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(71) Applicant: **Pentacon Holding B.V.**
2223 EG Katwijk (NL)

(72) Inventor: **Van Noort, Petrus Cornelus Maria**
2223 EG, Katwijk (NL)

(74) Representative: **Klavers, Cornelis**
Octrooibureau Klavers B.V.
Markerkant 1201.20
1314 AJ Almere (NL)

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(54) **Device for crushing flexible objects**

(57) A device (1) for crushing objects usually made of plastic material, which device (1) comprises a container (5) in which the objects are collected and crusher means (7) connected to the container (5). The crusher means (7) are provided with one or more projections (8),

each projection (8) being movable in a plane, and with a grate (9) provided with longitudinal slots (10) whose shapes have been selected to conform to the path described by the projections (8), such that the orbital plane passes at least partially through the longitudinal slot (10).

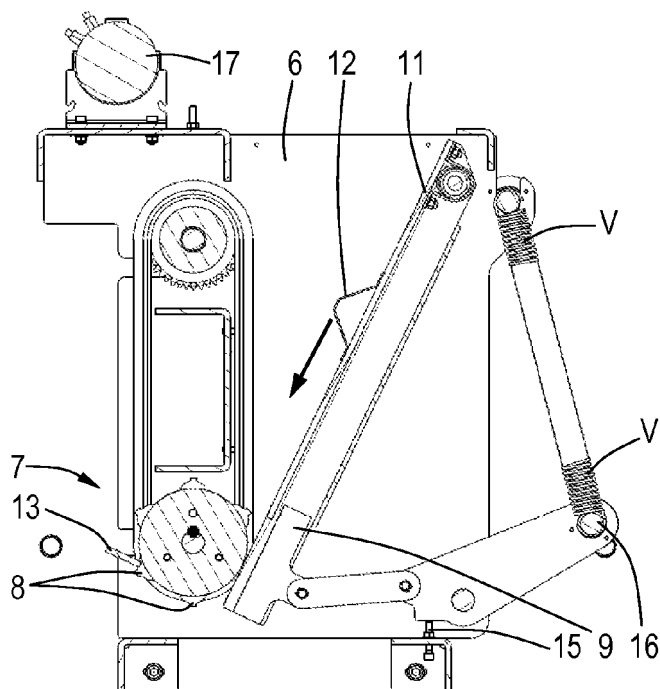


Fig.3

Description

[0001] The present invention relates to a device for collecting and processing objects made of plastic material, in particular objects having a fixed shape, such as bottles, containers, jerry cans, packages, flasks, holders and the like.

[0002] The present invention relates to a vehicle provided with such a device.

[0003] Such a device is generally known. A compacting device is known in particular from NL 1034075, by means of which device the aforesaid objects of plastic material are collected at collecting points, where they are compressed into packs or bales. The compressed state of the objects in packs or bales is maintained until final processing takes place after transport.

[0004] Problems that occur are related to the fact that collecting containers for the objects need to be present at the collecting site, which collecting containers of necessity have a large volume, since plastic objects such as bottles, containers, jerry cans and packages have a large volume. Upon subsequent transport, a relatively very great deal of air and relatively very little weight is moved, so that said transport is not very efficient. If the objects are already compacted during the pre-processing process by being compressed and held together, the plastic objects will spring back in part to their original volume upon being released. At that moment a large storage capacity will be required again for the storage of said objects.

[0005] A drawback of compressing the (possibly shredded, crushed or cut-up) collected plastic is that this process requires relatively much energy, and that moreover the compression chamber and the compression elements must be very sturdy and capable of resisting large forces and pressures (read: heavy).

[0006] The object of the present invention is to provide an improved device which makes it possible to save energy and which does not exhibit the aforesaid drawbacks, or at least to a lesser extent.

[0007] In order to accomplish that object, the device according to the invention is characterised in that it is a device for crushing objects usually made of plastic material, which device comprises a container in which the objects are collected and crusher means connected to the container, which are provided with one or more projections, each projection being movable in a plane, and with a grate provided with longitudinal slots whose shapes have been selected to conform to the path described by the projections, such that the orbital plane passes through the longitudinal slot.

[0008] The advantage of the device according to the invention is that it crushes the plastic objects, so that the crushed object can no longer return to its original shape and corresponding volume. Practically speaking, the plastic is initially subjected to impacts upon being crushed between the moving projection and the grate. Another advantage is the fact that the crushed product

need not be compressed in that case, because it is already compact in its crushed form. This makes a difference as regards storage capacity and transport volume, which, in certain conditions, makes for a more efficient transport. In the crushed form, the structure of the object and its original, voluminous shape are permanently affected, as it were, and the crushed product is relatively flat, but it need not be shredded or cut up completely. The crushed product, whose structure is only affected insofar as is necessary to prevent it from returning to its original shape, remains unchanged as regards its volume after crushing, regardless of whether it is subsequently packed or sealed. The advantage is that it can no longer return to its original shape after crushing.

[0009] Cutting up the product completely, as known from the aforementioned prior art, or shredding also results in the structure being affected, which process requires much more energy, but the final product will have been reduced to the generally smaller volume of shreds. Completely cutting up or shredding the objects also requires much more energy locally that the crushing treatment now being proposed, which energy is only available at high additional cost and risk at the collecting points - for example on the corner of the street.

[0010] The crusher means are of simple design, comprising one or more projections being movable in a plane and a grate provided with longitudinal slots. The path of the moving projections may extend through said slots, touch the grate surface, as it were, at the location of the slots, or extend slightly above the grate surface at the location of the slots. Unlike the situation where cutting or shredding takes place, however, use is not exclusively made of cutting elements comprising parts that make cutting contact with each other. In the device according to the invention, the shape of the slots will in all cases be selected to conform to the path described by the projections, such that the orbital plane will generally pass through the longitudinal slot. These parameters have been found to be important in putting the crushing process into practice.

[0011] One embodiment of the device according to the invention is characterised in that the roller is provided with a shaft which is connected to shaft positioning means for influencing the positions of the paths described by the moving projections, whilst alternatively, or possibly additionally, the grate is connected to grate positioning means for influencing the position of the grate relative to the paths described by the projections.

[0012] Advantageously the setting and tuning of the aforesaid positioning means takes place in dependence on the texture of the plastic objects to be crushed.

[0013] A preferred embodiment of the device according to the invention is characterised in that the grate is provided with holder means which are designed to move the grate aside when hard objects get between the movable projections and the grate or the slots.

[0014] Advantageously, hard objects - i.e. objects which are not made of plastic material and which cannot

be crushed - will fall from between the projections and the grate when the grate is thus moved aside. Moreover, the crusher means will not be damaged in that case, which prolongs the working life of said crusher means, but in addition to that the hard objects are isolated and automatically separated from the crushed objects, enabling the device to continue its normal operation, without any outside interference, when the grate subsequently returns to its original position.

[0015] Another preferred embodiment of the device according to the invention is characterised in that the device comprises an electric motor which effects the movement of the projections or the rotation of the rollers, and which is furthermore advantageously electrically powered by one or more batteries, which may or may not be charged by solar cells.

[0016] The amount of energy needed for the aforesaid crushing operation is small enough to be delivered by usual batteries, two 12V batteries in practice. If desired, the device according to the invention may also be mounted on a vehicle, such as a truck, in which such batteries - generally already charged - are normally present.

[0017] Further detailed embodiments, which are defined in the other claims, and their concomitant advantages are set forth in the description below.

[0018] The device according to the present invention will now be explained in more detail with reference to the figures below, in which like parts are provided with the same numerals. In the drawing:

Figure 1 shows and above-ground housing to be placed on top of an underground storage unit, in which housing the device according to the invention is present;

Figure 2 is a perspective view showing the device of figure 1 without the housing;

Figure 3 is a detail view of crusher means and chain conveyors as used in the device according to the invention;

Figure 4 is a view corresponding to figure 3 of the device on which the container with the access lock are placed; and

Figure 5a and the associated detail view show the way in which two cuts are formed in practice, with crushed, cut-out material of the object therebetween, sectional views B-B and A-A of which are shown in figures 5B and 5C, respectively.

[0019] Figures 1, 2 and 3 show a device 1 for crushing generally voluminous objects 0 which are generally made of plastic material. In figure 1 the device 1 is mounted in a housing 2, which is provided with an opening 3 which provides access to a container 5 via an access lock 4 (schematically shown). Such a housing 2 with the device 1 mounted therein can be disposed at a collecting location of recyclable objects and materials, for example, on an underground storage unit (not shown), or possibly on a vehicle. The access lock 4 provides access, in a manner

that is safe to the consumer or user, to the container 5 in which the plastic objects are collected for subsequent reuse.

[0020] Connected to the container 5, via a funnel-shaped construction 6 shown in figure 3, are crusher means 7. In this case the crusher means 7 are disposed at the bottom of the construction, each crusher means comprising one or more projections 8, which are each movable in the plane of the drawing in this case. The crusher means 7 further comprise a grate 9, which is provided with longitudinal slots 10, whose shapes have been selected to conform to the path described by the movable projections 8. Said path is such that the orbital plane, or the extension thereof, at least partially passes through the longitudinal slots 10 in question. The voluminous plastic objects that get between the moving projections and the longitudinal slots 10 in the grate 9 are thus crushed only to an extent sufficient to affect their voluminous spatial structure, resulting only in their ability to expand to their original volume again being irrevocably impaired. To that end the plastic objects are in practice subjected to impacts during said crushing operation when the object moves past the front of the longitudinal slot and is hit by the moving projection. In practice it is as if the three-dimensional product has been reduced to a two-dimensional shape, usually still being in one piece, by the crushing treatment.

[0021] During the crushing impacts, the surface of the object 0 is cut, usually in two places, and pushed through each time it gets between the projection 8 and the longitudinal slot 10, as a result of which two cuts C are formed, as shown in figure 5A and the detail view thereof and in figure 5B. The structure of the stretched strip of material between cuts C is irreparably damaged locally, as is also shown in figure 5C.

[0022] The aforesaid funnel-shaped construction 6 may be partially made up of a chain conveyor 11 extending downward in the direction of the crusher means 7, which chain conveyor has one or more teeth 12, which are driven in the direction of the crusher means 7 in the construction 6. The moving teeth 12 function on the one hand to tear plastic bags open, for example, and on the other hand to move the objects to the crusher means 7.

[0023] As shown in the various figures, the crusher means 7 comprise a rotationally drivable roller 13, which is circumferentially provided with the projections 8. The roller 13 forms a profile roller, as it were, whilst the longitudinal slots 10 and the grate form a die. The roller 13 furthermore has a shaft 14, which is mounted on usual shaft positioning means (not shown) for influencing the positions of the paths described by the moving projections 8 relative to the longitudinal slots 10. Preferably, the grate 9 is further provided with adjustable holding elements 16, which are designed to move the grate 9 aside when hard objects get between the movable projections 8 and the grate 9 or the longitudinal slots 10. The grate 9 may to that end be provided with weights or, as shown in the various figures, with one or more springs

V, so that the grate 9 will remain in place during normal use, but will be moved aside when hard, usually somewhat larger objects that cannot be crushed get between the crusher means 7. The device 9 will not jam in that case, and the impending jamming is automatically averted without interference by operators, because the hard object will additionally fall into a separate collecting bin disposed under the grate 9 when the grate moves aside. The force exerted on the grate 9 by the holding elements 16 is adjustable.

[0024] The projections 8, which can move past the front of the longitudinal slots 10, touch said slots or move in part between said slots, whichever is desired, may be simple impacting means 8, which do not require maintenance and which need not be sharpened, such as cams, hammers, hooks or the like. The impacting means 8 and the chain conveyors 11 (if present) are driven locally, using a chain or belt drive, and an electric motor 17 fed from one or more batteries. Said batteries are recharged, if necessary, by solar cells provided with a suitable control unit. Because the device 1 preferably comprises one frame 18 on which the container 5, the crusher means 7, the shaft and grate positioning means 15, the grate holder means 16, the electric motor 17 and the batteries and possibly the solar cells are mounted, it can be hoisted up as one whole, possibly together with the storage unit and the collecting bin suspended therefrom, without having to detach any connections.

Claims

1. A device for crushing objects usually made of plastic material, which device comprises a container in which the objects are collected and crusher means connected to the container, which are provided with one or more projections, each projection being movable in a plane, and with a grate provided with longitudinal slots whose shapes have been selected to conform to the path described by the projections, such that the orbital plane passes at least partially through the longitudinal slot.
2. A device according to claim 1, **characterised in that** the crusher means comprise a rotationally drivable roller, which is circumferentially provided with projections.
3. A device according to claim 2, **characterised in that** the roller is provided with a shaft which is connected to shaft positioning means for influencing the positions of the paths described by the moving projections.
4. A device according to any one of claims 1-3, **characterised in that** the grate is connected to grate positioning means for influencing the position of the grate relative to the paths described by the projec-

tions.

5. A device according to any one of claims 1-4, **characterised in that** the grate is provided with holder means which are designed to move the grate aside when hard objects get between the movable projections and the grate or the slots.
6. A device according to claim 5, **characterised in that** the grate is provided with weights or one or more springs for holding the grate in place during normal use.
7. A device according to any one of claims 1-6, **characterised in that** the projections are designed to cause turning at least at the location of the longitudinal slots upon their movement or rotation.
8. A device according to any one of claims 1-7, **characterised in that** the projections comprise impacting means, such as cams, hammers, hooks or the like.
9. A device according to any one of claims 1-8, **characterised in that** the device comprises an electric motor which effects the movement of the projections or the rotation of the rollers.
10. A device according to claim 9, **characterised in that** the device comprises one or more batteries, which may or may not be charged by solar cells.
11. A device according to any one of claims 1-10, **characterised in that** the device comprises one frame on which the container, the crusher means, the shaft and grate positioning means, the grate holder means, the electric motor, the batteries and possibly the solar cells are mounted
12. A device according to claim 11, **characterised in that** the frame is mounted in a housing, being dimensioned such that it can be placed on top of a (possibly underground) storage unit at a collecting location for plastic objects.
13. A device according to any one of claims 1-12, **characterised in that** the device comprises an access lock connected to the container to enable a safe in-feed of objects.
14. A device according to claim 13, **characterised in that** the device comprises at least one chain conveyor extending from said access lock in the direction of the crusher means, which chain conveyor may be provided with teeth which are movable in the direction of the crusher means.
15. A vehicle provided with a device according to any

one of claims 1-14.

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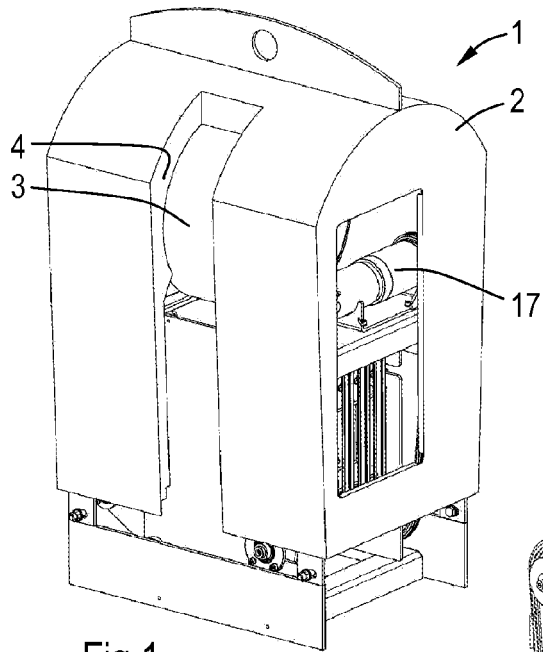


Fig.1

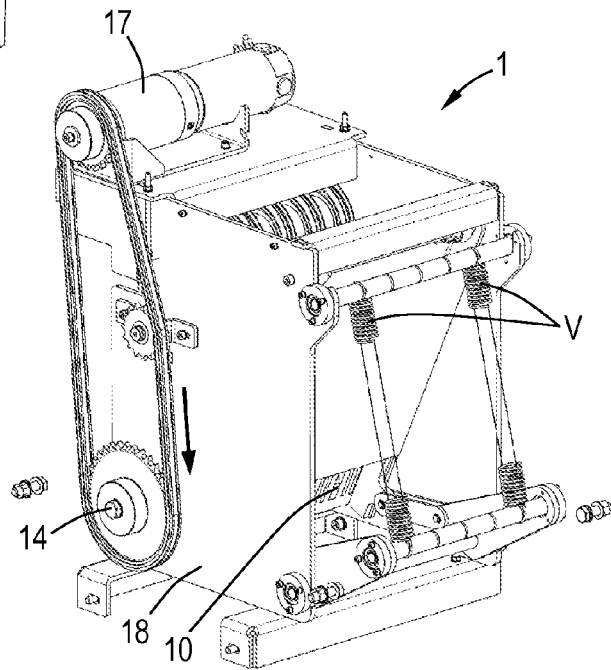


Fig.2

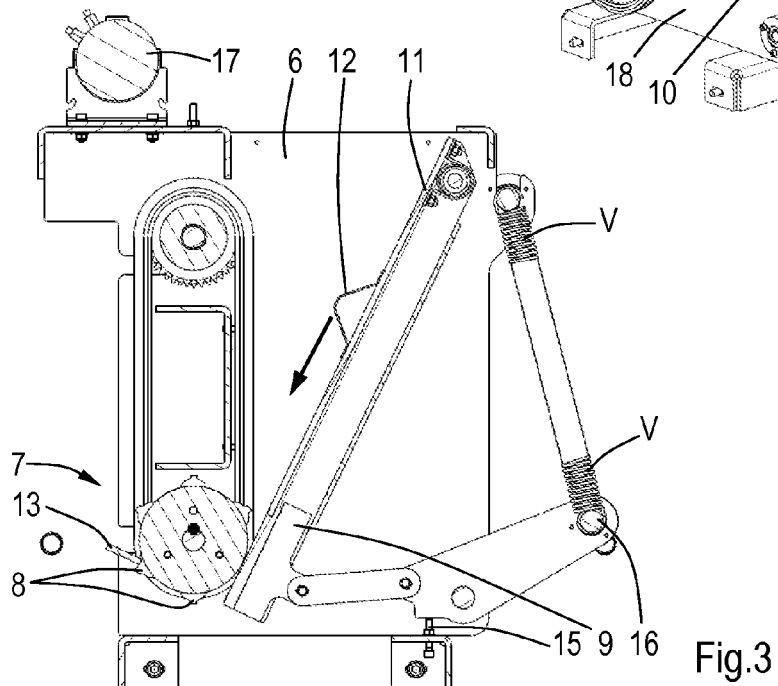


Fig.3

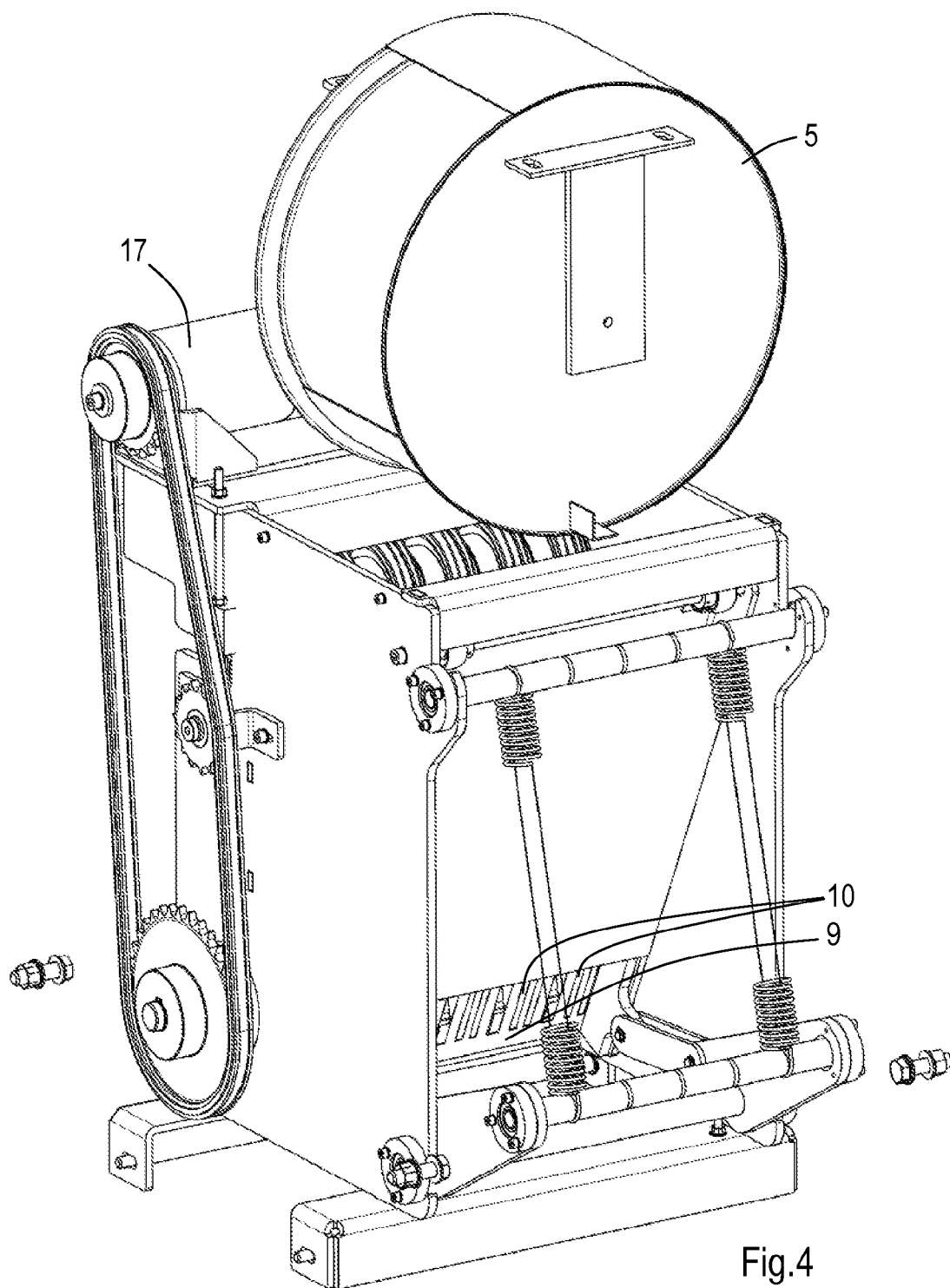
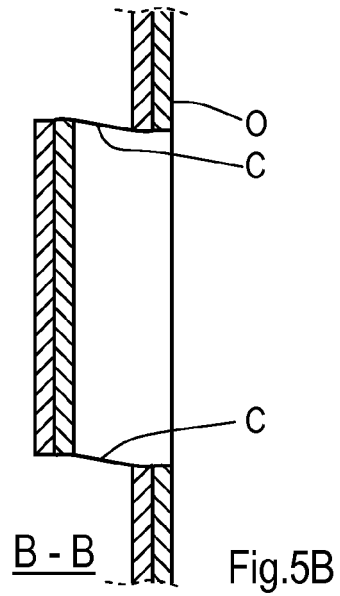
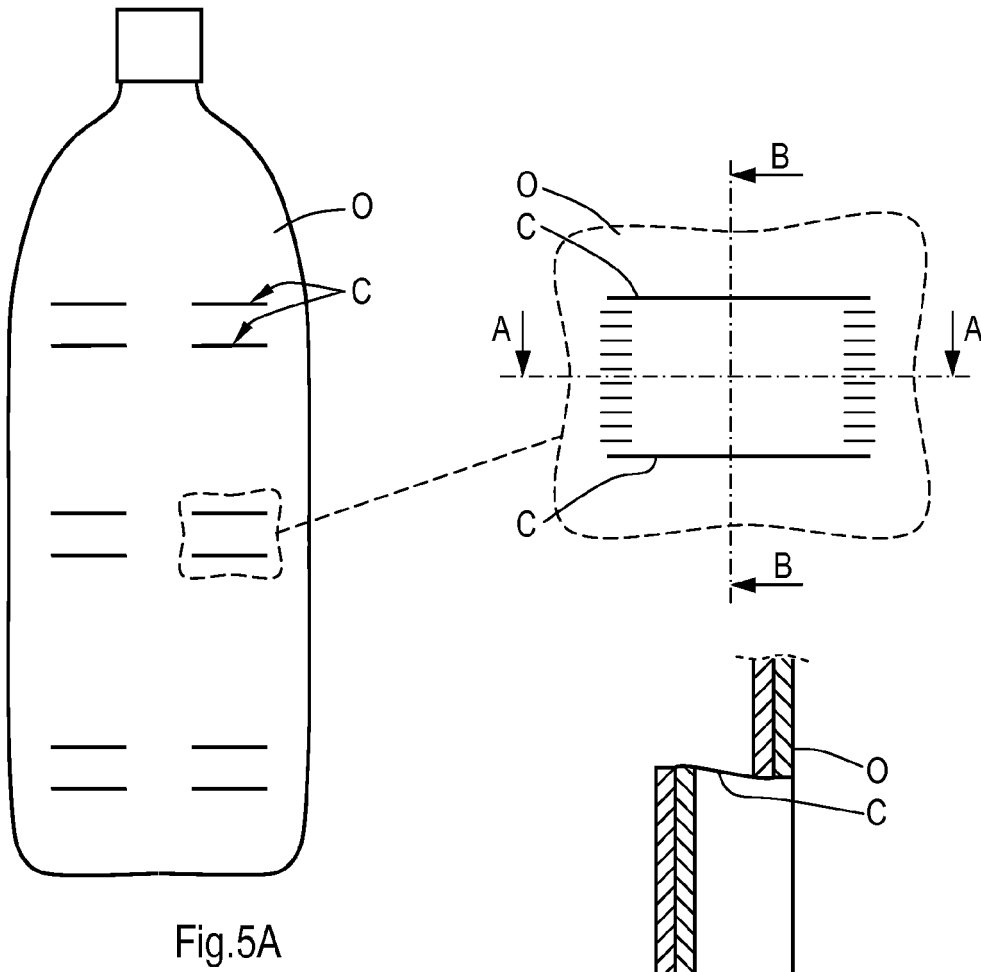
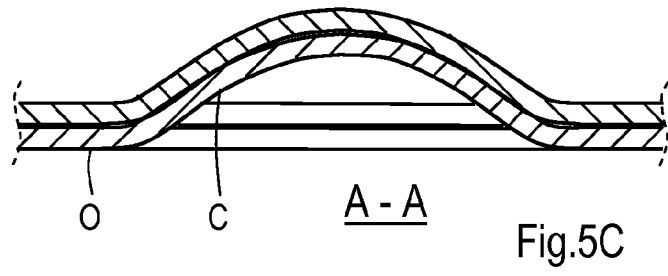


Fig.4





EUROPEAN SEARCH REPORT

Application Number
EP 11 16 0987

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Y	* paragraphs [0035] - [0037], [0039], [0040], [0043] - [0045], [0047] - [0049], [0053] - [0055]; figures 1-5 *	14	
Y	DE 39 07 791 A1 (VILLIGER PAUL [CH]) 19 October 1989 (1989-10-19) * column 2, line 1 - line 16; figure 1 *	14	
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The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (IPC)
			B30B
Place of search		Date of completion of the search	Examiner
The Hague		1 July 2011	Petrucchi, Luigi
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 11 16 0987

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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REFERENCES CITED IN THE DESCRIPTION

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