

**IMPROVED PACKAGING STRUCTURE OF CONTAINERS
FOR PHARMACEUTICAL USE, METHOD FOR
PROCESSING THEREOF, PROCESSING MACHINE
THEREFOR, AND USE THEREOF**

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ABSTRACT

The improved packaging structure of containers for pharmaceutical use comprises a plastic box-type body having a quadrangular bottom wall wherefrom upright side walls extend, a lid for closing the box-type body, the lid comprising a membrane of a material selectively permeable to a sterilising agent in order to sterilise said containers. It further comprises means for predetermined spatial positioning of the containers in order to feed, directly and automatically, process machines of the containers, the positioning means being internally and integrally formed with said box-type body. At least one of the side walls has at least one planar outer surface having at least a portion thereof in relief.

The method for processing the packaging structure comprises the step of limiting the magnitude of displacement of the

positioning means due to thermal deformation of the box-type body by fixing the position of the box-type body at the at least one portion in relief of at least one planar outer surface of at least one side wall of the box-type body. The process machine for containers for pharmaceutical use comprises a support for the box-type body of the packaging structure and at least one blocking element of shape conjugated to the at least one portion in relief of at least one planar outer surface of at least one side wall of said box-type body of the packaging structure for mutual engagement. The use of the packaging structure is for feeding, directly and automatically, the containers with a predetermined spatial position to a process machine for their manipulation.

WECLAIM

1. A packaging structure of containers for pharmaceutical use, comprising a plastic box-type body having a quadrangular bottom wall wherefrom upright side walls extend, a lid for closing said box-type body, said lid comprising a membrane of a material selectively permeable to a sterilising agent in order to sterilise said containers, means for predetermined spatial positioning of said containers in order to feed, directly and automatically, process machines of said containers, said positioning means being internally and integrally formed with said box-type body, characterised in that at least one of said side walls has at least one planar outer surface having at least a portion thereof in relief.

2. A packaging structure of containers for pharmaceutical use as claimed in claim 1, characterised in that said portion in relief is in negative relief.

3. A packaging structure of containers for pharmaceutical use as claimed in claim 1 or 2, characterised in that the depth of said

portion in relief is larger than the thickness of said at least one side wall.

4. A packaging structure of containers for pharmaceutical use as claimed in any preceding claim, characterised in that said portion in relief extends orthogonally to the plane of said bottom wall of said box-type body.

5. A packaging structure of containers for pharmaceutical use as claimed in claim 4, characterised in that said portion in relief intersects said bottom wall of said box-type body.

6. A packaging structure of containers for pharmaceutical use as claimed in any preceding claim, characterised in that said positioning means comprise an ordered distribution of positioning pins which, extending from said bottom wall of said box-type body, delimit a plurality of positioning seats for said containers.

7. A packaging structure of containers for pharmaceutical use as claimed in any claim 6, characterised in that said positioning pins are conformed and disposed in order to delimit groups of said positioning seats,

the form said positioning seats being conjugated to that of said containers.

8. A packaging structure of containers for pharmaceutical use as claimed in any claim 6 or 7, characterised in that said positioning pins each comprise a central cylindrical portion with flanges protruding radially therefrom.

9. A packaging structure of containers for pharmaceutical use as claimed in any claim 8, characterised in that said flanges each comprise at their extremities an enlargement of their thickness, said enlargement providing a contact point for said containers.

10. A packaging structure of containers for pharmaceutical use as claimed in claim 8 or 9, characterised in that it further comprises stiffening elements integrally and internally formed with said box-type body.

11. A packaging structure of containers for pharmaceutical use as claimed in any claim 10, characterised in that said stiffening elements comprise an ordered distribution of partitioning walls, the ends of which

join the ends of said flanges forming a honeycomb structure within said box-type body.

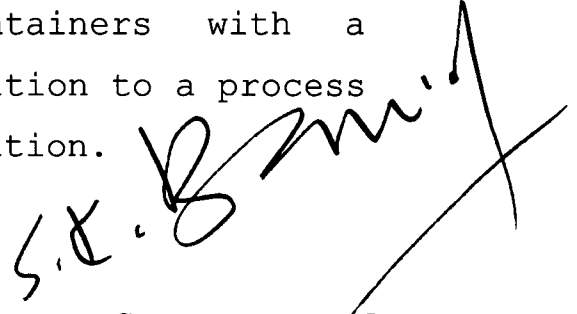
12. A packaging structure of containers for pharmaceutical use as claimed in any preceding claim, characterised in that said side walls have a step shaped in order to enlarge the upper part of said box-type body.

13. Method for processing a packaging structure of containers for pharmaceutical use, said packaging structure having a plastic box-type body with a quadrangular bottom wall wherefrom upright side walls extend, a lid for closing said box-type body, said lid comprising a membrane of a material selectively permeable to a sterilising agent in order to sterilise said containers, said packaging structure also having means for predetermined spatial positioning of said containers in order to feed, directly and automatically, process machines of said containers, said positioning means being internally and integrally formed with said box-type body, characterised in that of comprising the

step of limiting the magnitude of displacement of said positioning means due to thermal deformation of said box-type body by fixing the position of said box-type body at at least a portion in relief of at least one planar outer surface of at least one side wall of said box-type body.

14. Process machine for containers for pharmaceutical use, comprising a support for a box-type body of a packaging structure of any of claims 1 - 12 and at least one blocking element of shape conjugated to at least a portion in relief of at least one planar outer surface of at least one side wall of said box-type body of said packaging structure for mutual engagement.

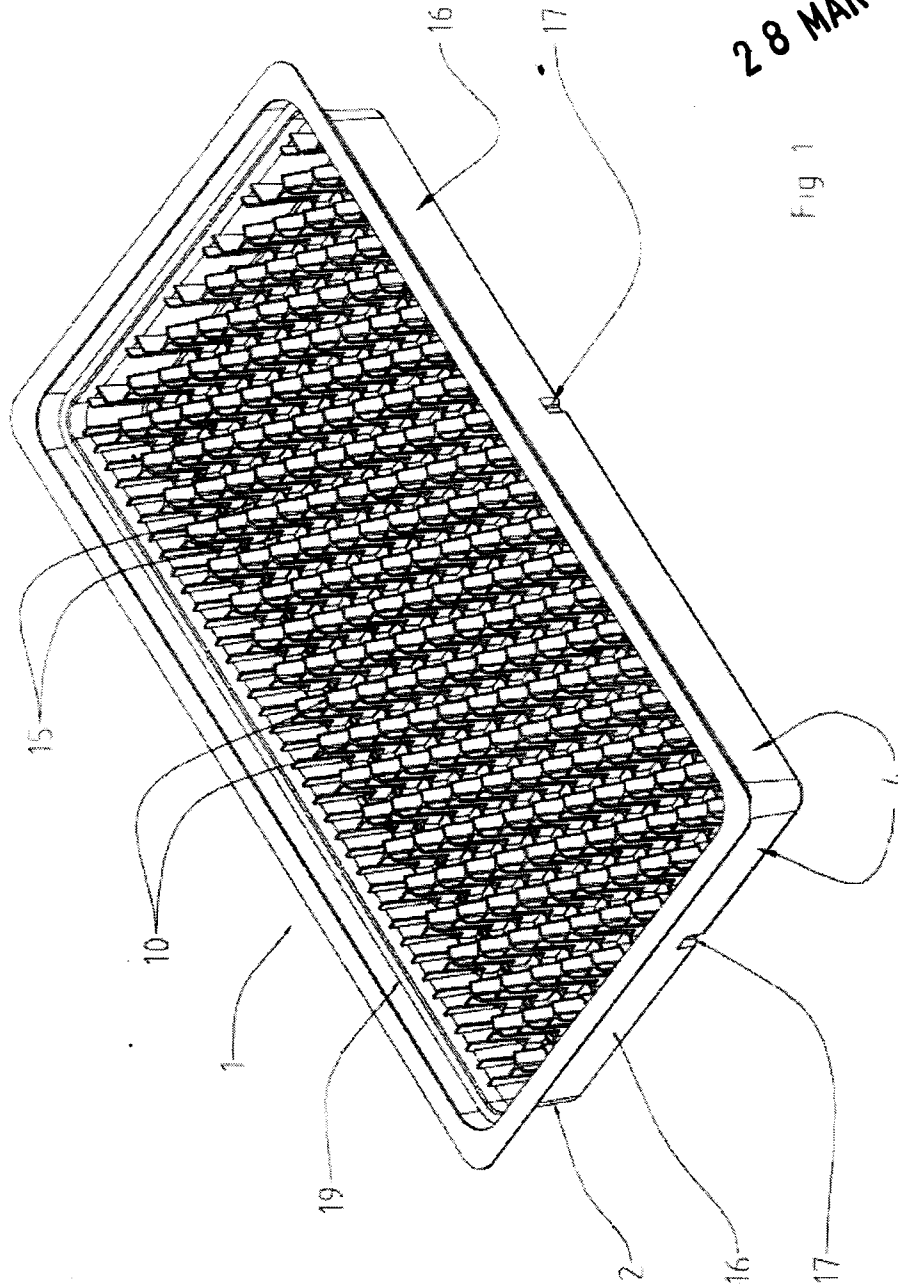
15. Use of a packaging structure for containers for pharmaceutical use as claimed in one or more of the preceding claims, in order to feed, directly and automatically, said containers with a predetermined spatial position to a process machine for their manipulation.


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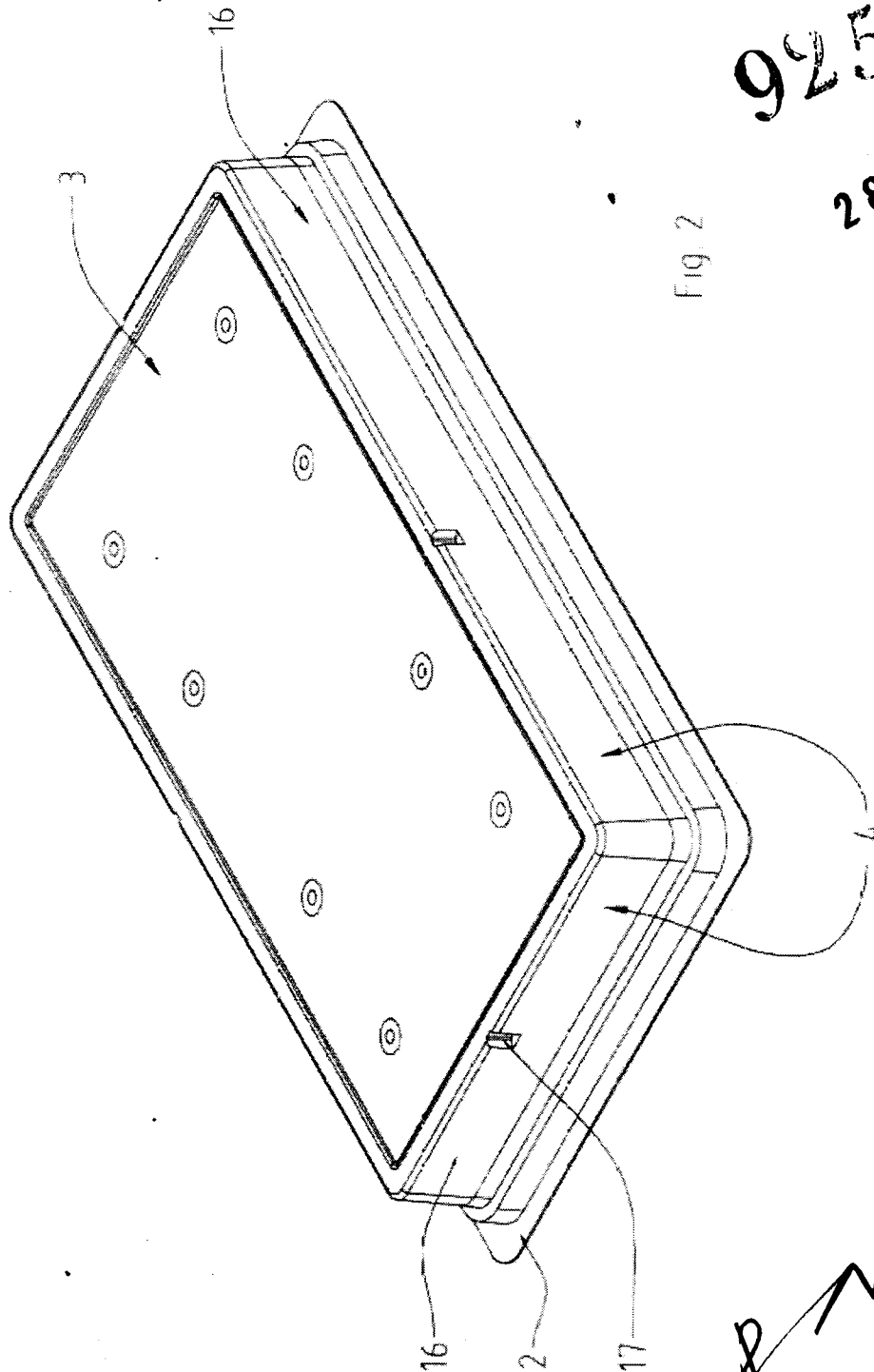
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Fig 2



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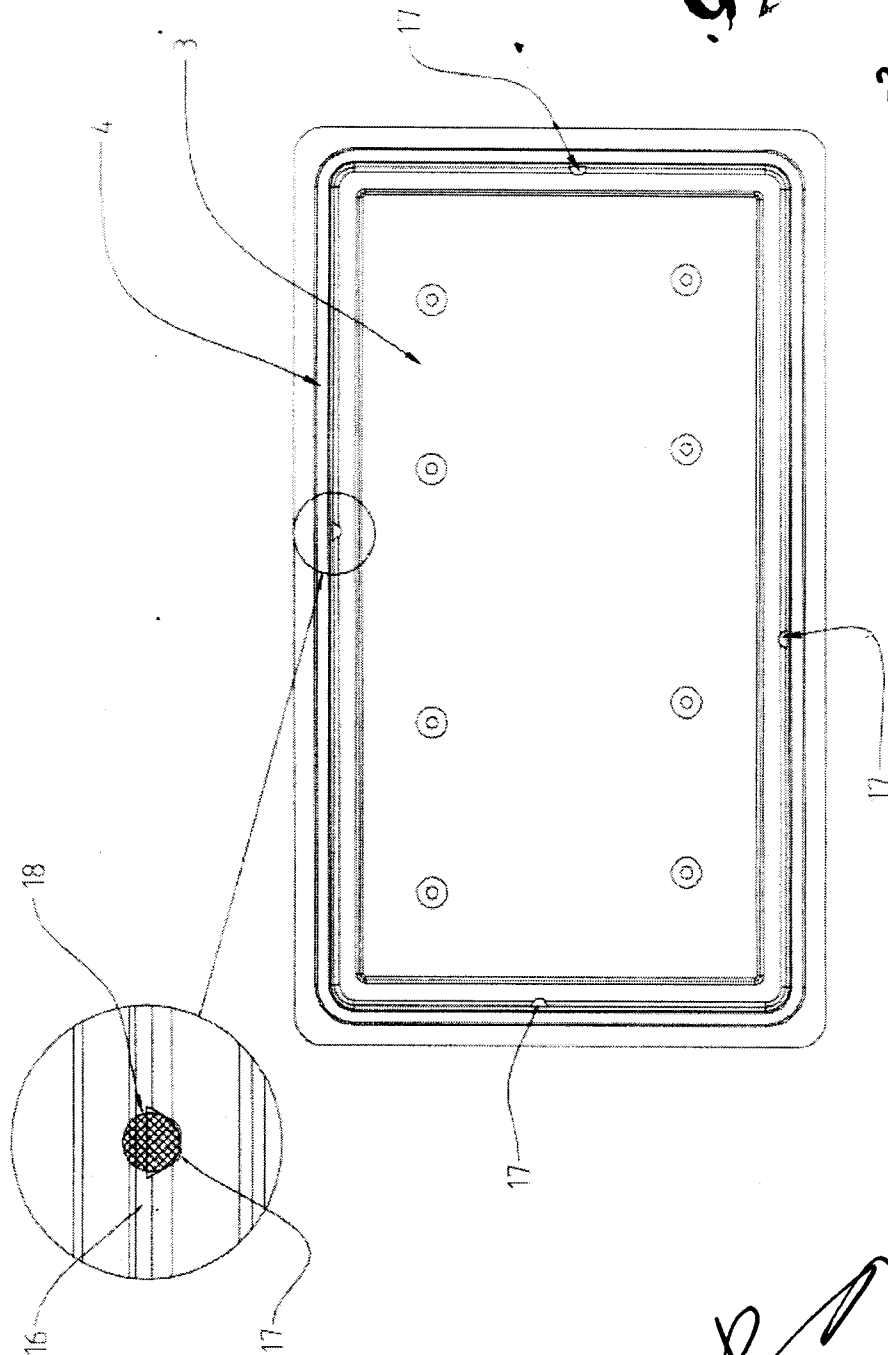


Fig 3

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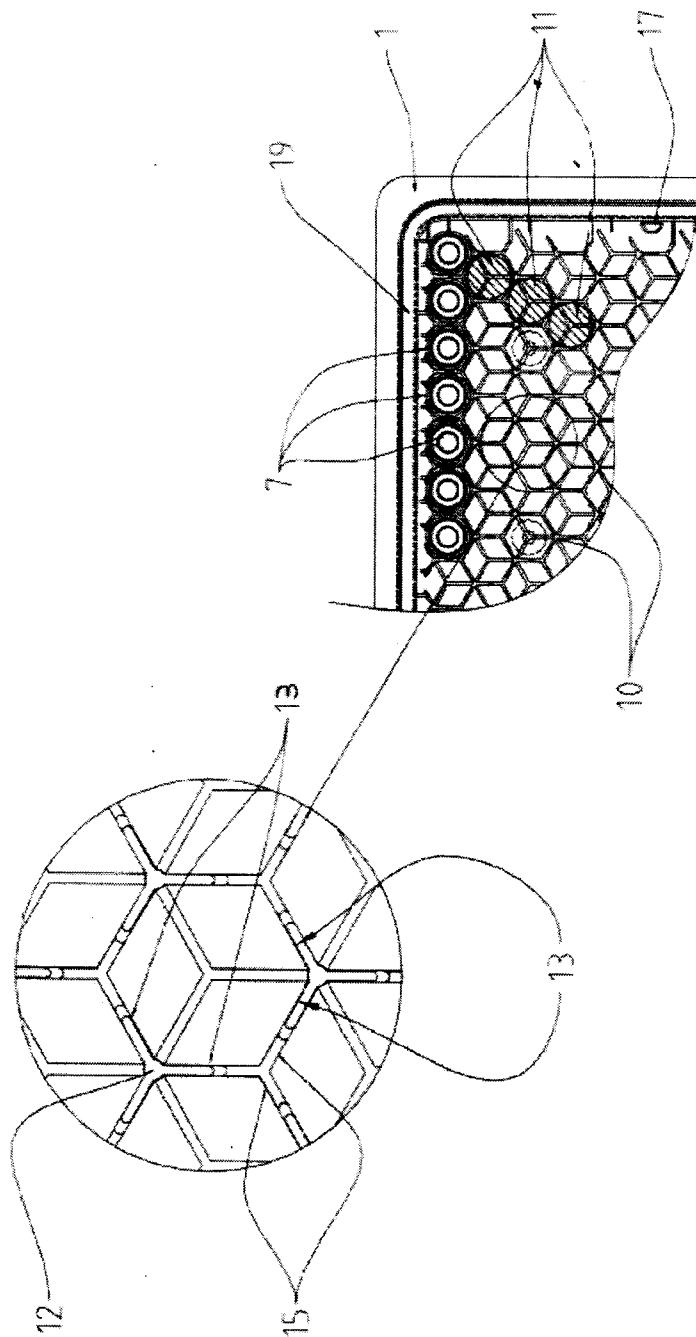
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FOR PHARMACEUTICAL USE, METHOD FOR
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DESCRIPTION

The present invention relates to an improved packaging structure of containers for pharmaceutical use, a method for processing thereof, a processing machine therefor, and use thereof.

Conventional packaging for containers for pharmaceutical use generally simply comprise a box-type body into which the containers are inserted, and a lid to close the box-type body, removable once the packaging has reached its destination at the pharmaceutical company for extraction of the containers, which must undergo washing and sterilisation before being filled with the medicinal product and capped.

The management of the packaging at the pharmaceutical company is extremely complicated due to the fact that, as mentioned, the containers must be

manipulated and conveyed through complex, costly and bulky washing and sterilisation systems before being finally filled.

WO2010/086128 describes a packaging structure of containers for pharmaceutical use suitable for providing pharmaceutical companies with pre-washed and sterilized containers ready to be filled, and allows feeding the containers directly and automatically to a process machine, thereby streamlining the process. In particular, it describes a packaging structure comprising a plastic box-type body having a quadrangular bottom wall from which upright side walls extend, a lid for closing the box-type body, said lid comprising a membrane of a material selectively permeable to a sterilising agent in order to sterilise the containers. It also comprises means for predetermined spatial positioning of the containers in order to feed, directly and automatically, process machines of the containers, the positioning means being internally and integrally formed with the box-type body.

However, during processing, such plastic packaging structures can undergo thermal expansion, contraction or other deformation, displacing the means for predetermined spatial positioning of the containers. Correct alignment of the containers with the process machine is necessary in order to obtain correct processing of the containers, such as filling and capping thereof.

The technical aim of the present invention is, therefore, that of providing an improved packaging structure of containers for pharmaceutical use, a method for processing thereof, a processing machine, therefor, and use thereof, that overcome the noted technical drawbacks of the prior art.

Within the scope of this technical task, one object of the invention is that of providing a packaging structure having improved parameter stability during processing.

Another object of the invention is to provide a packaging structure of containers

for pharmaceutical use suitable to permit automated manipulation of the containers.

Another object of the invention is that of providing a packaging structure of containers for pharmaceutical use able to ensure improved protection of the containers during processing.

A further object of the invention is that of enabling simplified processing of a packaging structure, improving efficiency of the processing while retaining structural simplicity and economics of design of the packaging structure.

The technical task, as well as these and other objects, are achieved according to the present invention by a packaging structure of containers for pharmaceutical use according to claim 1.

The present invention also relates to a method for processing a packaging structure of containers for pharmaceutical use according to claim 13, as well as a process machine for containers for pharmaceutical use according to claim 14 and use of a

packaging structure for containers for pharmaceutical use according to claim 15.

The presence of at least one portion in relief of at least one planar outer surface of at least one side wall of the box-type body enables the thermal expansion or contraction of the box-type body during processing to be greatly reduced. By cooperating with a blocking element on the process machine, the portion in relief ensures that the thermal expansion or contraction radiates from this point instead of from one of the side wall junctions of the box-type body which is usually used as an orientation point for the body during processing.

The relative dilatation of the seats for the containers in the box-type body along the longitudinal direction of the side wall, parallel to the plane of the bottom wall, is therefore significantly reduced. As a result, the magnitude of displacement of the containers relative to the apparatus of the processing machine, such as filling and capping appliances, is reduced, improving the results of these operations

and avoiding the need for manual repositioning of the containers or of the packaging structure in order to carry out these processing steps correctly. In particular, this allows a robotic manipulator to know more precisely the spatial coordinates of each container and consequently permits automated manipulation thereof. Moreover, damage to the containers by incorrect alignment with the apparatus of the processing machine or by human error during manual intervention can be avoided.

Other characteristics of the present invention are moreover defined in the subsequent claims. Further characteristics and advantages of the present invention will be more evident from the description of a preferred, but not exclusive, embodiment of the improved packaging structure of containers for pharmaceutical use, the method for processing thereof, the processing machine therefor, and use thereof according to the invention, illustrated in the attached non-limiting drawings, wherein:

- Figure 1 shows a perspective view of a packaging structure of containers for pharmaceutical use in conformity with a first preferred embodiment of the invention;
- Figure 2 shows a perspective view of the underside of the packaging structure of Figure 1;
- Figure 3 shows a plan view of the underside of the packaging structure of Figure 1, showing an enlarged view of the portion of the planar outer surface of the side wall in relief;
- Figure 4 shows a plan view from above of an alternative embodiment of the packaging structure, differing only from that of Figure 1 in the provision of an enlargement of the thickness at the extremities of the flanges of the positioning means, and showing an enlarged view of the positioning means.

Identical parts in the figures are indicated with the same reference number.

With reference to the aforesaid figures, a packaging structure of containers 7 for

pharmaceutical use is shown, indicated as a whole with reference number 1.

The packaging structure 1 comprises a plastic box-type body 2 with a quadrangular bottom wall 3 wherefrom upright side walls 4 extend.

The box-type body 2 is closed with a lid (not shown) comprising a membrane of material selectively permeable to a sterilising agent in order to sterilise containers 7 that the packaging structure is intended to house. The lid is preferably composed of a sheet detachably bound, such as by heat-sealing, along the free edge of the box-type body.

Advantageously the side walls 4 have a step 19 shaped in order to enlarge the upper part of the box-type body 2. This further aids robotic manipulation of the containers 7 by facilitating grip thereof.

Means for predetermined spatial positioning of the containers 7 are produced integrally, in a single piece, with the box-type body 2 and internally thereto. These positioning means preferably comprise

an ordered distribution of positioning pins 10 which, extending from the bottom wall 3 of the box-type body 2, delimit a plurality of positioning seats 11 for the containers 7.

The positioning pins 10 are preferably conformed and disposed in order to delimit groups of positioning seats 11, the form these positioning seats 11 being conjugated to that of said containers 7.

The positioning pins 10 are advantageously distributed with constant spacing in a plurality of rectilinear rows parallel to the two larger opposite side walls 4 extending from the quadrangular bottom wall 3 of the box-type body 2, which in particular is parallelepiped-shaped. The positioning pins 10 of alternate rows are advantageously aligned in a direction parallel to the two smaller opposite side walls 4.

At least one of the side walls 4 of the box-type body 2 has at least one planar outer surface 16 having at least a portion 17 thereof in relief. Preferably, the portion 17 in relief is in negative relief

relative to the planar outer surface 16 of the side wall 4. In an alternative embodiment (not shown), the portion in relief is in positive relief. Preferably, the portion 17 in relief is at an intermediate location along the side wall 4 in the direction parallel to the plane of the bottom wall 3 of the box-type body 2, in particular at or close to the central cross section of the side wall 4. In an alternative embodiment of the invention, two or more of the side walls 4 of the box-type body 2 have such outer planar surfaces 16 with portions 17 in relief. In the embodiment as shown in Figures 2 and 3, all of the four side walls 4 have such portions 17 in relief. This provides the user with flexibility in orientation of the box-type body relative to the processing machine, and, in the event that all four portions 17 in relief are engaged by the process machine during the processing steps as described below, a further improvement in limiting dilatation of the positioning seats 11 during processing.

The packaging structure in conformity with the present invention allows for an extremely simple production process given that the box-type body 2, with the portion 17 in relief and the means for predetermined spatial positioning of the containers 7 being integrally formed with the box-type body 2, can be produced in a single moulding operation.

Optionally, the portion 17 in relief extends orthogonally to the plane of the bottom wall 3, and preferably intersects the bottom wall 3. Preferably the depth of the portion 17 in relief is larger than the thickness of the side wall 4, thereby providing a significant recess or protrusion that is easily recognised by the user or by a process machine. When in negative relief, the portion 17 in relief on the at least one planar outer surface 16 of the at least one side wall 4 is advantageously positioned such that it does not interfere with any of the positioning seats 11 for the containers 7.

In use, the packaging structure 1 can be used to safely and easily transport the

containers 7 to the processing site and can be used in order to feed, directly and automatically, the containers 7 with a predetermined spatial position to a process machine for their manipulation.

The process machine for such containers 7 for pharmaceutical use comprise a support for a box-type body 2 of a packaging structure 1 and at least one blocking element 18 of shape conjugated to at least a portion 17 in relief of at least one planar outer surface 16 of at least one side wall 4 of the box-type body 2 of the packaging structure 1 for their mutual engagement. The blocking element 18 can be of any shape suitable for engagement with the portion 17 in relief. In the enlargement of Figure 3 the blocking element 18 is shown as having a circular cross-section for cooperating with a portion 17 in negative relief having an angular U-shaped cross-section. Advantageously, in the embodiment in which the portion 17 in relief is in the form of an angular channel extending orthogonally to the plane of the bottom wall 3 and

intersecting the bottom wall 3, such as shown in Figure 1, the blocking element 18 may be in the form of a cylindrical pin.

The method of processing the packaging structure 1 comprises the step of limiting the magnitude of displacement of the positioning means due to thermal deformation of the box-type body 2 by fixing the position of the box-type body 2 at at least the portion 17 in relief of at least the one planar outer surface 16 of the at least one side wall of the box-type body 2. In practice, the method may also comprise the steps of centering the box-type body 2 on a support of a process machine, aligning the at least one portion 17 in relief with at least one a blocking element 18 present on the process machine, allowing mutual engagement between the portion 17 in relief and the blocking element 18, and subsequent further processing of the packaging structure 1. Such further processing steps may comprise removing the lid, filling the containers 7 and capping the containers 7. The precise positioning of the containers 7 allows the

filling and capping steps to be carried out directly inside the box-type body 2, without moving or extracting the containers 7, providing advantages in terms of logistics and productivity.

Each positioning seat 11 occupies a prismatic volume partially delimited by three contiguous positioning pins 10 and having as a base a hexagon that inscribes the circumference of the containers 7, which particularly have a cylindrical body. The positioning pins 10 preferably each comprise a cylindrical portion 12, with flanges 13 protruding radially therefrom. In an embodiment not shown the flanges 13 each can comprise at their extremities an enlargement of their thickness, providing a contact point for the containers 7. In this case, as only these enlargements need have a specified thickness in order to provide the correct contact point and spacing for the containers 7, the flanges 13 can be of substantially smaller thickness, allowing a not insubstantial saving of plastic material during manufacture of the packaging structure. Moreover, box-type

bodies 2 of packaging structures known from the prior art and used in industry are generally of a standard size prior to processing and the number of containers 7 intended to be packaged therein is also generally standardised. By providing these enlargements, the packaging structure provides an even packaging of the containers 7 across the entirety of the box-type body 2, avoiding any superfluous marginal space near any of the side walls 4. The even weight distribution is advantageous for correct transportation of the packaging structure when housing the containers 7 and the even spatial distribution of the containers 7 prior to processing aids the correct positioning during processing.

The packaging structure 1 optionally comprises stiffening elements integrally and internally formed with the box-type body 2. Preferably these stiffening elements comprise an ordered distribution of partitioning walls 15, the ends of which join the ends of the flanges 13 that protrude radially from the positioning pins

10, thereby forming a honeycomb structure within the box-type body 2. This honeycomb structure provides structural rigidity to the packaging structure, aiding the prevention of deformation of the box-type body during processing.

Furthermore, the partitioning walls 15 preferably extend from the bottom wall 3 of the box-type body 2, and preferably to a height below the height of the positioning pins 10. The hexagonal-shaped enclosure formed by the cooperation of the partitioning walls with the positioning pins advantageously provides an enclosed area for containing liquid in the event of breakage of a corresponding container 7.

In the embodiments illustrated in the figures, the containers 7 are intended to rest directly on the bottom 3 of the box-type body 2 and have a height substantially equal to the height of the box-type body to facilitate gripping, filling or capping by manual or robotic manipulation. Optionally, the packaging structure 1 can have means for spacing the containers 7 from the bottom wall 3 of the box-type body 2, these

means being intended to adapt the box-type body 2 to containers 7 of a height even substantially lower than its height so that the containers 7 can be positioned with their tops in proximity to the top of the box-type body 2. Such spacing means may comprise forms (not shown) present within the positioning seats 11 and preferably produced integrally with the box-type body 2, these forms extending from the bottom wall 3 to a height substantially lower than that of the positioning pins 10, and transversely intersecting the positioning pins 10. In either embodiment, the bottom wall 3 of the box-type body is advantageously produced with a thickness of plastic capable of withstanding the force required to cap the containers 7 positioned in the positioning seats 11.

In a further alternative embodiment of the invention (not shown), the bottom wall 3 has through holes and is coated with another membrane selectively permeable to said sterilising agent. The through holes are dimensioned in order to permit insertion therethrough of corresponding

pusher means operated from the outside, in order to remove the containers 7.

The packaging structure of containers for pharmaceutical use, the method for processing thereof, the processing machine therefor, and the use thereof thus conceived are susceptible to numerous modifications and variations, all falling within the scope of the inventive concept; moreover, all the details can be substituted by technically equivalent elements.

In practice, the materials used and the dimensions can be any according to requirements and to the state of the art.