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

(11) Publication number: **0 155 021**
A1

(12) # EUROPEAN PATENT APPLICATION

(21) Application number: **85200149.4**

(22) Date of filing: **07.02.85**

(51) Int. Cl.⁴: **B 65 D 53/02**, B 65 D 53/06, B 65 D 41/04, B 65 D 41/34

(30) Priority: **09.02.84 NL 8400428**

(43) Date of publication of application: **18.09.85 Bulletin 85/38**

(84) Designated Contracting States: **AT BE CH DE FR GB IT LI LU NL SE**

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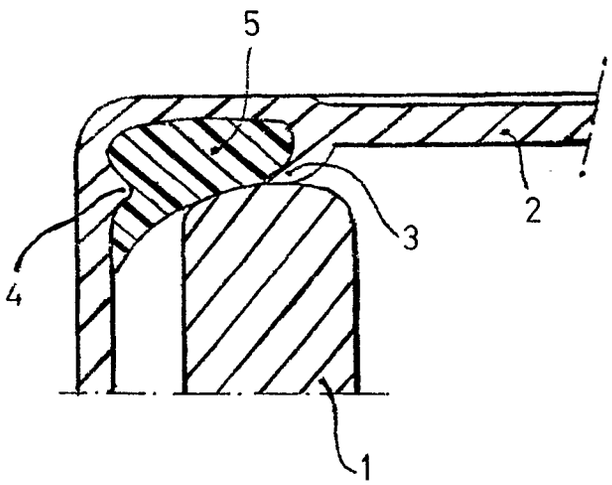
(54) **A process for making a closure cap, provided with a gasket and a sealing ring from a polypropylene material for a container; a closure cap provided with a gasket and a sealing ring from an olefin polymer, and a process for closing and sealing a container with a closure cap made from polypropylene material and provided with a sealing ring.**

(57) A process for making a closure cap (2) provided with a gasket (5) from a polypropylene material for a container (1), said closure cap (2) comprising an end wall and a circumferential side wall (11), in which process the gasket (5) is formed in the closure cap via a melting and a cooling operation by applying in the closure cap an amount of plastisol which is shaped therein into a gasket configuration at an elevated temperature adjusted after the plastisol addition; causing the plastisol shaped into the gasket configuration to melt completely by further energy supply and then cooling same to form the gasket, whereby starting from an integral combination of the closure cap (2) with a sealing ring (13) which is connected with the closure cap by means of a number of frangible bridges (12) capable of being broken on the first opening of the container, and, to form the gasket (5), carrying out the melting operation by heating the closure cap after addition of the plastisol to a temperature of 50 to 110°C and by exposing the resulting plastisol shaped into the gasket configuration subsequently, as is known per se, to microwave energy until the plastisol has been completely molten.



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A process for making a closure cap, provided with a gasket and a sealing ring from a polypropylene material for a container; a closure cap provided with a gasket and a sealing ring from an olefin polymer, and a process for closing and sealing a container with a closure cap made from polypropylene material and provided with a sealing ring.

The invention relates to a process for making a closure cap provided with a gasket from a polypropylene material for a container, said closure cap comprising an end wall and a circumferential side wall, in which process the gasket is formed in the closure cap via a melting and a cooling operation by applying in the closure cap an amount of plastisol which is shaped therein into a gasket configuration at an elevated temperature adjusted after the plastisol addition; causing the plastisol shaped into the gasket configuration to melt completely by further energy supply and then cooling same to form the gasket.

Such a process is known from Dutch patent application 80.03371. In this known process a closure cap often made by injection moulding from an olefin polymer, in particular a high-melting polypropylene having a melting point of approximately 165° C, after having been provided with a vinyl chloride resin plastisol, is preheated to a temperature which must be 5-35° C below the melting point of the employed olefin polymer, e.g., polypropylene, preferably 5-15° C,

i.e. it must be preheated to a temperature of at least 130° C, preferably 145-160° C, followed by exposure at this temperature in an appropriate oven to microwave energy having a frequency which is not critical from a technical point of view indeed, but is effectively 300-300,000 MHz. Exposure to the microwave energy takes place at the moment when the plastisol shaped into a gasket configuration is completely liquid, i.e. completely molten, which means that the resin has been completely solvated by the plasticizer.

Preheating can be appropriately carried out in a hot air oven.

In the known process it is indicated that, in general, a temperature of the closure cap of more than 35° C below the melting temperature thereof is probably not suitable for the conventional plastisols. If there is used a plastisol having a lower melting point, then also a lower temperature of the closure cap can be maintained in the preheating step. However, if there is started from a closure cap made from an olefin polymer melting at a lower temperature, then, conversely, the temperature range to be maintained for the closure cap in the preheating step must preferably be only 5-15° C, in particular 5-10° C below the melting point of the olefin polymer. Therefore, if the closure cap is made from, e.g., polyethylene having a high density, then, accordingly, the temperature range of the closure cap in the preheating step is preferably 120-125° C.

In practice, it is assumed in the known process that, e.g., after the plastisol has been added to the closure cap, this closure cap is brought into a hot air oven having an air temperature which is 30° C, preferably 20° C, below the melting point of the olefin polymer material from which the closure cap has been made. For instance, when polypropylene is used as the olefin polymer material, the preheating step is carried out, in practice, at an air temperature of 135-160° C for 1-10 min., e.g., an air temperature of 155° C for approximately 3 minutes, followed by the procedure in a microwave oven in which the ambient temperature is likewise high enough to prevent the preheated closure cap from sustaining heavy losses of heat, and which is, e.g., at least 140° C. The duration of the microwave procedure depends on the energy supplied and is not less than approximately 1 min.

The step of shaping the plastisol in the closure cap until a gasket configuration has been obtained can be performed in the conventional manner, preferably by injecting the plastisol in liquid or semi-liquid condition into the closure cap which is advantageously arranged upside down, i.e. the end wall is positioned at the bottom side, and distributing same therein by subjecting the closure cap to a rapid rotation. There is preferably used a closure cap the end wall of which is internally provided with an inner edge, the plastisol being injected into the annular space between the inner edge and the side

wall of the closure cap.

The known process is suitable for a variety of types of closure caps and containers, in particular, however, for closure caps of bottles of threaded construction or of the snap-on type, which caps can be provided with an unspecified anti-theft means, however, normally have a limited inner diameter of approximately 25-32 mm.

Various types of anti-theft means applicable in combination with a closure cap are known, a review of which is given in the article "Verschlüsse für Getränkeflaschen", published in Verpackings-Rundschau 10/1983, pages 1074-1093. Among these, the type comprising a sealing ring produced in one piece with the closure cap and connected with the side wall of the closure cap via a number of narrow frangible bridges to be broken on the first opening of the container cannot be used within the framework of the known process. Because of the high temperature of the closure cap to be maintained in the preheating step and subsequently upon exposure to the microwave energy of only 5-35° C below the melting point of the olefin polymer material used for making the closure cap, the narrow frangible bridges and the sealing ring, respectively, will be softened and deformed, which results in that the whole construction becomes useless.

The object of the invention is to provide a process with which it is none the less possible to prepare a closure cap provided with a gasket from a polypropylene

material, which is further provided with a sealing ring of the type that is integrally connected with the closure cap, in particular with its side wall, via a number of narrow bridges which are broken on the first opening of the container.

Another object of the invention is to provide a closure cap made from an olefin polymer and provided with a gasket of a plastisol material, which is suitable for use on a container having a wide mouth the diameter of which may be up to 90 mm and more, which closure cap is further provided with a sealing ring of the type defined in the preceding paragraph.

According to the invention there is provided a process of the type specified in the opening paragraph, which is characterized by starting from an integral combination of the closure cap with a sealing ring which is connected with the closure cap by means of a number of frangible bridges capable of being broken on the first opening of the container, and, to form the gasket, carrying out the melting operation by heating the closure cap after addition of the plastisol to a temperature of 50-110° C and by exposing the resulting plastisol shaped into the gasket configuration subsequently, as is known per se, to microwave energy until the plastisol has been completely molten.

The process according to the invention may start from a closure cap of a standard grade polypropylene; it is therefore not necessary to use a high-melting polypropyl-

ene material. There can also be used a normal type of plastisol, e.g., that consisting of a microsuspension of a vinyl chloride copolymer resin with 5% vinyl acetate and further comprising conventional constituents, e.g., one or more stabilizers, plasticizers, viscosity-reducing and/or torsion-reducing agents.

It is very advantageous to start from a closure cap the end wall of which is internally provided with an annular space bounded by two undercuts the outer one of which is substantially bounded by the inner periphery of the side wall of the closure cap, and into which annular space a dosed amount of plastisol is injected in the conventional manner.

Preferably, the starting point of the invention is a closure cap the end wall of which is thinner by 20-50% at the position where the gasket is to be formed, such as at the position of the annular space bounded by the undercuts mentioned before. This promotes the heat transfer to the plastisol in the oven, such as the hot air oven in which the preheating can be performed. Moreover, the higher flexibility of the end wall at the relevant position enhances the self-ventilating action of it when the contents of the container are pasteurized.

According to a further embodiment of the process of the invention the melting operation of the plastisol disposed in situ in the closure cap is carried out by preheating the combination of closure cap and plastisol

to 50-110° C and then exposing the resulting gasket configuration to microwave energy having a frequency of 10-200 MHz.

According to a preferred embodiment the melting operation is carried out by heating the closure cap after addition of the plastisol to 100° C within 15-30 sec. and completely melting the plastisol shaped into the gasket configuration by 3-15 sec. exposure to microwave energy having a frequency of 27.10-27.15 MHz. This frequency is permitted for industrial uses in the whole world.

In the process according to the invention a closure cap is obtained which comprises a homogeneous gasket, and which is further provided with an undamaged, undeformed sealing ring, and which closure cap may have such an inner diameter that it can be applied to a container having a wide mouth. For instance, according to the invention a closure cap can be obtained having an inner diameter which may be up to 90 mm or more.

The invention is particularly suitable for, although not limited to, the preparation of a closure cap with an integrally connected sealing ring the inner side wall of which is threaded so that this container can be opened or closed by rotation of the closure cap, in conjunction with corresponding provisions made at the neck of the container.

The invention also relates to a closure cap made of an olefin polymer comprising an end wall and a circumferential side wall provided with a gasket formed

from a plastisol material, for a container said closure cap being provided with a sealing ring which is integrally connected with the side wall of the closure cap via bridges capable of being broken on the first opening of the container, and said end wall having a wall thickness decreased by 20-50% at the gasket, the inner diameter of the closure cap very advantageously being up to 100 mm.

According to a preferred embodiment the closure cap of the invention is provided with an annular space bounded by two undercuts within which the gasket is contained, and is further characterized in that the inner undercut is tapered in cross-section and resilient and has such a width that upon closure of the container with the closure cap the undercut partly rests on the upper surface of the container edge.

When the closure cap is made from a polypropylene material, it is ensured that the diameter of the sealing ring is large enough to provide that after the container has been closed with the closure cap the sealing ring and the bridges are not in contact with the container. When the sealing ring and the bridges are heated during the sealing procedure, such a contact, as will be elucidated hereinafter, would mean that heat is dissipated via the container so that the polypropylene material becomes insufficiently plastic. On the other hand, when dimensioning the sealing ring and the bridges with a closure cap made from a polypropylene material, it is ensured that in the sealing procedure

the bridges can be overstretched under the locking collar and are malleable.

Finally the invention also relates to a process for closing and sealing a container in which, after the container has been closed, the temperature of the sealing ring is increased and the sealing ring is deformed over and around the locking collar towards the neck of the container. When a closure cap according to the invention is used which has been made from a polypropylene material, the procedure followed is such that after the container has been closed with the closure cap, the sealing ring is subjected to a heat treatment until a sufficient plasticity of the polypropylene material has been obtained, after which the sealing ring is mechanically pressed against the neck of the container over and around the locking collar with simultaneous overstretching and flattening of the bridges over and under the locking collar. The heat treatment may consist in, e.g., exposing the sealing ring and the bridges to air having a temperature of approximately 400° C for approximately 2 sec. After mechanically pinching with e.g. so-called clamps, the ring is positioned around the container under the locking collar and the frangible bridges are stretched and flattened. Thus it is achieved that in spite of per se relatively tough polypropylene material the sealing ring is easily detached at the frangible bridges on the first opening of the container. When the closure cap is loosened for the first time, the

sealing ring will substantially be detached from the closure cap via the bridges so that, after the closure cap has been closed again, it will always be visible that the container has been opened.

The closure cap according to the invention is the first to incorporate a combination of three properties, namely that (a) the container closed with the closure cap after filling can be closed in compression-proof and vacuum-tight condition substantially without any restriction; (b) the container can be closed again after opening so that it is completely shut off from the atmosphere, and (c) the closure of the container after the first filling is irreversibly sealable.

Because of the fact that the closure cap according to the invention can be made available with an inner diameter which may be up to 100 mm the possibility has been offered for the first time to seal containers having a wide mouth so that for the first time foodstuffs which, in practice, are packed mainly in containers having a wide mouth, e.g., a neck diameter of 90 mm, whether or not under a partial vacuum, can be offered to consumers in sealed condition with a guarantee of freshness. This ensures that the date indicating until when the product will keep, as it occurs on containers for foodstuffs, is a practically reliable date indeed. In the case of a closure without a sealing capable of being broken irreversibly such a date is actually a fiction.

The invention will be further illustrated by means of the drawing which shows an example of embodiment of the closure cap and the method of sealing it. In the drawing

Fig. 1 schematically shows an axial cross-section of a container closed with the closure cap;

Fig. 2 schematically shows an axial cross-section of a container closed with the closure cap and provided with a sealing ring, in the pre-sealed state;

Fig. 3 shows a cross-section along the line III-III in Fig. 2;

Fig. 4 shows, in cross-section, the assembly of closure cap and container according to Fig. 2 during sealing with the use of a so-called clamp; and

Fig. 5 shows a cross-section along the line V-V in Fig. 4, without the clamp and the container.

In Fig. 1 the wall of the neck of a container made of glass is indicated by 1, and 2 shows the closure cap of polypropylene. On the inside the closure cap is provided with an annular space formed by the two circumferential undercuts 3 and 4, which annular space comprises the gasket 5. The inner undercut 3 is crescent-shaped and is resilient due to the outwardly decreasing thickness of the material. The crescent-shaped construction permits the inner undercut to rest on a part of the edge of the neck opening of the container. As a result thereof a part of the higher unscrewing torsion of the gasket is absorbed

and reduced by the undercut. Moreover, the crescent-shaped undercut 3 ensures that in case of pasteurization of the contents of the container the expanded air generated in that process flows out between the undercut 3, which is thereby resiliently deflicted somewhat, and the edge of the neck whereby the deflected undercut simultaneously causes an additional clamping force to be exerted on the gasket and the gasket is retained in position.

Figs. 2-5 show the closure cap of polypropylene at 10, comprising side wall 11 and sealing ring 13 which is connected with side wall 11 via a frangible bridge 12. The neck portion of the container is shown at 14, which neck portion 14 is provided with locking collar 17.

In the state before sealing (Fig. 2) the side wall 11 with frangible bridges 12 and sealing ring 13 is clear of the container.

Fig. 4 shows the situation in which the frangible bridge 12 with the sealing 13, which where previously exposed to the action of hot air having a temperature of 400° C for 2 sec., has been grasped by the clamp 15 moving towards the container. The frangible bridge 12 is then overstretched over and under the locking collar 17 and flattened, the sealing ring 13 also being flattened simultaneously between the clamp 15 and the neck portion 14 of the container. Fig. 5 shows, in comparison with Fig. 3, the deformation experienced by the frangible bridge

12 and the sealing ring 13, which has resulted in that the sealing ring has a diameter smaller than the largest diameter of the locking collar 17. When the closure cap is unscrewed, an axial shift of the closure cap 10 is blocked by abutment of the sealing ring 13 against the locking collar 17. When the unscrewing movement is continued, the increasing force exerted by the locking collar 17 on the combination of sealing ring 13 and frangible bridge 12 will result in that the frangible bridge 12 weakened by overstretching and flattening, which is made of the per se tough polypropylene, is broken along the line of fracture 16 (Fig. 5).

Of course, amendments may be made to the invention as described above and shown in the drawing without departing from the scope of the invention.

Claims

1. A process for making a closure cap provided with a gasket from a polypropylene material for a container, said closure cap comprising an end wall and a circumferential side wall, in which process the gasket is formed in the closure cap via a melting and a cooling operation by applying in the closure cap an amount of plastisol which is shaped therein into a gasket configuration at an elevated temperature adjusted after the plastisol addition; causing the plastisol shaped into the gasket configuration to melt completely by further energy supply and then cooling same to form the gasket, characterized by starting from an integral combination of the closure cap with a sealing ring which is connected with the closure cap by means of a number of frangible bridges capable of being broken on the first opening of the container, and, to form the gasket, carrying out the melting operation by heating the closure cap after addition of the plastisol to a temperature of 50-110° C and by exposing the resulting plastisol shaped into the gasket configuration subsequently, as is known per se, to microwave energy until the plastisol has been completely molten.

2. A process according to claim 1, characterized by using a closure cap the end wall of which is thinner by 20-50% at the position where the gasket is to be formed.

3. A process according to claim 1, characterized

in that the melting operation is carried out by exposing the resulting plastisol shaped into the gasket configuration, after heating to 50-110°C, to microwave energy having a frequency of 10-200 MHz.

4. A process according to claim 3, characterized in that the melting operation is carried out by heating the closure cap after addition of the plastisol to 100°C within 15-30 sec. and completely melting the resulting plastisol shaped into the gasket configuration by 3-15 sec. exposure to microwave energy having a frequency of 27.10-27.15 MHz.

5. A closure cap from an olefin polymer comprising an endwall and a circumferential side wall provided with a gasket formed from a plastisol material, for a container, characterized in that said closure cap is also provided with a sealing ring with which the container can be sealably closed in conjunction with a locking collar disposed around the neck of the container, which ring is integrally connected with the side wall of the closure cap via frangible bridges capable of being broken on the first opening of the container, as is known per se, said end wall having a wall thickness decreased by 20-50% at the gasket.

6. A closure cap according to claim 5, characterized in that the inner diameter of the closure cap is up to 100 mm.

7. A closure cap according to claims 5-6, in which the end wall is internally provided with an annular space bounded by two undercuts and within which the gasket is

contained, characterized in that the inner undercut is tapered in cross-section and resilient and has such a width that when the container has been closed with the closure cap the undercut rests on a part of the upper surface of the container edge.

8. A closure cap according to claims 5-7 made from a polypropylene material, characterized in that the diameter of the sealing ring is large enough to provide that after the container has been closed with the closure cap the sealing ring and the bridges are not in contact with the container, but in the sealing procedure the bridges can be overstretched under the locking collar and are malleable.

9. A process for closing and sealing a container in which, after the container has been closed, the temperature of the sealing ring is increased and the sealing ring is deformed over and around the locking collar towards the neck of the container, characterized by using the closure cap according to claim 8 and, after the container has been closed with the closure cap, subjecting the sealing ring and the bridges to a heat treatment, until a sufficient plasticity of the polypropylene material has been obtained, and then mechanically pressing the sealing ring over and around the locking collar against the neck of the container while simultaneously overstretching and flattening the bridges over and under the locking collar.

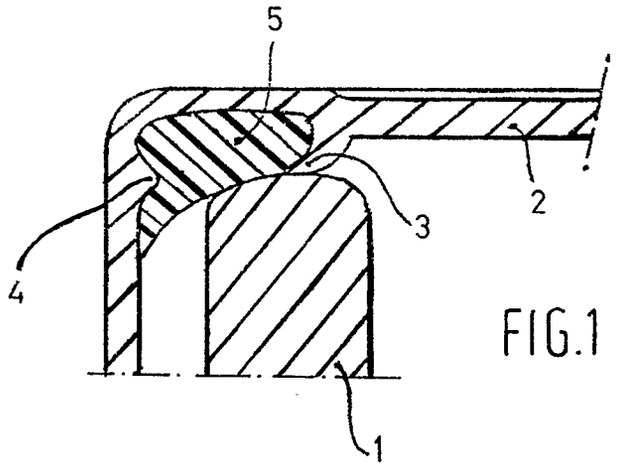


FIG.1

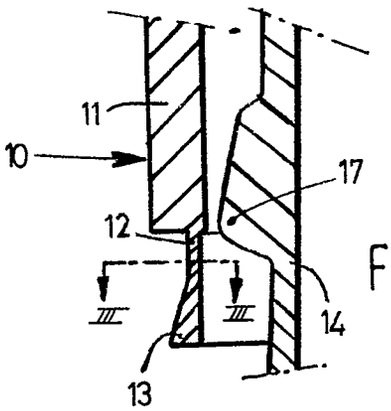


FIG.2

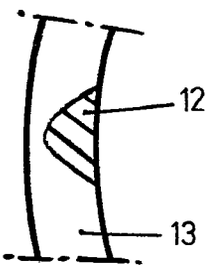


FIG.3

FIG.5

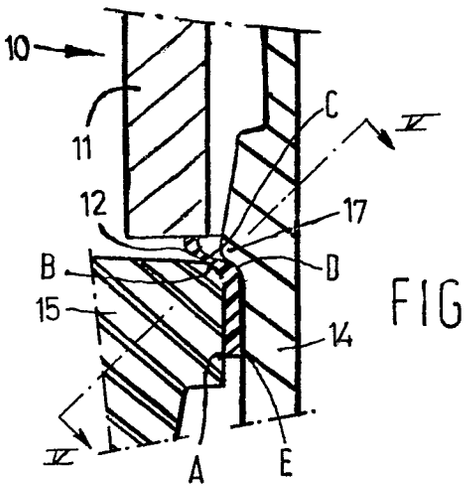
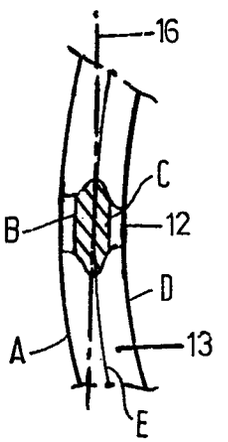


FIG.4



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EUROPEAN SEARCH REPORT

Application number

EP 85 20 0149

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
A	WO-A-8 400 346 (METAL CLOSURE GROUP) * Page 3, lines 6-15; page 4, lines 14-19; page 11, lines 30-37; figures 2,4 *	1,5,7	B 65 D 53/02 B 65 D 53/06 B 65 D 41/04 B 65 D 41/34
A	FR-A-2 378 996 (CONTINENTAL GROUP) * page 2, line 34 - page 3, line 22; page 9, lines 5-10 * & NL - A - 78 01003	1,4	
A	EP-A-0 034 997 (OBRIST) * Claim 1; figures 1,4-6 *	8,9	
A	GB-A-2 116 529 (GRACE)		

TECHNICAL FIELDS SEARCHED (Int. Cl.4)

B 65 D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	13-05-1985	BESSY M.J.F.M.G.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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