

METHOD FOR PRODUCING A DEVICE FOR CONNECTING A RECEPTACLE AND A CONTAINER, CORRESPONDING CONNECTING DEVICE AND READY-FOR-USE ASSEMBLY COMPRISING A DEVICE OF THIS TYPE.

5 The present invention relates to a process for manufacturing a device for connection between a recipient and a container, to a corresponding connection device and to a ready-to-use assembly comprising such a device.

 In the medicament-packaging domain, it is known to store a component of a pharmaceutical preparation, such as its active ingredient, in a recipient closed by a stopper
10 made of relatively non-rigid material, such as an elastomer. A liquid can be introduced in this recipient after perforation of the stopper in order to dissolve the component contained in the recipient or place it in suspension, so as to obtain a preparation in liquid form, in particular a medicament or a vaccine, ready to be administered to a patient.

 WO-A-97/10156, for example, discloses a device for connection between the afore-
15 mentioned closed recipient and a container. The latter contains liquid capable of being introduced into the recipient, once the latter has been opened by perforation of its stopper. Such a connection device comprises a base adapted to be immobilized on the recipient, in the interior volume of which an inner bore is formed.

 This device also comprises a plunger mounted to slide in the afore-mentioned bore,
20 which is provided with a member for perforating the stopper of the recipient, such as a hollow needle. This plunger is mobile between a position of storage, in which the perforation member is not in contact with the stopper, and a position of transfer, in which the perforation member passes through this stopper.

 This connection device also comprises a cap comprising a cover from which extend
25 lateral walls defining an opening. This cap is adapted to cover the outer periphery of the base, in particular during storage of the ready-to-use assembly formed by



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the recipient and its connection device.

In order to avoid any outward microbial migration towards the perforation member, which would contaminate the pharmaceutical preparation intended to come into contact with this member, it is known to provide sealing means between the opposite walls of the base and
5 the cap.

To that end, the teaching of EP-A-0 728 457 provides that the inner wall of the cap presents at least one peripheral edge projecting radially towards the inside. Furthermore, it is provided to coat the outer wall opposite the base by means of a sealing material with high viscosity. During the sliding movement between the base and the cap, the edges of this latter
10 scrape the sealing material disposed on the cap and form a circumferential O-ring, which is possible thanks to the high viscosity of the material used.

However, this known process of manufacture presents certain drawbacks. For example the circumferential seal thus formed does not ensure perfect tightness, whatever the relative pressure conditions between the outside and the inside of the base. In particular, in the case of
15 the pressure prevailing in the inner volume of the base being greater than atmospheric pressure, said circumferential O-ring is capable of being moved away from the edge area, with the result that this seal is in that case no longer able to perform its function of seal satisfactorily.

In order to overcome these different drawbacks, the invention proposes carrying out a
20 process for manufacturing a connection device which guarantees, on the one hand, a satisfactory seal between the opposite walls of the base and the cap and, on the other hand, an easy dismantling of these two elements.

To that end, it relates to a process for manufacturing a device for connection between a closed recipient and a container, this connection device comprising:

- 25
- a base intended to be immobilized on this recipient,
 - a plunger mobile in a bore in said base, this plunger being provided with a perforation member adapted to

traverse a stopper of the recipient, and

- a cap covering the outer periphery of the base at least partially, characterized in that a first element of the assembly formed by the base and the cap is made of a material which is harder than the second element of said assembly, in that the first element is provided with at least one peripheral edge intended to penetrate, tightly, in a region of the second element lying opposite, and in that the or each edge of the first element is coated by means of a lubricating agent adapted, once this coating operation is effected, to form a lubricating film adapted to remain in place on the or each sealing edge, during the relative displacement of the cap and the base, and when this cap and this base are immobile with respect to each other.

The invention enables the objects set forth hereinabove to be achieved.

The phase of coating each edge of the hard element by means of a lubricating agent leads to the wetting of these edges and, being given the characteristics of the lubricating agent used, to the formation of a lubricating film which is immobilized on these edges.

The fact of employing at least one sealing edge penetrating in the opposite wall of the element of lesser hardness, leads to the formation of a mechanical barrier preventing any outward microbial propagation towards the inner volume of the base. This guarantees a satisfactory seal for the connection device of the invention.

The difference in hardness between the first and second elements is, on the Shore D scale, between 10 and 15.

Once the cap is mounted on the base, each sealing edge penetrates in the opposite wall of the less hard element to a depth of about 10 to 15 micrometers.

By using a sealing agent whose catching characteristics are such that it leaves a lubricating film fast with the or each element that it coats, an operator is able easily to remove the cap from the base, immediately before use. This

film advantageously presents a thickness of between 5 and 10 micrometers. The presence of this film further provides a secondary sealing component, insofar as this film occupies the superficial micro-defects of the element with edges that it coats. Furthermore, being given that it presents a high catching power, this film cannot be driven away as a function of the differences in pressure prevailing between the outside and the inside of the base, which is advantageous over the prior art.

The lubricating agent advantageously presents a viscosity, at 20°C, included between 150 and 1500 centistokes.

The lubricating agent which is used advantageously presents a high spreading power thanks to its low surface tension and its low viscosity. This allows it to fill more satisfactorily the micro-porosities of the edges of the harder element penetrating in the less rigid element

The lubricating agent is advantageously non-miscible with water. This hydrophobic nature gives the lubricating film a high power of seal.

The lubricating agent is preferably stable and chemically neutral, and barely subject to evaporation. For example, it presents a factor of evaporation of about 0.5%, determined by a sample of 2 grams of lubricating agent placed in a 50 ml recipient and subjected to a temperature of 150°C for 24 hours. This lubricating agent advantageously presents a surface tension greater than that of air.

This lubricating agent may be a siliconed oil or a fluorinated oil.

According to another characteristic of the invention, the first element provided with at least one edge is coated by spraying the lubricating agent.

The invention also relates to a device for connection between a closed recipient and a container, this connection device comprising:

- a base intended to be immobilized on this recipient,

- a plunger mobile in a bore in said base, this plunger being provided with a perforation member adapted to traverse a stopper of the recipient, and

- a cap covering the outer periphery of the base at least partially,

characterized in that a first element of the assembly formed by the base and the cap is made of

5 a material which is harder than the second element of said assembly, in that the first element is provided with at least one peripheral edge penetrating, tightly, in a region of the second element lying opposite, and in that the or each edge of the first element is coated by means of a lubricating agent adapted to remain in place on the or each edge, during the relative displacement of the cap and the base, and when this cap and this base are immobile with

10 respect to each other.

According to other characteristics of the invention:

- the or each edge of the first element penetrates in the opposite wall of the second element, to a depth of between 10 and 15 micrometers.
- the lubricating film presents a thickness of between 5 and 10 micrometers; and
- 15 - the difference in hardness between the first and second elements is included between 10 and 15 on the Shore D scale.

Finally, the invention relates to a ready-to-use assembly comprising a closed recipient containing a product, in particular a pharmaceutical preparation, and a connection device as defined hereinabove, mounted on said recipient.

20 The invention will be more readily understood on reading the following description given solely by way of non-limiting example, and with reference to the accompanying drawings in which:

Figure 1 is a view in longitudinal section illustrating the different elements constituting a connection device according to the invention.

25 Figure 2 is a view in longitudinal section illustrating an operation of spraying a lubricating agent forming part of the process of treatment of the invention, and

Figure 3 is a view in longitudinal section, illustrating a base and a cap of the device of Figure 1, made according to the invention.

Figure 1 shows a recipient 2, for example a glass flask, containing a product (not shown) which is, for example, a powder intended to form an oral vaccine. This may equally well be any other type of pharmaceutical preparation, in particular any type of medicaments. The recipient 2 is obturated by means of a stopper 4, made in known manner of a relatively non-rigid material, such as an elastomer.

Figure 1 also illustrates a device, generally denoted by reference 6, allowing the connection between the recipient 2 and a container (not shown). The latter may be a syringe containing a liquid intended to dissolve the product contained in the recipient 2 or place it in suspension, or a supple bag, or another glass flask.

This connection device 6 comprises a base 8 adapted to be connected on the recipient 2 in known manner by its lower end 10. The latter is extended by a principal cylindrical portion 12 defining an inner bore 14 and a substantially smooth outer peripheral wall 16. The base 8 is made of a relatively non-rigid material such as low density polyethylene.

The connection device 6 also comprises a plunger 18 adapted to slide in the bore 14 of the base 8. This plunger is provided, in known manner, with a needle 20 for perforating the stopper 4. The plunger 18 is mobile between a position of storage, in which the needle is not in contact with the stopper, and a position of transfer, in which the needle 10 transpierces the stopper 4 and is in contact with the liquid contained in the recipient 2.

The connection device of the invention also comprises a cap, generally denoted by reference 22, which comprises a cover 24 from which extend lateral walls 26, of circular cross-section. These latter define an open end

28 of the cap, intended for fit of the base 8.

The inner periphery of the lateral walls 26 is provided with a plurality of teeth, or edges 30, extending peripherally, radially towards the inside. The cap 22 is made of a material harder than the base 8, for example high density polyethylene.

5 The edges 30, which have been shown exaggeratedly large in the Figures in order to render the drawings clearer, present an inner diameter d which is smaller than the outer diameter D of the base 8.

10 Figure 2 illustrates a phase of treatment forming part of the process of manufacture of the connection device 6 according to the invention. To that end, a spray device 32 of tubular shape is introduced in the internal volume of the cap 22. Said spray device comprises a plurality of radial orifices 34 ensuring spray of a lubricating agent with which the spray device 32 is supplied.

15 This lubricating agent is for example a fluorinated oil, such as the one marketed by WYNN'S FRANCE under reference WYNNOX H4, whose viscosity is 180 centistokes at 20°C. A siliconed oil may also be used, such as the one marketed by RHONE POULENC under reference SILBIONE 70 047 V1000, with a viscosity at 25°C of 1000 centistokes and a surface tension of 21.2 mN/m.

20 By spraying this lubricating agent on the area of the edges 30, a film 36 is formed on these edges 30, coating them and the vicinity thereof. Being given that the agent used presents a good capacity of catching on the surfaces that it coats, the film 36 presents an excellent holding. This film 36 thus remains fast with the edges 30 that it coats, both in storage position, when the cap 22 and the base 8 are mutually immobilized, and in position of use, when the cap 22 is displaced with respect to the base 8.

25 Figure 3 shows a phase of positioning of the connection device 6 of the invention.

The plunger 18 (not shown in this Figure 3) is firstly inserted, in known manner, in the bore 14 of the base 8. Then the cap 22 is added, for example in automatized manner, on the outer periphery of the base 8. The assembly thus constituted is then joined to the recipient 2, so as to be stored. During this phase of storage, the edges 30 penetrate in the opposite wall 16 of the base 8, which provided a satisfactory seal and avoids any outward microbial migration towards the inner volume of the base 8, and therefore of the needle 20. The presence of the film 36 provides a secondary component of seal.

Immediately before use of the connection device 6, the cap 22 is removed from the base 8 by a substantially vertical, upwardly directed action. This action is particularly easy, due to the presence of the film 36 ensuring lubrication between the opposite walls of the cap 22 and the base 8. The stopper 4 of the recipient 2 is then conventionally perforated by means of the needle 20. Finally, the container to which the recipient 2 is to be connected is brought towards the base 8.

The invention is not limited to the examples described and shown. For example, it may be provided to make any number of edges similar to those 30 of the cap 22. Furthermore, it is possible for the base 8 to be made of a harder material than the one constituting the cap 22. In this latter case, the outer periphery of the base 8 is provided with edges, similar to those 30, projecting radially outwardly and cooperating with the smooth inner wall of the cap, said smooth wall presenting an inner diameter smaller than the outer diameter of the edges of the base.

CLAIMS

1. Process for manufacturing a device (6) for connection between a closed recipient (2) and a container, this connection device (6) comprising:
 - a base (8) intended to be immobilized on this recipient (2),
 - 5 - a plunger (18) mobile in a bore (14) in said base (8), this plunger (18) being provided with a perforation member (20) adapted to traverse a stopper (4) of the recipient (2), and
 - a cap (22) covering the outer periphery (16) of the base (8) at least partially, characterized in that a first element (22) of the assembly formed by the base (8) and the cap (22) is made of a material which is harder than the second element (8) of said assembly (8,
 - 10 22), in that the first element (22) is provided with at least one peripheral edge (30) intended to penetrate, tightly, in a region of the second element (8) lying opposite, and in that the or each edge (30) of the first element (8) is coated by means of a lubricating agent adapted, once this coating operation is effected, to form a lubricating film (36) adapted to remain in place on the or each sealing edge, during the relative displacement of the cap (22) and the base (8), and
 - 15 when this cap (22) and this base (8) are immobile with respect to each other.
2. Process according to Claim 1, characterized in that the lubricating agent has a viscosity at 20°C of between 150 and 1500 centistokes.
3. Process according to one of Claims 1 or 2, characterized in that the lubricating agent is not miscible with water.
- 20 4. Process according to one of Claims 1 to 3, characterized in that the lubricating agent is a siliconed oil.
5. Process according to one of Claims 1 to 3,

characterized in that the lubricating agent is a fluorinated oil.

6. Process according to one of Claims 1 to 5, characterized in that the first element (22) provided with at least one edge (30) is coated by spraying the lubricating agent.

7. Device (6) for connection between a closed recipient (2) and a container, this
5 connection device (6) comprising:

- a base (8) intended to be immobilized on this recipient (2),

- a plunger (18) mobile in a bore (14) in said base (8), this plunger (18) being provided with a perforation member (20) adapted to traverse a stopper (4) of the recipient (2), and

- a cap (22) covering the outer periphery (16) of the base (8) at least partially,

10 characterized in that a first element (22) of the assembly formed by the base (8) and the cap (22) is made of a material which is harder than the second element (8) of said assembly (8, 22), in that the first element (22) is provided with at least one peripheral edge (30) intended to penetrate, tightly, in a region of the second element (8) lying opposite, and in that the or each edge (30) of the first element (8) is coated by means of a lubricating agent adapted to remain
15 in place on the or each sealing edge, during the relative displacement of the cap (22) and the base (8), and when this cap (22) and this base (8) are immobile with respect to each other.

8. Device according to Claim 7, characterized in that the or each edge (30) of the first element (22) penetrates in the opposite wall of the second element (8) to a depth of between 10 and 15 micrometers.

20 9. Device according to one of Claims 7 or 8, characterized in that the lubricating film (36) has a thickness of between 5 and 10 micrometers.

10. Device according to one of Claims 7 to 9, characterized in that the difference in hardness between the

first (22) and second (8) elements is, on the Shore D scale, between 10 and 15.

11. Ready-to-use assembly comprising a closed recipient (2) containing a product, in particular a pharmaceutical preparation, and a connection device (6) according to any one of Claims 7 to 10, mounted on said recipient (2).