

Device for Producing Blowmolded Container Products From Plastic Material

The invention relates to a device for producing blowmolded container products from plastic material by means of individual mold halves, which run along a production line and which can be moved in pairs toward one another and away from one another, in order to close and/or open a production mold, in which the container products are molded and from which, following the demolding process, the container products emerge in the form of a container chain that is moved along the production line. In order to facilitate the demolding process, a demolding unit, which acts on the emerging container chain outside the production mold, is provided.

Methods and devices for manufacturing plastic container products are known in the prior art (DE 199 26 329 A1). In order to manufacture such products, a tube consisting of plasticized plastic material is extruded into a molding device. One end of the tube is closed by heat sealing. The closed end tube is expanded by generating a pneumatic pressure gradient acting on the tube and applied to the molding walls of the molding device, comprising two opposite individual molding halves, to form the container. Then, in carrying out the bottelpack[®] method that is known in this technical field, the respective plastic container is filled under sterile conditions into the molding device by means of a suitable charging mandrel. After the charging mandrel has been removed, the filled container is hermetically sealed and a specific head geometry is formed. For the

purpose of forming the actual plastic container, in which fluid is later stored, two individual mold halves in the form of molding jaws may be moved toward one another by, for example, hydraulic or servo-electric drive means in order to achieve a closing position and away in opposite directions from one another into one of their opening positions. In order to achieve in this case very high ejection rates of container products, DE 103 23 335 A1 describes a multi-station arrangement, where the various molding steps are divided among different stations that are arranged one after the other in an imaginary circular arc so as to form a type of carousel arrangement, which makes possible very high cycle frequencies for the plastic product to be ejected. In such systems these plastic products emerge in the form of a container chain along a production line.

A suitable synthetic plastic material for the container products is typically polyethylene, which can be processed quite well in such production systems and is, therefore, preferred. However, the use of polyethylene as a material for containers causes problems if the fill material that is to be filled into the respective container product is a liquid that is to be autoclaved at 121 °C. This can be the case especially when, for example, it involves a highly sensitive pharmaceutical composition. In such cases, the prior art makes sure that, for example, the fill orifice of the container tube is covered by a sterile barrier at least from the time of the orifice's formation up to the filling of the associated container in a cleanroom. In this case, it is possible to achieve good results, if, as described in DE 10 2004 004 755 A1, a sterile medium is conveyed by means of said barrier in the direction of the container fill orifice using a medium conveying device in order to improve the sterility. Another or an additional strategy for enhancing the sterility is simply to provide higher processing temperatures, for example, during the production of the tube for the container product or during the filling process of the fill material. However, such a procedure conflicts with the temperature sensitivity of the polyethylene that is provided as the synthetic plastic material.

Owing to the processing temperature of the polypropylene material that is much higher than that of polyethylene and owing to the possible higher autoclaving temperature of 121 °C, the sterility requirements can be satisfied in a simple and cost-efficient way. However, considerable processing problems present an obstacle to the use of polypropylene.

Owing to the much higher outlet temperatures resulting from the use of a propylene material, and owing to the resulting stiffer surface finish as compared to containers made of polyethylene, there are difficulties in separating the containers from the respective walls of the production mold. In order to remedy these difficulties, document DE 21 65 816 C3 proposes a device for producing molded, continuous, and contiguous containers made of polypropylene material, a demolding unit that has a conveying device that acts on the emerging container chain outside the production mold and imparts to the container chain a draw-off speed that is less than the speed of movement of the production mold. As a result of this procedure, the containers experience an elastic contraction that in turn is designed to facilitate the separation of said containers from the walls of the mold. However, this approach does not ensure that the demolding process will run efficiently, especially when high cycle frequencies are to be achieved.

In light of this problem, the object of the invention is to provide a device that makes it possible to produce container products from polypropylene material in a simple, economical, and reliable manner.

The invention achieves this object with a device that has the features disclosed in patent claim 1 in its entirety.

The characterizing part of claim 1 of the invention discloses a demolding unit provided with a power drive, by means of which the container chain can be deflected out of the production line into a back-and-forth movement. Therefore, the result with respect to the container chain is a

shaking or oscillatory motion in the outlet area so that the separation from the walls of the mold is guaranteed even at the high cycle frequencies that are required for an efficient operation.

In light to these circumstances, the device is preferably configured such that the container chain can be deflected at least essentially in the direction of the closing and opening movements of the individual mold halves by means of the power drive of the demolding unit. Consequently, the container chain is put into an oscillatory motion running transversely to the conveying direction.

In this respect, the device can be preferably configured such that the demolding unit has a driver arrangement, which is drive-coupled to the power drive and which has two bearing surfaces, on which the container chain, moving along the production line, is guided and over which the deflection forces can be transferred to the container chain.

This driver arrangement can have a passage channel, of which the wall sections form a skirt for the moving container chain as well as the bearing surfaces for the transfer of the deflection forces to the container chain.

In this respect, the device is preferably configured such that the passage channel has moveable wall sections that can be moved into a closed position, which corresponds to the closed skirt of the container chain, and into an open position, during which the driver arrangement can be forced to engage with the container chain and to disengage from it. In this way, the device can be made ready for use in an especially easy way in that on startup of production, the driver arrangement with open wall sections of the passage channel is moved up to the container chain, and then the passage channel is closed in order to form a skirt for the container chain.

The driver arrangement can have a support frame, which is drive-connected to the motor that serves as the power drive and which forms the stationary wall sections of the passage channel.

In this case, the moveable wall sections of the passage that make it possible to open and close the skirt are mounted on said support frame so that they can be pivoted between the open position and the closed position.

In the case of containers with a small volume, for example, ampules, the production process is typically configured in such a way that a plurality of containers that lie next to one another are molded simultaneously, so that they form a wide area container chain, in which a plurality of containers that lie next to one another are combined so as to form a container chain train. In this respect, the device can be configured in such a way that the length of the support frame is equal to or larger than the width of the container chain train and that the moveable wall sections can be hinged to the end regions of the support frame that are located laterally to the container chain train.

Furthermore, the device can be preferably configured such that the demolding unit is mounted so as to be adjustable in position on a device frame between a rest position, which is located at a distance from the production line, and a working position, supporting the demolding process at the container chain or the container chain train. As a result, the outlet area of the production mold is freely accessible for maintenance or adjustment measures, when the demolding unit is in the rest position, while, owing to the position adjustable arrangement, the demolding unit can be made ready for use in a simple way. For this position adjustment, the device carrier, which is a component of the demolding unit and on which can be mounted both the guide tracks for the driver arrangement and the motor serving as the power drive, can be mounted on the device frame so as to be pivotable about an axis that runs perpendicular to the direction of the production line and parallel to the guide plane of the guide tracks.

For the pivot movements between the rest position and the working position of the demolding unit, there is preferably a pivot drive in the form of a linear drive, which is connected in

an articulated manner to the device carrier at a distance from its pivot bearing as well as to an articulated point, which is located on the device frame at a distance from the pivot bearing of the device carrier.

The invention is explained in detail below in conjunction with one embodiment depicted in the drawings.

- FIG. 1 is a schematic drawing of a highly simplified overview of one embodiment of the device according to the invention, where the operating state is shown with the demolding unit in the working position.
- FIG. 2 is a drawing of just one subsection of the production line of the embodiment, where the moveable individual mold halves, which can be moved into a position that closes the production mold, are shown as a sectional view. In this respect, a container product along the line of an ampule is shown inside the production mold.
- FIG. 3 is a top view of just the demolding unit of the embodiment, where a container chain emerging from the production mold in the form of a wide container chain train is shown as a cross-sectional view. In this case, a passage channel that is intended for the container chain train and that has closed wall sections, which are indicated by dashed lines, forms a closed skirt; and the solid lines denote the moveable wall sections in their open position; and
- FIG. 4 is a side view of the demolding unit from FIG. 3. In this case, the demolding unit is shown in the working position, but with the wall sections of the passage channel in the open position.

In FIG. 1 the production segment that is located at the top in the figure is designated as a whole as 1; and the subsequent demolding unit that is connected to the top production segment in the downward direction is designated as a whole as 3. The production segment 1 involves a device for carrying out a blowmolding process in accordance with the bottelpack[®] system known from the prior art, and, specifically, in an embodiment, in which the various molding steps are carried out at a number of stations along a production line 5. As in a carousel configuration, the individual mold halves 7, of which only some are numbered in FIG. 1, are moved toward each other in pairs on an imaginary circular arc path, in order to form a closed production mold, and are moved away from each other again, in order to open the mold. Since systems that work according to the bottelpack[®] method are known from the prior art, there is no need at this point to provide the technical details of the production segment 1 in FIG. 1.

This figure shows clearly that the resulting container chain 9 emerges from the production segment 1 along the production line 5 and then travels to the demolding unit 3. It is clearly evident from FIG. 3 that the container chain 9 is a container chain train that covers a wide area. In this case, a plurality of individual containers 11 having an ampule-like shape (FIG. 2), of which only a few are numbered in FIG. 3, next to one another in the container chain 9. In order to facilitate the separation of the containers 11 from the walls of the individual mold halves 7 moving away from each other at the outlet area, the demolding unit 3 imparts to the container chain 9 a deflecting movement, as indicated with the double arrow 13 in FIG. 1. For this purpose, the demolding unit 3 has a driver arrangement 15, which produces, in drive connection with an electric drive motor 17, the deflection movement of the container chain 9, in order to reliably separate the containers 11 from the wall sections of the mold.

The full technical details of the demolding unit 3 and the driver arrangement 15 are shown more clearly in FIGS. 3 and 4. This driver arrangement 15 forms, with the support frame 19, the stationary wall sections of a passage channel 21 (FIG. 3) for the container chain 9 with the

containers 11. The movable wall sections 23, which are pivoted on the support frame 19, can be moved into an open position, which is shown with the solid lines in FIG. 3. In this position the container chain 9 can be moved easily into the open passage channel 21 in order to start up the device. The moveable wall sections 23 have angled frame legs 25, which form the hinge point at the ends of the support frame 19. The length of these frame legs 25 is adapted to the thickness dimensions of the containers 11 of the container chain 9 such that when the wall sections 23 are folded down into the closed position, as shown with the dashed line in FIG. 3, a form-fitting skirt of the container chain 9 is formed in the passage channel 21.

The support frame 19 of the driver arrangement 15 is guided on guide tracks 27 for the deflection movements, which run according to the double arrow 13 in FIGS. 1 and 4. Like the motor 17, these guide tracks are also mounted on a device carrier 29, which in turn is mounted on a device frame 31 of the demolding unit 3 so as to be pivotable about a pivot axis 33. At a distance from this pivot mounting, a linear drive 35 in the form of a hydraulic or pneumatic working cylinder is hinged at 28 on the device carrier 29. This working cylinder in turn is supported on the device frame 31 at a hinge point 37 at a distance from the pivot bearing 33.

Since the device carrier 29 of the demolding unit 3 is mounted in a pivotable manner on the device frame 31, the demolding unit can be folded down from the working position, shown in FIGS. 1 and 4, into a rest position by retracting the power drive 35, for adjustment and maintenance measures as well as preparation for startup, in that the driver arrangement 15 is located outside the outlet area of the container chain 9. For the startup of the device, the device carrier 19 is moved into the working position, shown in FIGS. 1 and 4, by moving out the power drive 35. Starting from the operating state shown in FIG. 4, the wall sections 23 that are in the open position are pivoted into the closed position, in order to close the passage channel 21, i.e., to form a skirt of the container chain 9. FIG. 3 shows the most clearly that the motor 17 has an output gear 39 with an eccentric device 41, which converts the rotational movement into a reciprocating

movement and which is coupled to the support frame 19 by means of adjustable push rods 43. This gear system imparts to the support frame 19 and, thus, the container chain 9, located in the passage channel 21, a back-and-forth shaking motion. At the same time, it is possible to provide a stroke in the range of 10 to 20 mm long and, for example, one shuttle per second. In any case, the shaking motions in the outlet area of the container chain 9 ensure a reliable separation of the molded containers 11 from the walls of the mold, even if one uses materials, in particular polypropylene materials, that are difficult to demold and require high processing temperatures, or if the material to be demolded is very stiff. As a result, it is possible to exploit the advantages arising from the use of polypropylene materials, instead of polyethylene or a co-extruded multi-layered composite. These advantages are also due to the fact that the polypropylene material can be autoclaved at higher temperatures (121 °C); and at the same time it is even more advantageous to obtain the polypropylene material from just one extrusion head than it is to use the multi-layered systems referred to.

Instead of the depicted linear drive 35 in the form of a working cylinder for adjusting the position of the demolding unit 3 between the working position and the rest position, other kinds of drive and gear means can be provided, for example, a spindle drive and the like. It is also possible to provide locking mechanisms that allow the demolding unit 3 to be releasably fixed in the working position and/or the rest position or in desired intermediate positions.

Claims

1. A device for producing blowmolded container products (11) from plastic material by means of individual mold halves (7), which run along a production line (5) and which can be moved in pairs toward one another and away from one another, in order to close and/or open a production mold, in which the container products (11) are molded and from which, following the demolding procedure, the container products emerge in the form of a container chain (9) that is moved along the production line (5), so that in order to facilitate the demolding procedure, a demolding unit (3), which acts on the emerging container chain (9) outside the production mold, is provided, characterized in that the demolding unit (3) has a power drive (17), by means of which the container chain (9) can be deflected out of the production line (5) into a back-and-forth movement (5).
2. The device according to claim 1, characterized in that the container chain (9) can be deflected at least essentially in the direction of the closing and opening movements of the individual mold halves (7) by means of the power drive (17) of the demolding unit (3).
3. The device according to claim 2, characterized in that the demolding unit (3) has a driver arrangement (15), which is drive-coupled to the power drive (17) and has bearing surfaces, on which the container chain (9), moving along the production line (5), is guided and over which the deflection forces can be transferred to the container chain (9).
4. The device according to claim 3, characterized in that the driver arrangement (15) has a passage channel (21), of which the wall sections (19, 23, 25) form a skirt for the moving container chain (9) as well as the bearing surfaces for the transfer of the deflection forces to the container chain (9).

5. The device according to claim 4, characterized in that the passage channel (21) has moveable wall sections (23, 25) that can be moved into a closed position, which corresponds to the closed skirt of the container chain (9), and into an open position, in which the driver arrangement (15) can be forced to engage with the container chain (9) and to disengage from the same.
6. The device according to claim 4 or 5, characterized in that the driver arrangement (15) has a support frame (19), which is drive-connected to the motor (17) that serves as the power drive, and which forms the stationary wall sections of the passage channel (21), and on which are mounted the moveable wall sections (23, 25) of the passage channel (21), which make it possible to open and close the skirt, so that said wall sections can be pivoted between the open position and the closed position.
7. The device according to claim 6, characterized in that the support frame (19) is displaceably guided on guide tracks (27), which run transversely to the production line (5), and is coupled to the motor (17) by means of an eccentric device (41), which converts the rotational motion of said motor into a back-and-forth displacing motion.
8. The device according to claim 6 or 7, characterized in that in order to form a passage channel (21) for a wide area container chain (9), in which a plurality of containers (11) that lie next to one another are combined so as to form a container chain train, the length of the support frame (19) is equal to or larger than the width of the container chain train and that the moveable wall sections (23, 25) are hinged to the end regions of the support frame (19) that are located laterally to the container chain train.
9. The device according to claim 8, characterized in that the moveable wall sections (23, 25) have angled frame legs, which have at one end respectively a short leg (25), which forms

the articulated point on the support frame (19), and of which the length defines the width of the passage channel (21) measured in the direction of the back-and-forth movement, and a longer frame leg (23), which is connected to said short leg at right angles and which forms in the closed position the bearing surfaces on the wide side of the container chain (9) that faces the same.

10. The device according to one of claims 1 to 9, characterized in that the demolding unit (3) is mounted so as to be adjustable in position on a device frame (31) between a rest position, which is located at a distance from the production line (5), and a working position, which supports the demolding process at the container chain (9).
11. The device according to one of claims 7 to 10, characterized in that the guide tracks (27) and the motor (17) are mounted on a device carrier (29), which is mounted on the device frame (31) so as to be pivotable about an axis (33) that runs perpendicular to the direction of the production line (5) and parallel to the guide plane of the guide tracks (27).
12. The device according to claim 11, characterized in that in order to transfer the demolding unit (3) between the rest position and the working position, a linear drive (35) is provided as a pivot drive, which is connected in an articulated manner to the device carrier (29) at a distance from its pivot axis (33) as well as to an articulated point (37), which is located on the device frame (31) at a distance from the pivot axis (33) of the device carrier (29).