

CONTAINER AND APPARATUS FOR PRODUCING THE SAME

The invention relates to a container, a hermetically sealed ampule in particular, having a hollow receptacle element for holding a medium to be dispensed, such container having a dispensing opening which communicates outside the receptacle element with a hollow chamber of a sealing element which forms the head component of the container, which chamber keeps the dispensing opening clear, which sealing element is detachably connected to the receptacle element by way of a point of separation in the area of the dispensing opening. The invention furthermore relates to a device for producing the container according to the configuration of features disclosed herein.

Containers of the indicated type are used in particular to store media of the most varied type which are to be dispensed in the hollow receptacle element, for example in the form of medical solutions, suspensions and/or semisolid preparations such as gels. In order to be able to quickly clear the dispensing opening of the receptacle element, there is a sealing element which forms the head component of the container and which can be separated from the remaining receptacle element in a so-called twist-off motion as a toggle sealing element by way of a given point of separation.

So that the dispensing opening which is provided in the receptacle element is not unintentionally sealed during the molding process for the container for the point of separation, the sealing element has a hollow chamber which, carrying fluid or media, undergoes transition into the receptacle element by way of the dispensing opening and which surrounds its side edge which is

otherwise bordered to the outside by the wall components of the container. If the sealing element is separated from the remaining receptacle element by way of the point of separation when the toggle closure is being opened by means of the twist-off motion, the hollow chamber for this purpose also provides for the dispensing opening remaining open with its original initial shape and for example bordering wall components of the container not being pushed against each other such that closure of the dispensing opening might unintentionally occur.

In order to be able to ensure unimpeded dispensing of the medium which is to be dispensed and which is held in the receptacle element, the free cross section of the dispensing opening must be dimensioned to be correspondingly large, and likewise the free entry cross section of the indicated hollow chamber. The latter however then results in the disadvantage that the medium stored in the receptacle element overflows into the hollow chamber and then can no longer flow back, especially when the fluid medium stored in the hollow chamber is held in the hollow chamber due to its surface tension. But if part of the medium to be dispensed remains in the hollow chamber, it is lost for a removal process from the container; this is especially disadvantageous when exact dosing is critical during dispensing or the medium to be dispensed is inherently very expensive or when exact mixing ratios and concentrations for later use are critical when suspensions are being dispensed.

DE 102 02 907 A1 suggests providing a hermetically sealed container with an improved closure to prevent loss of the pertinent active agent; these proposed measures alone can still result in loss of the active agent in the hollow chamber of the sealing element designed as the head component. As part of a dispensing opening the known container has a delivery mouthpiece and a hollow closure section with an elevated region. The closure section is connected to the delivery mouthpiece by way of a tear strip as the point of separation. The elevated region in the hollow closure section partially reduces retention of liquid drops on the inside of the closure section, the delivery mouthpiece having a wall which tapers to the top and inside in a straight line and which is designed to cause the liquid drops or liquid portions in the closure section and in the delivery mouthpiece to flow back down into the body section of the container with the hollow receptacle element. Consequently, liquid is no longer sprayed when the closure section is separated from the

delivery mouthpiece as part of the dispensing opening along the tear strip as the point of separation. In spite of these measures, especially for fluid media with a high surface tension, it is possible that they will settle in the remaining hollow chamber volume and will then not be available for removal, and the container walls which are necessarily provided and which run in a straight line in the area of the delivery mouth piece limit the free shape of container geometries. The indicated known containers can be obtained within the scope of a conventional blow-fill-seal process, in the same manner as the container as claimed in the invention described below.

On the basis of this prior art, embodiments of the invention seek to further improve the known solution such that the medium to be dispensed no longer remains in the indicated hollow chamber of the head or sealing element and cannot be returned by way of the essentially stipulated funnel geometries of the dispensing opening to the receptacle element as the actual container interior, so that for this purpose, within the larger framework, free container shaping tailored to customer specifications and to aspects of practicability is possible. Embodiments of the invention relate to a container with the features of claim 1 in its entirety and the pertinent container can be efficiently produced with a device with the totality of the configuration of features of claim 7.

According to an aspect of the present invention, there is provided a container, a hermetically sealed ampule in particular, having a hollow receptacle element for holding a medium to be dispensed, such container having a dispensing opening which communicates outside the receptacle element with a hollow chamber of a sealing element which keeps the dispensing opening clear, such sealing element forming the head component of the container, and which sealing element is detachably connected to the receptacle element by way of a point of separation in the area of the dispensing opening, characterized in that to reduce the free volume of the hollow chamber, opposite wall components of the sealing element are displaced into the hollow chamber to prevent the dispensing medium stored in the receptacle element from being able to penetrate into the hollow chamber.

The container according to embodiments of the invention is characterized in that to reduce the free volume of the hollow chamber the opposite wall components of the sealing element are displaced into the hollow chamber to prevent the dispensing medium stored in the receptacle element from being able to penetrate into the hollow chamber. In contrast to the known solution, there is therefore no elevated wedge-shaped or dome-shaped region on the free top end of the hollow closure section of the head component as a hollow chamber, but rather on the facing wall sections which border the hollow chamber they are moved toward each other and in this way, to reduce the free chamber volume, are displaced into the hollow chamber; this leads to markedly improved volume reductions.

The opposite adjacent wall components which have been displaced toward the dispensing opening into the hollow chamber transversely or obliquely thereto reduce the hollow chamber volume such that the medium to be dispensed, even in the form of a very thin liquid medium, cannot

travel at all into the hollow chamber, but remains in the hollow receptacle element. In this respect, in embodiments of the invention, the problem therefore does not arise of having to return to the container interior the medium to be dispensed which penetrates into the hollow chamber by way of the oblique surfaces of the delivery mouth piece which run in a straight line, but rather for this purpose the shape of such a dispensing opening and delivery mouthpiece can be freely selected within a widely drawn framework; this makes possible short longitudinal dimensions in implementation, especially in the axial direction of the container.

The device according to embodiments of the invention which is used to produce the indicated container has at least two mold jaws for producing the head component of the container, which in turn have mold recesses for the hollow chamber and for the wall components of the sealing element which border the hollow chamber. These devices are readily available on the market in a plurality of embodiments and permit a so-called blow-fill-seal process, as has become known in the trade under the brand name "bottelpack®" for example.

On the basis of these known devices, the device according to embodiments of the invention is characterized in that there are mold parts which can be triggered within the mold recesses which relate to the hollow chambers; these parts facing each other in the retracted position enable complete formation of the hollow chamber and in the extended position move the adjacent wall components of the hollow chamber toward each other as the free chamber volume is reduced in molding. These mold parts which by preference are designed as pneumatically driven plungers can be housed in a space-saving design within the respective mold jaws with their mold recesses and can be triggered in a timely and controlled manner. By integrating the additional mold parts within the mold jaws moreover space-saving accommodation is ensured, as is a reliable configuration which can be implemented cost-efficiently.

Other advantageous embodiments are the subject matter of the other dependent claims.

The container as claimed in the invention and the device will be detailed below using one exemplary embodiment each as shown in the drawings. The figures are schematic and not to scale.

- FIG. 1 shows in a front view a container combination of five individual containers, viewed in the direction of looking at FIG. 1 the container at the extreme right relating to an execution according to the prior art;
- FIG. 2 shows a side view of the combination as shown in FIG. 1;
- FIG. 3 shows enlarged the sealing element which is shown at extreme left in the direction of looking at FIG. 1 within the circular cutout designated as "X" there;
- FIG. 4 shows a front view of the components of the mold jaw, the mold jaw parts being shown for producing the container geometry as shown in FIG. 3 and the actual container in terms of the molding tool not being shown in FIG. 4 for the sake of simpler representation;
- FIG. 5 shows in a perspective a partial extract turned by 180° relating to the molding tool as shown in FIG. 4, once with the plunger extended and once with it retracted;
- FIG. 6 shows a longitudinal section through the molding tool as shown in FIG. 4 for a container production mold.

The container as claimed in the invention is made in particular in the form of a hermetically sealed ampule. A combination of five of these containers is shown in FIG. 1, the individual containers being separable from each other along their adjoining longitudinal edge with the formation of an individual container. Almost any rows of containers to be manufactured as well as individual containers can be produced.

The indicated containers are produced from a moldable plastic material, for example they consist of polyamide or a polyethylene material. Furthermore, it is possible to produce these container products in a co-extrusion process with a multilayer wall structure or to coat the plastic in order to increase its impermeability, for example to vacuum-coat the container on the outside. By preference at any rate materials are used which can be easily used for a blow-fill-seal process, as has become known in the trade under the brand name "bottelpack®" for example.

Each container has a hollow, blow-molded receptacle element 10 which is used to hold a medium to be dispensed which is not detailed, among others in the form of medical liquids, suspensions, gels or the like which have been added under sterile conditions. As FIG. 3 in particular shows, the receptacle element 10 for dispensing the stored medium which is to be dispensed is provided with a dispensing opening 12 which communicates outside the receptacle element 10 with the hollow chamber 14 of a sealing element 18 which forms the head component 16 of the container, which chamber keeps the dispensing opening 12 clear, and which sealing element is detachably connected to the receptacle element 10 by way of a point of separation 20 in the area of the dispensing opening 12. This point of separation 20 can be formed by a plastic wall component which has a reduced wall thickness and which extends between the head component 16 and the receptacle element 10.

This point of separation 20 is designed in such a way that the head component or sealing element 16, 18 can be easily twisted off of the receptacle element 10 in the form of a toggle closure by hand (twist-off closure) in order in this way to clear the dispensing opening 12 for the process of removal of the medium to be dispensed. This separation process is known in the prior art in a plurality of embodiments as are readily available on the market, so that they will not be detailed here.

Viewed in the direction of looking at FIG. 1, on the extreme right a container 10 is shown which is still provided with the conventional hollow chamber design. This hollow chamber 14 is designed as a solid ball and with its lower enclosing edge ensures that both during the molding

process for the container, and also later when the head component 16 is being separated, the dispensing opening 12 does not unintentionally seal, but remains open for the desired removal process.

But it is possible at this point that the medium which is to be dispensed and which is stored in the receptacle element 10 will reach the hollow chamber 14, and encouraged by the respective surface tension of the medium to be dispensed, will remain there with the result that the medium which is to be dispensed and which is held in the hollow chamber 14 will no longer be available for the subsequent dispensing process by way of the actual hollow receptacle element 10. This missing amount cannot be tolerated, especially when high-precision dosing is important, the medium to be dispensed is very expensive and/or the prescribed or desired concentration enters as a factor with respect to the mixtures and suspensions accommodated in the receptacle element.

In contrast thereto, the four containers of the container design as claimed in the invention located on the left viewed in the direction of looking at FIG. 1, following the conventional solution, in which to reduce the free volume of the hollow chamber 14 the opposite wall components 22 of the sealing element 18 are displaced into the hollow chamber 14 in order in this way to prevent the medium which is to be dispensed and which is stored in the receptacle element 10 from being able to penetrate into the hollow chamber 14 at all.

Preferably here it is provided that as shown in the figures that the displaced wall components 22 of the sealing element 18 extend transversely to the dispensing opening 12, so that in this way within a widely drawn framework a relatively large contact surface arises for the opposite wall components 22 which for this purpose are also in contact with each other transversely to the longitudinal axis 24 of the container (compare FIGS. 2 and 3) displaced against each other. Depending on the embodiment, it would however also be possible to allow the wall components 22 which are to be displaced to meet each other in the opposite direction at an oblique angle (not shown).

Because the two opposite wall components 22 can move uniformly toward each other, a favorable afterflow behavior for the other plastic material is created, so that tension peaks in the shaping process and thus possible failure points are avoided. The uniform displacement motion of the two wall components 22 for one hollow chamber 14 ensures that the sensitive area of the dispensing opening is not touched in order especially to ensure that the free enclosing edge of the dispensing opening in terms of cross section is preserved, in order to thus be able to ensure a smooth removal process later. For efficient process control it is advantageous that the opposite wall components 22 which have been displaced adjacently to each other touch within the hollow chamber 14 of the sealing element 18; for operation of the invention it would however also be sufficient simply to at any rate move the wall components 22 toward each other to such an extent that the remaining free chamber cross section of the hollow chamber 14 with its holding volume is reduced, such that the medium to be dispensed cannot reach the hollow chamber 14 due to its surface tension.

As FIGS. 1 and 3 furthermore show, the displaced wall components 22 touching each other within the hollow chamber 14 leave an annular chamber segment 26 exposed, and this configuration with respect to the afterflow behavior of the plastic material likewise constitutes an optimum as for the actual shaping and the holding capacity for the medium to be dispensed. Regardless of this, it is however possible in special container geometries or for implementation of special Luer-Lock forms to define the opposite wall components which have been displaced toward each other differently (not detailed). The indicated annular space in the form of the annular chamber segment 26 viewed in the direction of looking at the figures from overhead discharges into the dispensing opening 12 and for this purpose allows pressure equalization relative to the situation of the receptacle element 10 so that in this regard the medium to be dispensed could not be unintentionally sucked out of the receptacle element 10 in the direction of the hollow chamber 14, for example by way of vacuum effects; this also applies to the case in which separation by way of the point of separation 20 is being carried out.

The device as claimed in the invention for producing the container as shown in one of the FIGS. 1 to 3 is detailed as shown in FIGS. 4ff. The device as claimed in the invention has at least two mold jaws 28 for producing the head component 16 of the container. As shown in FIG. 4, one of the two mold jaws 28 is only half shown there and to open and close the mold a second mold jaw which is not detailed with the corresponding mold recesses 30 is moved away from or towards the illustrated mold jaw 28 as shown in FIG. 4. Generally the two mold jaws 28 are moved uniformly toward each other or away from each other. These mechanical molding devices are conventional and are in pertinent use in the field of blow-fill-seal processes, as have become known under the trade name "bottelpack®" for example.

In the mold jaw 28 shown in FIG. 4, viewed in the direction of looking at FIG. 4, underneath there is another mold jaw 32 which shown only partially is used for shaping for the respective receptacle element 10 and there is a sealing mold jaw 34 located over it. Depending on the selected molding process, the indicated mold jaws can be triggered jointly; but the possibility also exists of moving the individual mold jaws against each other, for example initially a pair of mold jaws 28 for producing the head component or sealing element 16, 18, and only then to trigger the other pairs of mold jaws 32 in order to obtain the desired hollow receiving bodies 10 for a container.

As FIG. 4 furthermore shows, there are mold recesses 36 in the respective mold jaw 28 in order to form the hollow chamber 14 or the wall components of the sealing element 18 which border the hollow chamber 14. Viewed in the direction of looking at FIG. 4, in turn the tool located at the far right is designed for container manufacture, in which the hollow chamber 14 is designed as a full hollow ball according to the container configuration according to the representation in FIG. 1 at the extreme right. It is quite possible to combine the free hollow chamber cross sections and those with reduced hollow chamber cross sections with each other for different containers within the mold tool, if this is deemed necessary for reasons of practicability.

As FIGS. 5 and 6 furthermore show, there are mold parts 38, designed preferably as individual plungers 40, which can be triggered within the mold recesses 36 which relate to the respective hollow chamber 14. This mold part 38 extends through the dome-shaped or hemispherical mold recess 36 within the respective mold jaw 28. These conditions are shown especially distinctly in FIG. 5, which figure however is shown rotated by 180° compared to FIG. 4, i.e., the mold recesses 30 for the receiving bodies 10 viewed in the direction of looking at FIG. 5 are shown at the top and the sealing elements 18 located opposite are accordingly pointing down.

To produce a spherical hollow chamber 14, viewed in the direction of looking at FIG. 5 the right plunger 40 remains behind, and to displace the wall components 22 the left plunger 40 for forming the hollow chamber volume as claimed in the invention is extended forward and projects into the hemispherical recess 36, in any case preferably to such an extent that the then pertinently displaced wall section as the wall component 22 comes into contact with the displaced wall component 22 of the plunger 40 of another corresponding mold jaw tool, which plunger is opposite in the longitudinal direction in one axis and is not detailed.

If the objective is an undisrupted hollow chamber cross section, it is of course also possible, instead of a retracted cylindrical plunger 40 as shown in FIG. 5, to completely omit it and make the mold in the conventional manner as is customary. If the hollow chamber 14 has a different geometrical structure instead of the illustrated spherical shape, adaptation of the free working cross section of the plunger 40 used at the time may be necessary. If the mold jaw 28 shown in FIG. 4 relates to a separately triggerable partial mold, in this respect in a configuration of a modular concept the replacement of the mold jaw 28 by another is easily possible in order in this way to be able to produce different container geometries, also in terms of the head-closure side, with only one molding device or molding machine.

FIG. 6 in turn relates to a longitudinal section through the associated molding tool to the mold jaw structure as shown in FIG. 4. As shown in FIG. 6, the plunger 40 there is held in a guide plate 42 which within a control chamber 44 separates the two component spaces 46, 48 from each

other within it. If these component spaces 46, 48 are connected to an energy input, for example in the form of a pneumatic input, the plunger 40 can be shifted to the left out of its inactive position shown in FIG. 6, viewed in the direction of looking at FIG. 6, for example to assume an active position as shown in FIG. 5 which shows completion of the displacement of the wall component.

By applying pressure in the chamber 46 and depressurizing the partial chamber 48, in turn the plunger 40 can be moved back into its inactive position, in which the free front side of the plunger 40 still overlaps the dome bottom of the domed mold recess 36 at the same time. Motion sensors which are not detailed can monitor the pertinent operating position of the plunger 40 and relay it to a central control which is not detailed for the machine. Instead of the guide plate 42, in one embodiment of the apparatus design as claimed in the invention which is not detailed, it would also be possible to directly trigger the plunger 40 by means of a working medium or energy medium. The use of electromagnets would also be possible, as have been used for years for example in magnetic valve technology in order to be able to trigger plunger motion. It is also possible to allow at least part of the plunger 40 to move in an oblique configuration instead of a transverse configuration if the required container geometry compels this.

Claims

1. Container, a hermetically sealed ampule in particular, having a hollow receptacle element for holding a medium to be dispensed, such container having a dispensing opening which communicates outside the receptacle element with a hollow chamber of a sealing element which keeps the dispensing opening clear, such sealing element forming the head component of the container, and which sealing element is detachably connected to the receptacle element by way of a point of separation in the area of the dispensing opening, characterized in that to reduce the free volume of the hollow chamber, opposite wall components of the sealing element are displaced into the hollow chamber to prevent the dispensing medium stored in the receptacle element from being able to penetrate into the hollow chamber.
2. The container as claimed in claim 1, wherein the displaced wall components of the sealing element extend transversely to the dispensing opening or assume an oblique angle to it.
3. The container as claimed in claim 1 or 2, wherein the opposite wall components displaced adjacently to each other touch within the hollow chamber of the sealing element.
4. The container as claimed in claim 3, wherein the displaced wall components touching each other within the hollow chamber leave exposed at least partially the chamber segments which discharge into the dispensing opening, at least partially carrying media.

5. The container as claimed in one of claims 1 to 4, wherein on the outer peripheral side the hollow chamber is formed from wall pieces of a hollow ball.
6. The container as claimed in one of claims 4 to 5, wherein the chamber segments in their entirety form an inherently closed annular space which encompasses the wall components which are touching each other and which discharges into the dispensing opening.
7. Device for producing a container as claimed in one of claims 1 to 6 having at least two mold jaws to produce the head component of the container which have mold recesses for the hollow chamber and for the wall components of the sealing element which border the hollow chamber, wherein there are mold parts which can be triggered within the mold recesses relating to the hollow chamber, which parts facing each other in the retracted position make possible complete formation of the hollow chamber and in the extended position move the adjacent wall components of the hollow chamber toward each other as the free chamber volume is reduced in molding.
8. The device as claimed in claim 7, wherein the respective mold part consists of a plunger which can move forward and backward and which extends through the mold recess which may be associated to it for the hollow chamber, preferably in a plane transversely to the longitudinal plane of the mold jaws adjacent to each other or obliquely thereto.
9. The device as claimed in claim 8, wherein a pneumatic triggering means is used for the traversing motion of the respective plunger.