.03.1993**

(51) Int Cl.[6]: **B65D 81/00**, B65D 81/113

(86) International application number:
PCT/CA93/00106

(87) International publication number:
WO 93/18986 (30.09.1993 Gazette 1993/24)

(54) GAS-CONTAINING PRODUCT SUPPORTING STRUCTURE

GAS ENTHALTENDE TRAGSTRUKTUR

STRUCTURE CONTENANT DU GAZ UTILISEE POUR SUPPORTER DES PRODUITS

(84) Designated Contracting States:
AT BE CH DE DK ES FR GB GR IE IT LI NL PT SE

(30) Priority: **16.03.1992 US 851333**

(43) Date of publication of application:
28.12.1994 Bulletin 1994/52

(73) Proprietor: **INTEPAC TECHNOLOGIES INC.**
King City, Ontario L7B 1G3 (CA)

(72) Inventors:
- **DICKIE, Robert, G.**
  Newmarket, Ontario L3Y 4V8 (CA)
- **CLEE, Michael, D.**
  Newmarket, Ontario L3Y 7X2 (CA)

(74) Representative: **Rackham, Anthony Charles**
Lloyd Wise, Tregear & Co.,
Commonwealth House,
1-19 New Oxford Street
London WC1A 1LW (GB)

(56) References cited:
EP-A- 0 325 070
EP-A- 0 398 345
WO-A-92/07774
DE-A- 4 034 038
DE-U- 9 205 804
US-A- 3 403 713
US-A- 3 949 879
US-A- 4 801 213

Note: Within nine months from the publication of the mention of the grant of the European patent, any person may give notice to the European Patent Office of opposition to the European patent granted. Notice of opposition shall be filed in a written reasoned statement. It shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).

EP 0 630 344 B1

Description

This invention relates generally to product support packaging inserts and more particularly to ecologically advantageous packing inserts for supporting products within outer shipping cartons and protecting the supported products against external shock.

When shipping fragile products, it is desirable to provide protection against external shock which is as complete as possible and, at the same time, minimize both packaging and shipping costs. In the past, both expanded polystyrene (EPS or styrofoam) and polyurethane or polyethylene (flexible foam) inserts have been used for such purposes with considerable success. In recent years, however, environmental concerns over both EPS and flexible foams have been growing. Both are very voluminous per pound and thus tend to exhaust landfill areas much too quickly. Any foamed plastic product is, moreover, both difficult and costly to reclaim or recycle back to its original non-foamed state. There is, therefore, an ongoing need for new packaging techniques which not only provide adequate protection to products against external shock and minimise both packaging and shipping costs but also present minimal ecological problems in the disposal of packaging material after they have served their intended purpose.

US-3949878 describes a protective packing product which has a plurality of non-communicating chambers, some of which are provided with perforations which permit venting of those chambers to the atmosphere so as to provide a damped cushioning effect in the event that it is subjected to high impact shock.

EP-A-325 070 describes a type of shaped inflatable bladder which is used as a packing material. The bladder only retains its shape whilst inflated. It is also not good at absorbing shocks.

US-3 403 713 describes a preshaped rigid and self-supporting structure which is hollow. Shock absorbency is produced by the wall joining the inner and outer shells of the structure.

According to the present invention there is provided in combination, a supporting structure for positioning and supporting a product within an outer packing container, a product to be positioned and supported, and an outer packing container in which the supporting structure and the product are contained, wherein the product to be supported has a predetermined configuration at least at a predetermined portion thereof, and wherein the outer packing container has a predetermined configuration at least at a predetermined portion thereof where the supporting structure is to be placed, and wherein the supporting structure has a predetermined configuration for supporting the product at the predetermined portion thereof, and comprises:

a blow-moulded semi-rigid and self-supporting monolithic gas containing bladder having an average wall thickness of about 0.8mm (about 1/32inch), and having a preformed product receiving portion in a first region of the bladder, wherein the product receiving portion has a predetermined configuration and dimensions so as to be co-operative with the predetermined portion of the product, so as to receive the predetermined configuration of the predetermined portion of the product,

a packing container contacting portion in a second region of said bladder which is remote from and generally opposed to the first region, in which the packing container contacting portion is such as to be co-operative with the predetermined configuration of the predetermined portion of the outer packing container, and

in which the product receiving portion of the gas-containing bladder retains its predetermined configuration and dimensions as a consequence of its own structure when the gas-containing bladder contains gas, and when the gauge pressure of that gas is approximately zero.

The bladder may be either a vertical or a horizontal positioning element and may typically be used in sets of top and bottom pairs within a single outer packing container.

The bladder provides both product support and impact protection during storage and shipping and can be easily collapsed after use. Collapsed, the bladder is compact and can be re-used indefinitely before it is finally re-cycled, and need not be discarded, thus minimising environmental impact. Before final assembly for shipping, bladder materials require relatively little storage space and even formed bladders can themselves be stored either wholly or partially deflated to save space.

For purposes of this patent application, use of the term "inflated" to refer to gas within an air bladder or other gas-containing bladder shall mean that there is gas within the bladder. The gas may be at ambient pressure (zero gauge pressure), or somewhat above or below zero gauge pressure. Generally, the bladder is not purposely inflated above atmospheric pressure, either during manufacture or at the time of use. Correspondingly, the term deflated shall mean that the bladder has been collapsed, with a small amount of gas remaining therein. Likewise, semi-inflated or semi-deflated means that the bladder is in a partially collapsed condition with a corresponding amount of gas therein.

The air bladder may be composed of a plastic resin material such as polyethylene, and is produced by blow moulding. Blow moulding involves extruding a semi-solid tube of the plastic material into a mould having the product's outer wall shape. After the mould is closed, a jet of air from a nozzle forces the plastic material to expand and contact the metal walls of the mould. The plastic resin is cooled and hardened almost instantly as the mould is kept cool by circulating water through built-in internal cavities. Blow moulding is well know and is al-

ready the process of choice in the manufacture of many commercial products such as large soft drink bottles, gas cans, and even garbage cans. Use of blow moulded plastic material is particularly advantageous environmentally with respect to the present invention in that the materials it makes use of may be recycled with a minimum of cost or inconvenience. There are, furthermore, no environmentally hazardous substances or expansion agents which are used in the manufacturing process. Moreover, the material of the air bladder itself can be made up with virtually 100% recyclable material, due to modern recycling techniques.

In accordance with one embodiment of the invention, the air bladder may contain a plurality of interior chambers or compartments. Such interior chambers, when present, provide location controllable damping by way of separate air shock absorbers in areas such as corners subject to potentially higher impacts. When a passage is provided between one chamber and another, the size of the passage is controlled by baffling and has a direct influence on the rapidity with which those chambers will deflate under load. A high degree of controllable damping is thus provided. Alternatively, multiple air bladder chambers may be entirely sealed from one another in order to provide maximum isolation if needed to meet directional load requirements. When air bladder chambers are sealed from one another in this manner, the blow molding process makes use of a separate inflation nozzle for each chamber. This aspect of the invention adds yet another controllable design element to protective packaging technology, allowing smaller and effective protective packing containers or shipping cartons.

Damping is also realized due to the increased pressure of the gas within the bladder. Special gases such as sulphur hexafluoride may be used to maximize the damping capacity of the gas. Further, damping is also obtained as a result of the resiliency of the plastic that constitutes the air bladder and also from the relatively small amount of elasticity of that plastic. In terms of damping, it is detrimental to have too much elasticity in the plastic material because this amount of elasticity could cause motion to be returned to the product being supported. Other gases that may be used include carbon dioxide nitrogen, argon and krypton.

In accordance with yet another aspect of the invention, the air bladder may be further inflated with air or other gases as desired either before or after the air bladder has been sealed, and even after assembly of the product and the air bladder within the packing container. The air bladder may thus, when required, be only partially inflated or even fully deflated after manufacture, allowing the air bladder to take up less room during shipping of the air bladder per se and also making final assembly of the product and one or more air bladders within the container easier to accomplish. After final assembly, inflation needles can be forced through the outer container at one or more predetermined inflation points, where they penetrate the designated air bladder chambers and inflate them to designated pressure levels.

The supporting structure is a semi-rigid self supporting monolith that can be made from relatively thick polyethylene plastics material or similar. The structure has been designed with the properties of typical polyethylene plastics in mind. Polyethylene plastic having a thickness of about 0.8 mm (about 1/32 inch) is resilient and slightly elastic, and is also stiff enough to support an appreciable load if used in a suitably designed load bearing structure.

The load bearing supporting structure must perform the following functions:

- support a static vertically oriented load (all or at least a portion the weight of the product);
- support a vertically oriented dynamic load due to vertically displaced motion of the product or outer package;
- support a horizontally oriented (in the other two dimensions) dynamic load due to horizontally displaced motion of the product or outer package;
- deform so as to cushion the product from high accelerative or decelerative forces, with such deformation being realized over as large a displacement as reasonably possible, so as to minimize the forces transmitted to and therefore absorbed by the product.

The product supporting structure of the present invention has been designed so as to have walls thick enough to support a static load of several pounds so that a product may be supported by the strength of the walls alone, and also to absorb the extra forces caused by dynamic loading.

The product supporting structure of the present invention has also been designed so as to have walls that are thin enough to be at least partially deformable under typical dynamic loading conditions, so that the overall structure will deform and thus absorb the force of the load over a relatively large displacement, at least as large as reasonably possible. Such large displacement deformation helps to minimize the deceleration forces encountered in receiving and supporting a load and in damping the motion of dynamic loading.

The walls must be thin enough to be resiliently and somewhat elastically, deformable so that the structure will non-permanently deform under a static or dynamic load caused by the weight of the material and the movement of the material to be absorbed without permanently deforming the material. The elasticity allows the structure to return to its original shape after it has been deformed by a load, within limits. If the walls are too thick, then the structure will not deform by a significant amount, and therefore will not be able to minimize the accelerative or decelerative forces imparted to it. Further, the structure will be less resilient and be more likely to be permanently deformed if it is deformed by at least

a certain amount, and will be less likely to elastically return to its original shape.

The invention may be better understood from the following more detailed description of several specific embodiments, taken in the light of the accompanying drawing, in which :

Figure 1 illustrates a product supporting vertical end cap air bladder embodying various aspects of the invention;
Figure 2 is a plan view showing details of the end cap air bladder illustrated in Figure 1;
Figures 2A, 2B, and 2C are cross-sectional views of the end cap air bladder shown in Figure 2;
Figure 2D is a side view of the end cap air bladder shown in Figure 2;
Figure 3 illustrates product supporting horizontal tray air bladders embodying various aspects of the invention;
Figure 4 shows an inflation gun suitable for post molding inflation of air bladders embodying various aspects of the invention;
Figure 4A illustrates tip details of the inflation gun shown in Figure 4;
Figure 5 is an exploded isometric view of a further specific embodiment of the present invention showing a discrete product supporting structure co-operating with the corner of a product and the corner of an outer package; and
Figure 6 is a cross-sectional view of the product supporting structure of Figure 5.

In order to properly understand the present invention, it is necessary to first understand the applied physics of the situation where impact forces would be experienced by the outer package containing the product and also experienced by the supporting structures and the product itself. There are essentially two types of situations. The first situation involves an outer package in motion, which has been impacted by an external object that may or not be moving, and which decelerates the package. The second situation involves a package that may or may not be moving, and which is impacted by an external object that is moving which in turn accelerates the package. The former case is more common in the handling and shipment of packages of goods and typically occurs when a package is dropped. In either case, there is a change of speed of the package and of the product therein.

In the first situation, inertial forces of the product are transmitted to the supports, to the outer package and to the external object. The supporting structure absorbs as much as possible of the forces. The supporting structure transmits a force to the product, which causes the product to decelerate. In the second situation, accelerative forces are transmitted from the external object to the outer package, to the supports and then to the product. The supporting structure absorbs as much as the force as possible. Some of the force is transmitted to the product, which in turn accelerates the product.

In either case, there are forces transmitted to the product, and the product must absorb the energy being transmitted by these forces. If the forces are too high, damage to the product could result. It is therefore necessary to minimize the forces that reach the product so that it will not be damaged.

It must be realized that basically what is happening is that kinetic energy is being transferred to the product. When an outer package is hit by a moving external object, the kinetic energy of the external moving object must be absorbed. When an outer package is dropped and subsequently impacts onto to a surface such as a floor, the kinetic energy of the product inside at the time of the impact must be absorbed from the product by the supporting structure, and so on.

In order to absorb kinetic energy while realizing a minimum amount of force transmitted to the product, it is necessary to distribute the energy absorption over time as much as possible and to keep the acceleration and deceleration of the product as close to constant as possible. In order to accomplish this, it is necessary to, among other things, maximize the displacement over which the acceleration takes place. Thus, a relatively resilient supporting structure is preferable.

In use, when an object is introduced to the supporting structure, the relatively stiff yet resilient plastic that forms the supporting structure supports the initial weight loading of the object placed thereon. As more of the weight of the object is borne by the supporting structure, the weight of the object causes the structure to deform and correspondingly causes the pressure of the gas inside to increase. As the pressure of the gas inside the supporting structure increases, the gas provides a correspondingly increased support for the load. The structure continues to deform, in a resilient manner, until the resistive force provided by the supporting structure and the increased pressure of the gas therein are equal and opposite to the load thereon, and equilibrium is reached. In this manner, a relatively large displacement of the supporting structure is possible before equilibrium is reached, which provides relatively low supporting or damping forces for the object being supported.

In a dynamic load situation, the supporting structure and the pressure of the gas therein supports the changing load of a supporting object in a manner analogous to that described immediately above.

If the supporting structure were inflated to a positive gauge pressure of perhaps (about 0.14-0.34 atmospher) (2-5 p.s.i), then the pressure of the gas in the supporting structure would help support the weight of a load placed on the supporting structure virtually as soon as the load is placed thereon. This means that there would be comparatively less displacement of the supporting structure when a load is placed thereon and correspondingly the load would not be damped over as great a distance -- that is to say that the energy from the product

being supported would be absorbed within a short distance and therefore over a relatively short period of time, which in turn would cause relatively high forces to be transmitted to the product, which may be undesirable.

In comparison if the supporting structure does not have a positive gauge pressure, then the structure would deform for a greater distance after receiving a load, all the while absorbing energy during the deformation due to the resiliency of the plastic. By the time the air pressure was sufficiently high to help support the load, the energy from the placement of the load would already be partially absorbed and correspondingly lower forces would be transmitted to the product.

Figure 1 illustrates a typical application of the invention. In the protective packaging industry, vertical packaging elements are usually referred to as "end caps", while horizontal packaging elements are usually referred to as "trays". Figure 1 shows one of a pair of "end caps" which may, for example, be used in the packaging of personal computers. In Figure 1, an air bladder 11 forming the end cap is shown with a product receiving cavity 13 facing the viewer. Air bladder 11 is product specific in the sense that, once formed, a specific end cap will receive only a product with external dimensions matching the internal dimensions of cavity 13 and will only fit within shipping cartons matching its own external dimensions. Thus, in the illustrated application, the side of a personal computer may fit into the cavities 13 of a pair of air bladder end caps and the entire assembly may be placed in a snug fitting corrugated cardboard box (not shown) which serves as an outer shipping container. As an alternative, for instance when an inner container is desired for housing multiple products, the internal dimensions of cavity 13 may be made to match the external dimensions of that inner container. Such an alternative may be desirable when multiple products are to be packed within a single inner container, which is then given protective support within the outer shipping container. In a broad sense, the filled inner container then becomes the product to be stored or shipped.

As shown in Figure 1, product receiving cavity 13 in air bladder 11 is bounded by four respective corner elements 15, 17, 19, and 21 and by two respective side walls 23 and 25. Although many examples of air bladder 11 will have corner elements, the need for side walls will depend a good deal upon the specific application. A relatively large product may, for example, require side walls between corner elements 15 and 17 and between corner elements 19 and 21. A relatively small product, on the other hand, may not require even the presence of side walls 23 and 25.

Air bladder 11 in Figure 1 is, in accordance with an important aspect of the invention, composed of a suitable plastic resin material, such as polyethylene, and is produced by a blow molding process to form the illustrated end cap. In that process, a semi-solid tube of the plastic resin material is extruded into a mold that has the shape of the product's outer wall. In the instance illustrated, the shape is that of the outer wall of a personal computer. After the mold is closed, a blast of high pressure air through one or more holes in the wall of the mold forces the plastic tube to expand and contact the metal walls of the mold. The plastic resin then cools and hardens as the mold is cooled by circulating water through internal cavities in the mold. In an application such as that illustrated in Figure 1, air bladder end cap 11 is inflated during the blow molding process to a gauge pressure of approx. 0.20 to 0.34 atmospheres (about 3 to 5 pounds per square inch).

Figure 2 is a plan view of end cap air bladder 11 of Figure 1 with the side of air bladder 11 forming cavity 13 shown facing the viewer. Figure 2 illustrates several details not shown in Figure 1, one being the division of air bladder 11 into two separately sealed main chambers 27 and 29, bounded by the exterior dimensions of the air bladder and by side walls 31 and 33, which are indicated by respective dashed lines. Chambers 27 and 29 are thus separated from one another in the vertical plane because of the vertical orientation of air bladder 11. Without the separation, the weight of the product (a computer in this instance) would compress the an in lower chamber 29 into upper chamber 27, resulting in a partial collapse of lower side wall 25 and lower corner elements 17 and 21.

Although main chambers 27 and 29 within air bladder 11 in Figure 2 are sealed from one another, the invention makes it possible to provide sub-chambers within main chambers. Such sub-chambers are partially segregated from other chambers in order to provide a controllable shock damping effect. Examples of such sub-chambers are corner elements 15, 17, 19, and 21 in Figure 2. Corner element 15 is molded to be a corner baffling sub-chamber, defined by the outer walls of air bladder 11 and by fingers or protrusions 35 and 37 extending from the outside of air bladder 11 into the interior until they nearly contact one another. The gap 39 left between protrusions 35 and 37 permits the passage of air between the corner baffling chamber and main chamber 27 but only at a relatively slow rate. The degree of isolation of the sub-chamber forming corner element 15 is controlled by the size of gap 39.

As shown in Figure 2, remaining corner elements 17, 19, and 21 are similarly constructed and provide corner baffling sub-chambers which operate in a similar manner. Extra shock protection is provided in this manner at respective corners of the ultimate shipping package. In the interest of clarity, reference numerals 35, 37, and 39 are used to denote corresponding components in all four corner elements in Figure 2.

Figure 2A is cross-sectional view of air bladder 11 in Figure 2, taken along the line A-A, which is broken at the center in order to show details of both exterior and interior construction. Recess 41 in Figure 2A marks the end of side walls 31 and 33 separating upper and lower chambers 27 and 29. The matching recesses 37 mark the ends of the similarly numbered protrusions into

those chambers to provide restricted air flow between upper and lower chambers 27 and 29 and their respective ones of corner sub-chamber elements 19 and 21.

Figure 2B is another cross-sectional view of air bladder 11 in Figure 2, this time taken along the line B-B. Here, dividing walls 31 and 33 are farthest apart from one another. Portions of upper and lower chambers 27 and 29 are shown, as is recess 41 at the other end of air bladder 11.

Figure 2C is yet another cross-sectional view of air bladder 11, this time taken along the line C-C. Here, the ends of protrusions 35 and 37 into the interior of air bladder 11 are shown, along with gap 39 which is provided between them to provide for the restricted flow of air needed for corner damping.

Figure 2D, finally, is a side view of air bladder 11, with side wall 25 and corner elements 17 and 21 facing the viewer. Dashed lines 43 marks the bottom and ends of product supporting cavity 13 of air bladder 11.

Figure 3 illustrates another typical application of the invention, this time providing horizontal trays for packaging a product such as a television set. In Figure 3, a first air bladder 51 forms an upper tray and a second air bladder 53 a lower tray. The two air bladder trays provide respective top and bottom support for a product 55 (shown by dashed lines) within a corrugated cardboard outer shipping container 57 (also shown by dashed lines). Air bladder trays 51 and 53 are shown as mirror images of one another in this particular example, for purposes of clarity, but need not be identical as a general proposition.

In Figure 3, holes 59 and 61 are an example of a number of holes extending entirely through respective air bladder trays 51 and 53 to constrict the passage of air between various sections of their single main interior chambers by forming sub-chambers. Protrusions 63 and 65, similarly, are examples of protrusions extending partially into respective air bladder trays 51 and 53 both from the exterior of the air bladders and from the product supporting cavities to perform a similar purpose. In Figure 3, a product supporting cavity 67 in lower air bladder tray 53 faces up, while a similar product supporting cavity (not seen) in upper air bladder tray 51 faces downward.

In a horizontal application of the invention such as that shown in Figure 3, it is sometimes advantageous to manufacture respective air bladder trays 51 and 53 initially slightly deflated. Such slight deflation simplifies the packing process in that the deflated and hence slightly undersized air bladders will more easily fit into corrugated cardboard outer container 57. After product 55 and the two slightly deflated air bladder trays 51 and 53 are installed within container 57 and container 57 is sealed, air bladder trays 51 and 53 may be further inflated directly through corrugated cardboard container 57 with an inflation gun, an example of which is shown in Figure 4.

In Figure 4, an inflation gun 71 is essentially an air valve connected to a hollow needle upon which there is a small heater element installed within a gun tip 73. Inflation gun 71 is connected to a regulated air supply (not shown) through an air line 75, and to a variable power source (not shown) through a power line 77 to control the needle temperature. A trigger mechanism 79 on the handle of gun 71 provides the user with on-off control and a heat adjust knob 81 (also on the handle) permits accurate control of the heater element within gun tip 73. An air pressure gauge 83 and a heat gauge 85 complete the combination.

Details of inflation gun tip 73 in Figure 4 are shown in Figure 4A. Gun tip 73 is composed of a neoprene bellows 87 which surrounds a hollow air and heater needle 89 and a heater coil 91. Heater coil 91 encircles the base of needle 89 and bellows 87 compresses upon itself to expose needle 89 when the user presses the gun against an intended target such as outer container 57 in Figure 3.

In practice, when in the idle mode, needle 89 in Figure 4A remains at a temperature approximately ten percent higher than the melting temperature of the plastic air bladder material. Outer packing container 57 in Figure 3 may have pre-printed inflation point instructions and markings of locations where the needle is to be forced through corrugated cardboard container 57 and into the air bladder. By way of example, in the areas where the extruded plastic tube is pinched off and sealed, the air bladder walls are often three to four times thicker than the walls of the rest of the bladder. Such areas, generally, are good post-assembly inflation points. Pressing trigger 79 in Figure 4, will inflate the bladder to preset pressure level. In order to keep needle 89 from continuing to melt the bladder and creating an oversize opening during the five to ten second filing time, incoming air is relied upon to drop the temperature of needle 89 quickly below the melting point of the plastic bladder material. Once the preset pressure is reached and incoming air stops, needle 89 quickly cycles back up to temperature, allowing it to remelt the plastic to ease its withdrawal. As needle 89 withdraws, internal bladder pressure pushes some of the melted plastic into the hole left by the needle and reseals the bladder.

Upon final disassembly when the shipped product reached its destination, graphic instructions on the bladder itself may be used to instruct the consumer to puncture the bladder for easy removal of the product as well as to provide either general or specific disposal and recycling instructions.

Reference will now be made to Figure 5, which shows an alternative embodiment of the present invention. In this alternative embodiment, a supporting structure 100 is used to position and support a product 102 within an outer packing container 104. Typically, a total of eight such supporting structures 100 would be used, one in each corner of the product 102. The product supporting structure 100 supports the product 102 at a predetermined portion thereof. The supporting structure

100 has a predetermined configuration and predetermined dimensions such that it supports the product at the predetermined portion -- which is of a predetermined configuration. Further, the outer packing container 104 has a predetermined configuration, with the supporting structure 100 to be placed at a predetermined portion thereof.

When in use in combination with the product 102 and the outer packing container 104, the supporting structure comprises a gas-containing bladder 110 that has a product receiving portion 112 in a first region of the gas-containing bladder 110. The product receiving portion 112 has a predetermined configuration and dimensions so as to be co-operative with the predetermined portion of the product 102 and so as to receive in generally intimate and co-operating relation thereto the predetermined configuration of the predetermined portion of the product 102. The predetermined configuration and dimensions of the supporting structure 100 are adapted to fit the predetermined configuration of the predetermined portion of the product. Typically, the predetermined portion of the product is a portion of a corner of the product 102.

The gas-containing bladder 110 has a package containing portion 114 in a second region thereof. The second region is remote from and generally opposed to the first region. The package containing portion 114 is such as to be co-operative with the predetermined configuration of the outer packing container 104.

The supporting structure 100 has a predetermined size and shape when it is manufactured. The supporting structure 100 is typically manufactured with an opening 116 therein. A plug 118 is adapted to fit into the opening in sealed relation thereto and is inserted therein either immediately after manufacture or just before use. Thus, a sealable opening into the gas-containing bladder 110 is provided. When the plug 118 is in place, the gas-containing bladder 110 is sealed to its ambient surroundings. For shipping purposes, the supporting structure may be shipped without the plug in, in which case it is somewhat collapsible if necessary, or it may be shipped with the plug 118 in the opening 116. The supporting structure 100 retains its size and shape when the gauge pressure of the gas within the gas-containing bladder 100 is zero, irrespective of whether the gas-containing bladder 110 is sealed or open to the ambient surroundings.

The supporting structure 100 is capable of supporting a load thereon even when the interior of the gas-containing bladder 110 is in fluid communication with the ambient surroundings.

The gas-containing bladder 110 may be sealed so as to have a gauge pressure of the gas therein that is about zero. This will allow for relatively soft cushioned damping of the product 102. It is also possible to inflate the gas-containing bladder 110 to a gauge pressure above zero, typically within a range of about 0.01 to about 2.0 atmospheres Such additional gas pressure would cause the air bladder 110 to provide firmer damping for the product 102.

In a further alternative embodiment of the invention, the predetermined configuration and dimensions of the supporting structure 100 may be adapted to fit a predetermined configuration of a predetermined portion of a product, with the predetermined portion of the product being an edge of the product. For example, a long slender item may be supported at its centre, or a plate or a drum at selected places around its circumference.

Preferably, the supporting structure 100 is made of a plastics material having an average wall thickness in the order of approx. 0.8 mm (about 1/32 of an inch). The material that forms the supporting structure 100 can be chosen from the group consisting of polyethylene, polypropylene, and co-polymers thereof; as well as vinyl, polyvinylchloride, or nylon. The gas within the gas-containing bladder 110 is most commonly air, but also may be chosen from the group consisting of nitrogen, carbon dioxide, sulphur hexafluoride, argon and krypton.

The gas-containing bladder 110 may comprise a plurality of discrete chambers therein, with the discrete chambers being in fluid communication with one another through small openings, which are means for restricting gas flow between chambers. These openings allow a small amount of gas to pass therethrough in a given time, thereby providing a baffling effect which ultimately aids in the cushioning effect provided by the gas-containing bladder 110. Preferably, contiguous chambers within the gas-containing bladder are in fluid communication with one another.

Reference will now be made to Figure 6 which shows the supporting structure 100 of the present invention having the product 102 placed thereon. It can be seen that the portion of the product 102 that is supported by the supporting structure 100 is a somewhat complicated shape, and the predetermined configuration and dimensions of the supporting structure are adapted to fit to the predetermined configuration of the predetermined portion of this product. When the product 102 is placed on the supporting structure 100, there is a static force. indicated by arrow 120, which of course is in a downward direction. This static force 120 causes the supporting structure 100 to deform somewhat as shown by the dash lines 122. If, as usual, the gas-containing bladder 110 is sealed, then the deformation causes an increase in pressure of the gas within the gas-containing bladder 110.

Claims

1. In combination, a supporting structure (11,100) for positioning and supporting a product (55,102) within an outer packing container (57, 104), a product to be positioned and supported, and an outer packing container in which the supporting structure and the product are contained, wherein the product to

be supported has a predetermined configuration at least at a predetermined portion (13, 112) thereof, and wherein the outer packing container has a predetermined configuration at least at a predetermined portion thereof where the supporting structure is to be placed, and wherein the supporting structure has a predetermined configuration for supporting the product at the predetermined portion thereof, and comprises:

a blow-moulded semi-rigid and self-supporting monolithic gas containing bladder (11, 51, 53, 110) having an average wall thickness of about 0.8mm (about 1/32inch), and having a preformed product receiving portion (13, 67, 112) in a first region of the bladder, wherein the product receiving portion has a predetermined configuration and dimensions so as to be co-operative with the predetermined portion of the product, so as to receive the predetermined configuration of the predetermined portion of the product,
a packing container contacting portion (15, 17, 19, 21, 114) in a second region of said bladder which is remote from and generally opposed to the first region, in which the packing container contacting portion is such as to be co-operative with the predetermined configuration of the predetermined portion of the outer packing container, and
in which the product receiving portion of the gas-containing bladder retains its predetermined configuration and dimensions as a consequence of its own structure when the gas-containing bladder contains gas, and when the gauge pressure of that gas is approximately zero.

2. The combination of Claim 1 in which the gas-containing bladder is sealed to its ambient surroundings.

3. The combination of Claim 1 in which the gas-containing bladder has a sealable opening (116) therein.

4. The combination of any preceding claim in which the gauge pressure of the gas within the gas-containing bladder is positive and is from about 0.01 to about 2.0 atmospheres above ambient pressure.

5. The combination of any preceding claim in which the gas-containing bladder comprises a plurality of discrete chambers in fluid communication with one another, and further includes means for restricting gas flow and fluid communication between chambers.

6. In combination, a supporting structure (11, 100) for positioning a product (55, 102) within an outer packing container (57, 104), a product to be supported, and an outer packing container into which the supporting structure and the product are inserted, wherein the product to be supported has predetermined external dimensions, and the outer packing container has predetermined internal dimensions, said supporting structure comprising :

an at least partially inflated blow-moulded and sealed semi-rigid and self-supporting monolithic plastic resin gas-containing bladder (11, 51, 53, 110) having an average wall thickness of about 0.8mm (about 1/32 inch), and having a preformed external product receiving cavity (13, 67, 112) at one side thereof, wherein that external cavity has a predetermined shape and predetermined dimensions so as to fit the predetermined external dimensions of the product, wherein the exterior of the gas-containing bladder at the other side thereof remote from the external cavity has a predetermined shape and predetermined dimensions (114) so as to fit the predetermined internal dimensions of the packing containers, and
wherein the product receiving portion of the gas-containing bladder retains its predetermined configuration and dimensions as a consequence of its own structure when the gas-containing bladder contains gas and when the gauge pressure of that gas is approximately zero.

7. The combination of Claim 6 in which the said at least partially inflated gas-containing bladder contains a plurality of interior sub-chambers formed by baffle members extending into the interior of the gas-containing bladder, whereby a damping effect on gas moving from one of the interior sub-chambers to another is exerted by the baffle members.

8. The combination of Claim 7 in which the supporting structure has a plurality of corners, and at least some of the interior sub-chambers are positioned at those corners.

9. The combination of any preceding claim in which the supporting structure is made of a plastics material which is polyethylene, polypropylene, and copolymer thereof, vinyl, polyvinylchloride or nylon.

10. The combination of any preceding claim in which the gas in the gas-containing bladder is air, nitrogen, carbon dioxide, sulphur hexafluoride, argon or krypton.

Patentansprüche

1. Kombination aus einer Stützkonstruktion (11, 100) zur Positionierung und zum Stützen eines Produkts (55, 102) in einem Transportbehälter (57, 104), einem zu positionierenden und zu stützenden Produkt und einem Transportbehälter zur Aufnahme der Stützkonstruktion und des Produkts, wobei das zu stützende Produkt zumindest in einem definierten Bereich (13, 112), der Transportbehälter zumindest in einem definierten Bereich, in dem die Stützkonstruktion anzuordnen ist, und die Stützkonstruktion zum Stützen des Produkts in dem definierten Bereich eine bestimmte Form aufweisen und letztere durch folgendes gekennzeichnet ist:

   einen blasgeformten halbharten und selbsttragenden, in einem Stück hergestellten, mit Gas gefüllten Stützhohlkörper (11, 51, 53, 110) mit einer durchschnittlichen Wanddicke von etwa 0,8 mm (etwa 1/32 Zoll) und mit einem vorgeformten Produktaufnahmebereich (13, 67, 112) in einem ersten Abschnitt des Stützhohlkörpers, wobei der Produktaufnahmebereich eine solche bestimmte Form und solche Abmessungen aufweist und somit mit einem definierten Bereich des Produkts so abgestimmt ist, daß er einen definierten Bereich des Produkts mit einer bestimmten Form aufnimmt,

   einen Transportbehälterkontaktbereich (15, 17, 19, 21, 114) in einem vom ersten Abschnitt entfernten und in der Regel auf der entgegengesetzten Seite dazu befindlichen zweiten Abschnitt des Stützhohlkörpers, in dem der Transportbehälterkontaktbereich mit der bestimmten Form des definierten Bereichs des Transportbehälters abgestimmt ist, und dadurch, daß

   der Bereich des mit Gas gefüllten Stützhohlkörpers für die Aufnahme des Produkts seine bestimmte Form und Abmessungen aufgrund seiner eigenen Konstruktion beibehält, wenn der mit Gas gefüllte Stützhohlkörper aufgeblasen ist und der Überdruck des Gases etwa Null beträgt.

2. Kombination nach Anspruch 1, bei der der mit Gas gefüllte Stützhohlkörper gegenüber seiner Umgebung abgedichtet ist.

3. Kombination nach Anspruch 1, bei der der mit Gas gefüllte Stützhohlkörper mit einer verschließbaren Öffnung (116) ausgeführt ist.

4. Kombination nach einem der vorstehenden Ansprüche, bei der der Überdruck des Gases im Inneren des mit Gas gefüllten Stützhohlkörpers positiv ist und 0,01 bis etwa 2,0 atü beträgt.

5. Kombination nach einem der vorstehenden Ansprüche, bei der der mit Gas gefüllte Stützhohlkörper aus einer Anzahl von getrennt ausgeführten und miteinander kommunizierenden Kammern besteht und des weiteren Mittel zur Begrenzung des Gasstroms und der Kommunikation zwischen den Kammern umfaßt.

6. Kombination aus einer Stützkonstruktion (11, 100) zur Positionierung eines Produkts (55, 102) in einem Transportbehälter (57, 104), einem zu stützenden Produkt und einem Transportbehälter, in den die Stützkonstruktion und das Produkt eingesetzt werden, wobei das zu stützende Produkt bestimmte Außenabmessungen und der Transportbehälter bestimmte Innenabmessungen aufweist und die Stützkonstruktion durch folgendes gekennzeichnet ist:

   einen zumindest teilweise aufgeblasenen blasgeformten und verschlossenen, halbharten und selbsttragenden, in einem Stück hergestellten, mit Gas gefüllten Kunststoffstützhohlkörper (11, 51, 53, 110) mit einer durchschnittlichen Wanddicke von etwa 0,8 mm (etwa 1/32 Zoll) und mit einem vorgeformten äußeren Produktaufnahmehohlraum (13, 67, 112) auf einer Seite, wobei dieser äußere Hohlraum eine bestimmte Form und solche Abmessungen hat, daß er den definierten Außenabmessungen des Produkts entspricht, dadurch

   daß der mit Gas gefüllte Stützhohlkörper auf der anderen, vom äußeren Hohlraum weg gerichteten Seite außen eine bestimmte Form und bestimmte Abmessungen (114) hat, so daß er den definierten Innenabmessungen des Transportbehälters entspricht, und dadurch

   daß der Produktaufnahmebereich des mit Gas gefüllten Stützhohlkörpers seine bestimmte Form und Abmessungen aufgrund seiner eigenen Konstruktion beibehält, wenn der mit Gas gefüllte Stützhohlkörper aufgeblasen ist und der Überdruck des Gases etwa Null beträgt.

7. Kombination nach Anspruch 6, bei der der zumindest teilweise aufgeblasene, mit Gas gefüllte Stützhohlkörper eine Anzahl von inneren Kammern besitzt, die durch Unterteilungselemente gebildet werden, die sich in das Innere des mit Gas gefüllten Stützhohlkörpers erstrecken, wobei mit Hilfe der Unterteilungselemente eine Dämpfungswirkung auf das aus den inneren Kammern in andere Kammern strömende Gas ausgeübt wird.

8. Kombination nach Anspruch 6, bei der die Stützkonstruktion mehrere Ecken hat und mindestens einige der inneren Kammem in diesen Ecken angeordnet sind.

9. Kombination nach einem der vorstehenden Ansprüche, bei der die Stützkonstruktion aus einem Kunststoff hergestellt ist, bei dem es sich um Polyethylen, Polypropylen und ein Copolymer davon, Vinyl, Polyvinylchlorid oder Nylon handelt.

10. Kombination nach einem der vorstehenden Ansprüche, bei der das Gas des mit Gas gefüllten Stützhohlkörpers Luft, Stickstoff, Kohlendioxid, Schwefelhexafluorid, Argon oder Krypton ist.

Revendications

1. En combinaison, une structure-support (11, 100) destinée à positionner et supporter un produit (55, 102) à l'intérieur d'un récipient d'emballage extérieur (57, 104), un produit devant être positionné et supporté, et un récipient d'emballage extérieur, dans lequel la structure-support et le produit sont contenus, dans lequel le produit devant être supporté présente une configuration prédéterminée au moins sur une partie (13, 112) prédéterminée de celui-ci, et dans lequel le récipient d'emballage extérieur présente une configuration prédéterminée au moins sur une partie prédéterminée de celui-ci, dans laquelle la structure-support doit être placée, et dans laquelle la structure-support a une configuration prédéterminée pour supporter le produit sur sa partie prédéterminée, et comprenant:

   une vessie (11, 51, 53, 110) contenant du gaz, moulée par soufflage, monolithique, semi-rigide et auto-portante, ayant une épaisseur de paroi moyenne d'environ 0,8 mm (environ 1/32 pouce) et ayant une partie de réception de produit (13, 67, 112) pré-formée de la vessie, et ayant une partie de réception de produit (13, 67, 112) pré-formée dans une première zone de la vessie, dans laquelle la partie recevant le produit a une configuration et des dimensions prédéterminées, de manière à coopérer avec la partie prédéterminée du produit, de manière à prendre la configuration prédéterminée de la partie prédéterminée du produit,

   une partie de contact de récipient de produit (15, 17, 19, 21, 114), dans une deuxième zone de la vessie, distante et globalement exposée à la première zone, dans laquelle la partie de contact de récipient de produit est réalisée de manière à coopérer avec la configuration prédéterminée de la partie prédéterminée du récipient d'emballage extérieur, et

   dans laquelle la partie recevant le produit de la vessie contenant le gaz garde sa configuration et ses dimensions prédéterminées, suite à sa structure propre, lorsque la vessie contenant du gaz est chargée en gaz et lorsque la pression relative du gaz par rapport à l'atmosphère est à peu près nulle.

2. La combinaison selon la revendication 1, dans laquelle la vessie contenant du gaz est scellée vis-à-vis de l'environnement ambiant.

3. La combinaison selon la revendication 1, dans laquelle la vessie contenant du gaz présente une ouverture (116) pouvant être scellée.

4. La combinaison selon l'une quelconque des revendications précédentes, dans laquelle la pression effective du gaz se trouvant dans la vessie contenant du gaz est positive et est comprise dans la plage allant d'environ 0,01 à 2,0 atmosphères au-dessus de la pression ambiante.

5. La combinaison selon l'une quelconque des revendiations précédentes, dans laquelle la vessie contenant du gaz comprend une pluralité de chambres séparées, mises en communication de fluide les unes les autres, et comprend en outre des moyens destinés à restreindre l'écoulement du gaz et la communication de fluide entre les chambres.

6. En combinaison, une structure-support (11, 100) destinée à positionner un produit (55, 102) dans un récipient d'emballage extérieur (57, 104), un produit devant être supporté, et un récipient d'emballage extérieur, dans lequel la structure-support et le produit sont insérés, dans laquelle le produit devant être supporté présente des dimensions externes prédéterminées et le récipient d'emballage extérieur présente des dimensions internes prédéterminées, ladite structure-support comprenant :

   une vessie (11, 51, 53, 110) contenant du gaz, en résine plastique, monolithique, semi-rigide et auto-portante, moulée par soufflage et scellée au moins partiellement gonflée, vessie ayant une épaisseur de paroi moyenne d'environ 0,8 mm (environ 1/32 pouce) et ayant une cavité de réception de produit externe (13, 67, 112) pré-formée à côté de celle-ci, dans laquelle cette cavité externe est de forme prédéterminée et de dimensions prédéterminées, de manière à s'adapter aux dimensions externes prédéterminées du produits,

   dans laquelle l'extérieur de la vessie contenant

du gaz, à l'autre côté de celle-ci distante de la cavité externe, présente une forme prédéterminée et des dimensions (114) prédéterminées, de manière à s'adapter aux dimensions internes prédéterminées des récipients d'emballage, et

dans laquelle la partie de réception de produit de la vessie contenant du gaz conserve sa configuration et ses dimensions prédéterminées, suite à sa structure propre, lorsque la vessie contenant du gaz est chargée en gaz et lorsque la pression effective de ce gaz est à peu près nulle.

7. La combinaison selon la revendication 6, dans laquelle la vessie contenant du gaz au moins partiellement gonflée contient une pluralité de sous-chambres intérieures formées par des organes déflecteurs s'étendant à l'intérieur des vessies contenant du gaz, de manière qu'un effet d'amortissement du gaz passant d'une des sous-chambres intérieures à une autre soit exercé par les organes déflecteurs.

8. La combinaison sel on la revendication 7, dans laquelle la structure-support a une pluralité d'angles, et au moins certaines des sous-chambres intérieures sont positionnées à ces angles.

9. La combinaison selon l'une quelconque des revendications précédentes, dans laquelle la structure-support est constituée d'un matériau plastique qui est du polyéthylène, polypropylène et un copolymère de ceux-ci, du vinyle, du polychlorure de vinyle ou du nylon.

10. La combinaison selon l'une quelconque des revendications précédentes, dans laquelle le gaz se trouvant dans la vessie contenant du gaz est de l'air, de l'azote, du dioxyde de carbone, de l'hexafluorure de soufre, de l'argon ou du krypton.

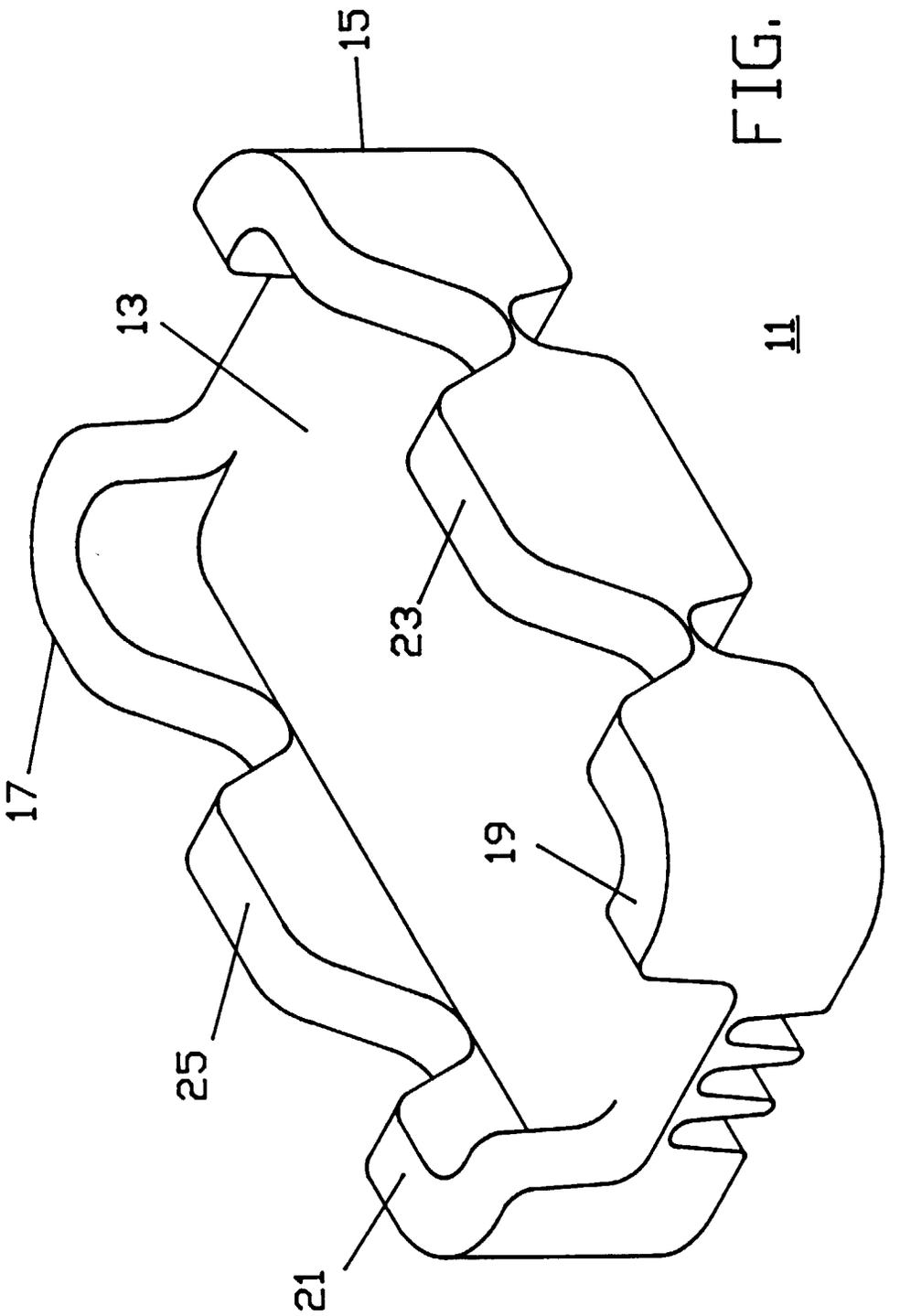
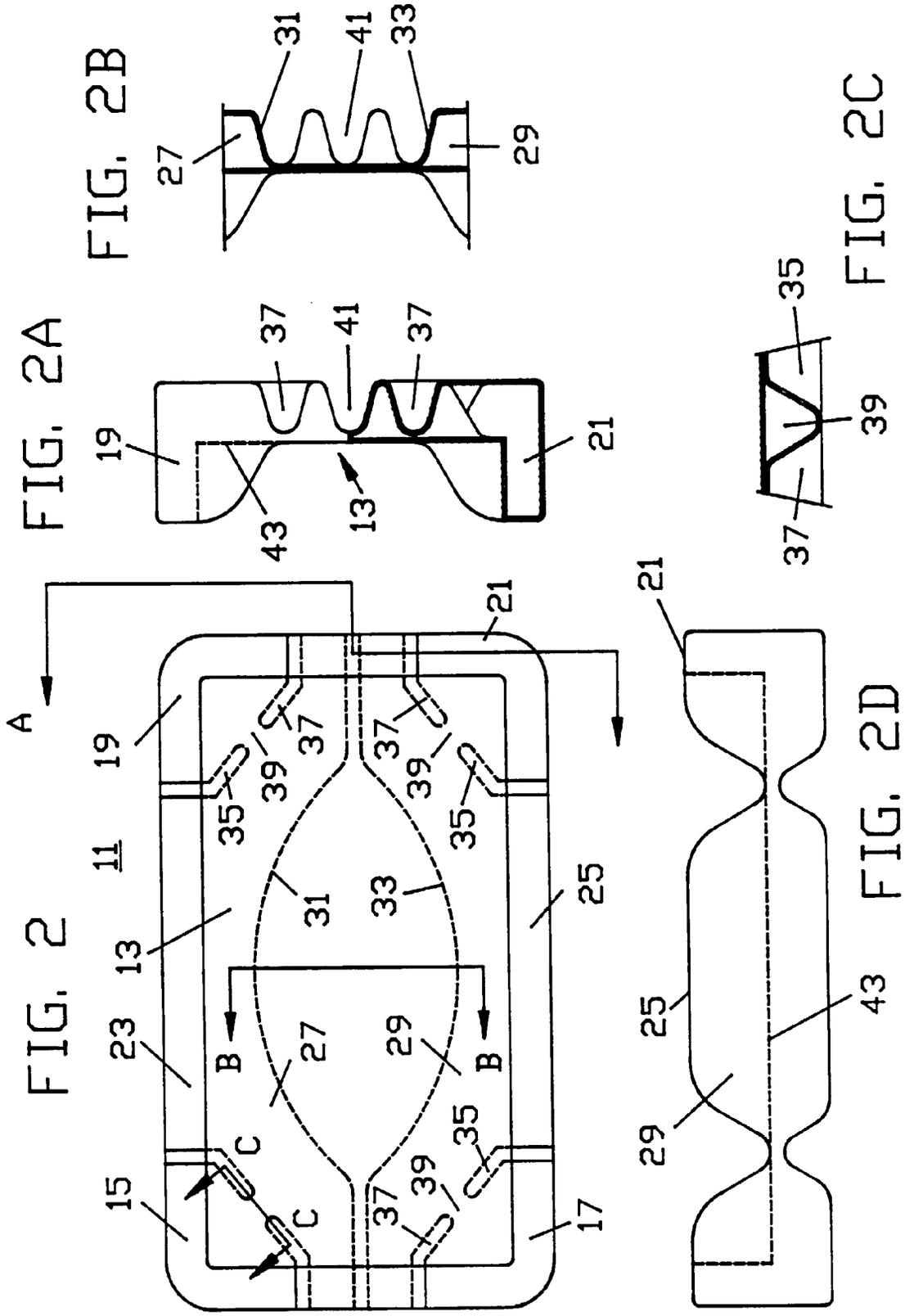


FIG. 1


FIG. 2
FIG. 2A
FIG. 2B
FIG. 2C
FIG. 2D
A
B
C
11
13
15
17
19
21
23
25
27
29
31
33
35
37
39
41
43

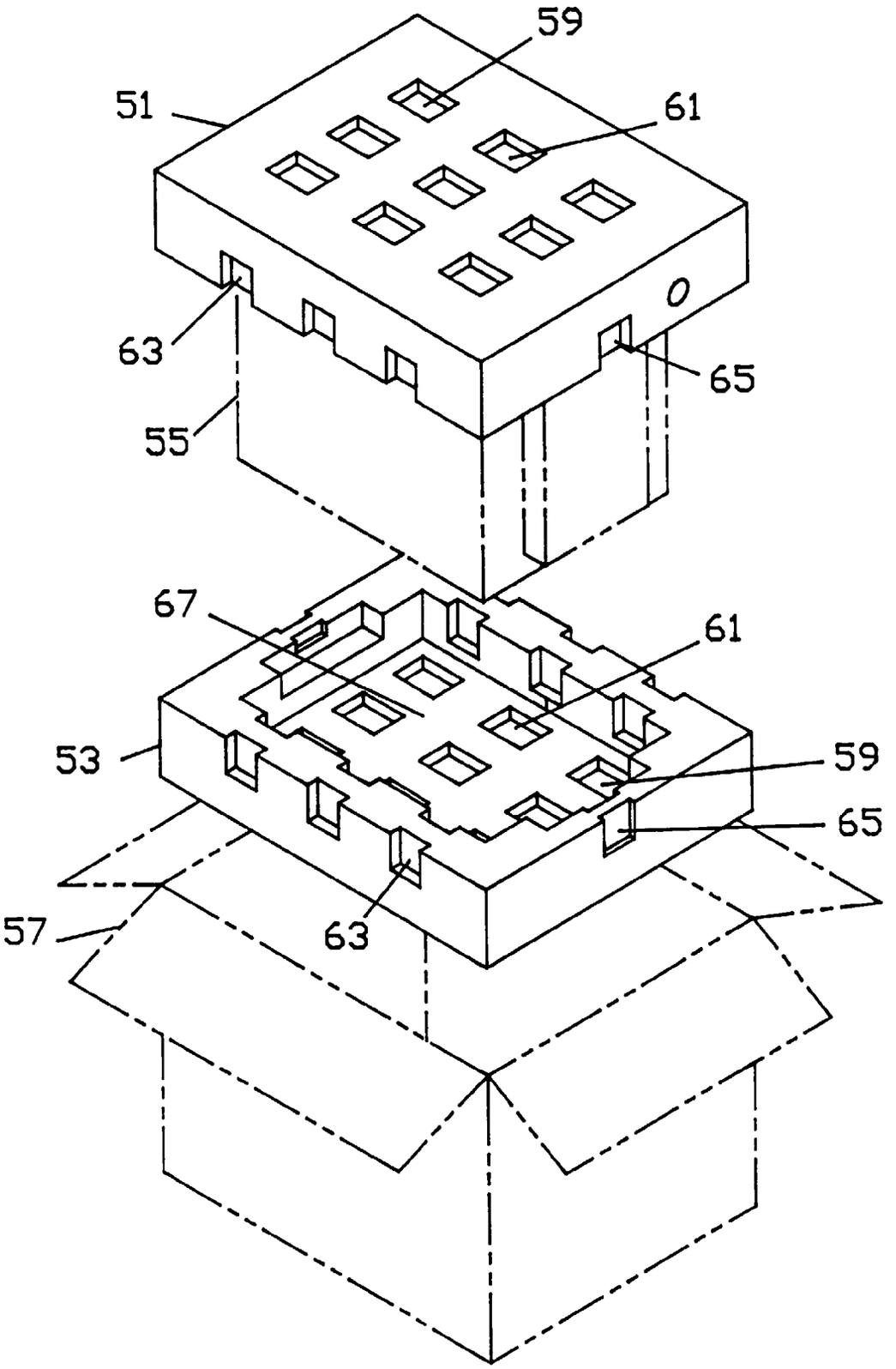


FIG. 3

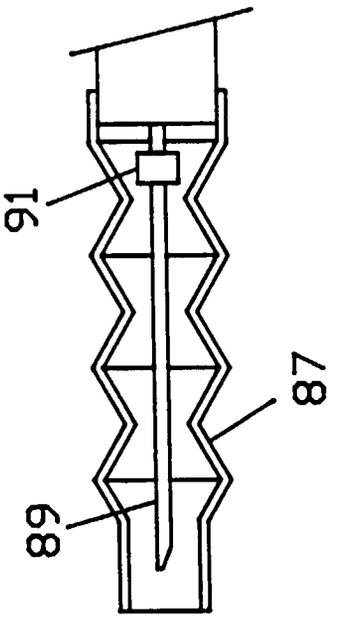


FIG. 4A

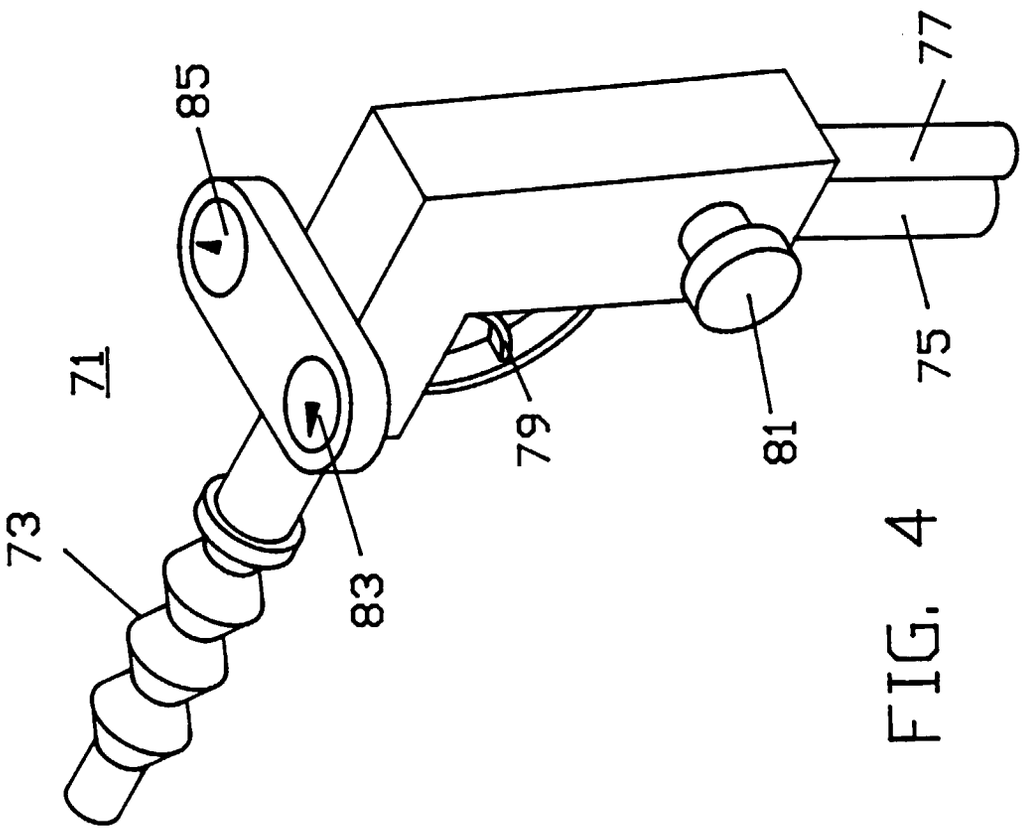


FIG. 4

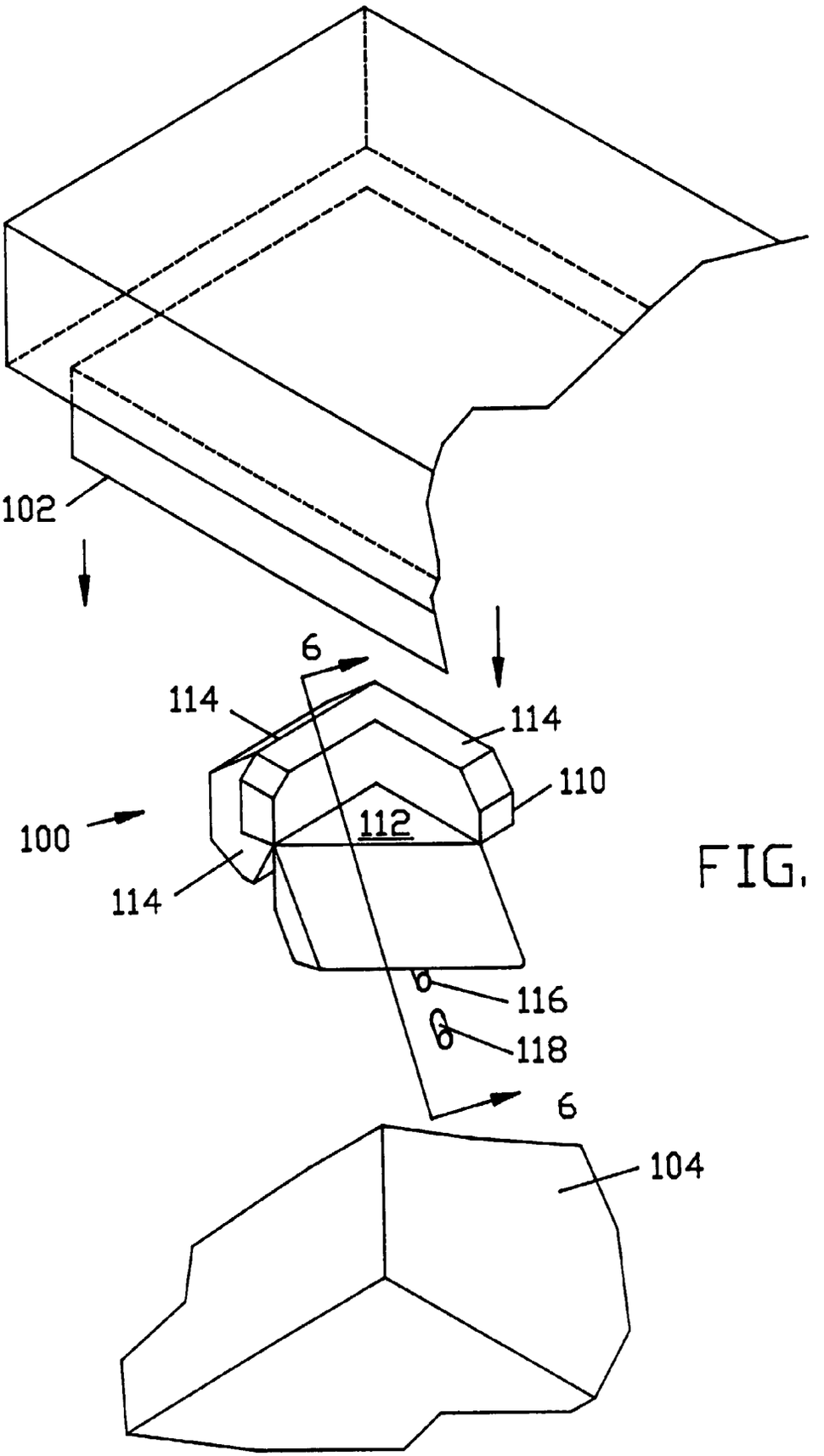


FIG. 5

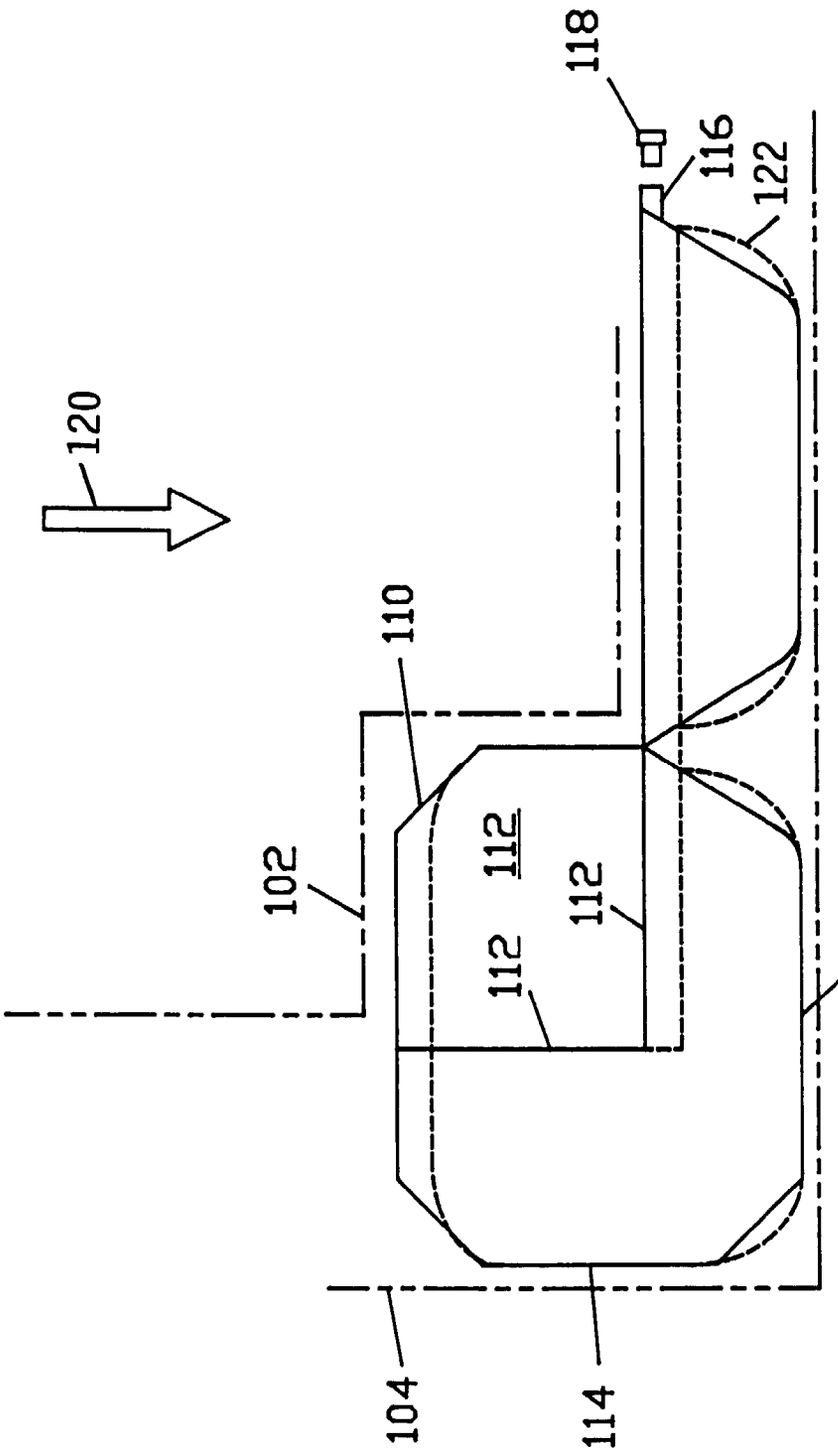


FIG. 6