

Apparatus for Conditioning Plastic Containers for Putting
the Same Into Use

The invention relates to an apparatus for conditioning plastic containers for putting the same into use, specifically containers, in particular ampules, which are molded to one another so as to form container blocks side by side at parting lines, at which the containers can be separated from one another for use.

Processes and apparatus for manufacturing plastic container products are known in the prior art (DE 199 26 329 A1). In order to manufacture such products, a tube of plasticized plastic material, such as polyethylene or polypropylene, 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® process that is known in this technical field, the respective plastic container is filled within the molding device under sterile conditions by means of a suitable charging mandrel. After the charging mandrel has been removed, the filled container is hermetically sealed and a specified 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 each other by, for example, hydraulic or electric drive means in order to achieve a closing position and away in opposite directions from each other 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 circle 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 along a production line in the form of a container chain, in which a plurality of individual containers lie side by side next to one another. Further processing takes place such that in the next phase of the production line, the container blocks or ampule blocks are punched out of the container chain, in particular in the form of an ampule web, with a punching device. In each case, the blocks exhibit a number of individual containers that are suitable for shipping and use. Frequently, each ampule block comprises five ampules that are connected by parting lines.

The arrangement of containers, for example ampules, in blocks, is practical and advantageous in terms of packaging and shipping. However, in contrast, the use of the individual containers or ampules is less user-friendly. Even if the parting lines inside the blocks are carefully configured and with thin walls, the separating process is laborious and even difficult, especially if it involves a relatively stiff synthetic plastic material, as is the case with containers made of polypropylene.

Working on this basis, the object of the invention is to provide an apparatus that makes it possible to condition containers such that the individual containers or the ampules are easy and convenient to separate for use, while, nevertheless, retaining a secure coupling to the parting lines for packaging and shipping purposes.

This object is achieved, according to the invention, by an apparatus that has the features disclosed in patent claim 1 in its entirety.

Accordingly, the invention calls for a pre-separation station into which the container blocks can be moved in conveying steps and which provides for each of the parting lines of the blocks an oscillating knife, by means of which a pre-separation incision is produced at the respective parting line. Depending on the strength properties of the synthetic plastic material of the containers, the length of the pre-separation incision relative to the entire length of the parting lines is chosen such that for packaging and shipping a secure cohesion is maintained owing to the remaining length of the respective parting line, yet the separating step is easy to carry out without great effort. Owing to the high cycle frequencies, which are conventional in efficiently operating container production systems, the goal is to move as many containers as possible into the pre-separation station in each conveying step. Therefore, this pre-separation station is designed such that there are a correspondingly large number of oscillating knives that have to be driven for the cutting operation. In light of the relatively rigid plastic material, this applies especially to polypropylene, the resulting necessary high cutting force and the correspondingly high drive power that is necessary for the common drive of the oscillating knives, the drive unit has to be extremely efficient and be designed with an overly high demand for installation space, if a larger number of oscillating knives are to execute their cutting stroke at the same time. In light of these circumstances, the apparatus according to the invention is configured such that the oscillating knives are coupled to the common drive in such a special way that the cutting strokes take place in a sequence that is offset in time in relation to each other. At a given drive power, the resulting temporal load distribution that is achieved in this way allows a higher number of oscillating knives to be operated.

Accordingly, an especially advantageous embodiment provides that in order for the cutting stroke of the cutting edge of the oscillating knives to follow a circular path, the oscillating knives can be arranged to be radially projecting on a common blade shaft, which is connected to a rotary drive, and on which at least one oscillating knife is mounted so as to be offset relative to at least one additional oscillating knife by an angle of rotation for the time offset sequence of the cutting strokes.

If this arrangement provides that in each conveying step more than one container block can be moved into the pre-separation station and, in so doing, each block that is to be provided with the pre-separation incisions has a group of oscillating knives, then these oscillating knives can be oriented on the blade shaft preferably such that the pre-separation incisions take place simultaneously at more than one block.

In apparatus designed for high cycle frequencies in which three blocks with five ampules each can be moved into the pre-separation station in each conveying step, it may be advantageous to configure the arrangement such that the four oscillating knives of each of the groups are arranged on the blade shaft such that in each case the four oscillating knives that belong to two different groups perform the cutting stroke at the same time. The result is not only an optimal time distribution of the torque load on the drive shaft, but also an advantageous bending moment load on the drive shaft owing to the fact that the cutting force is introduced in the axial direction of the shaft.

In advantageous embodiments, a conveying device can move the container blocks from an input station to the pre-separation station and from said pre-separation station into a discharging station that is used to remove the container blocks provided with pre-separation incisions. As a result, there is the possibility of automating the operation of extruding the synthetic plastic material to the working step of packaging by connecting the input station as a continuation of the production line directly downstream from the punching device in which the container blocks are punched out of the container strip.

In this respect, the conveying device has preferably a guide track, along which can be moved a transport slide that has a frame for the container blocks that are to be conveyed.

At the same time, the arrangement can be configured such that the transport slide in the linearly running guide track can be moved so as to shuttle back and forth between the input station and the pre-separation station.

Here, the pre-separation station can have a lifting device that can lift the container blocks out of the transport slide into a separating position for the pre-separation incisions. Hence, the transport slide is emptied for the return run into the input station and is thus ready for the next conveying step.

For the blocks provided with the pre-separation incisions, the conveying device can have a conveying track for moving these blocks into the discharging station, from which the pre-cut container blocks are unloaded by means of, for example, an unloading conveyor with a conveying direction extending transversely to the direction of the conveying track.

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

- FIG. 1 shows a highly simplified schematic drawing of a side view of one embodiment of the apparatus according to the invention;
- FIG. 2 shows likewise a highly simplified schematic drawing of a top view of the embodiment depicted in FIG. 1;
- FIG. 3 shows a sectional view, which is enlarged compared to FIGS. 1 and 2, along the cutline III - III from FIG. 1, and

FIG. 4 shows a side view of an ampule block, which is approximately to scale, in the finished state, but prior to a conditioning that is carried out for putting into use.

The embodiment of the apparatus according to the invention that is shown in the drawings having an input station 1, a pre-separation station 3, and a discharging station 5. The input station 1 has the beginning of a conveying device, by means of which a transport slide 7 can be moved along a linear and horizontal guide track 8. This transport slide forms a frame 9 (see FIG. 2), which can be used as a seat, which can hold the three ampule blocks 11 that lie side by side and comprise five ampules 13 each, in order to move these ampule blocks into the pre-separation station 3 in the direction of the arrow 15 from FIG. 1. FIG. 4 shows, in an individual representation, an ampule block 11 with five individual ampules 13, which are molded to one another along their abutting side edges at parting lines 17.

The illustrated embodiment of the apparatus constitutes a continuation of a container production line, the apparatus following a punching device (not illustrated) that is connected upstream from the input station 1 and the ampule blocks 11 being punched out of a so-called ampule web in the same way as it is produced, for example, according to the bottelpack® system. Coming from the punching device, the blocks 11 are placed, as indicated by the arrow 19 in FIG. 1, into the transport slide 7, located at the beginning of the guide track 8, so that there are three blocks 11, lying side by side, in the frame 9.

After the transport slide 7 with the blocks 11 has been moved into the pre-separation station 3, the blocks 11 are lifted out of the frame 9 of the transport slide 7 and brought into their separating position, as shown in FIG. 3, in order to produce the pre-separation incisions at the parting lines 17. This step is carried out by means of a lifting device, which has lifting rails 21,

which lie against the underside of the ampules 13 starting from the open end 23 of the slide 7 and via openings in the bottom on said slide, in order to lift the blocks 11 out of the frame 9. For this purpose, the rails 21 can be moved vertically by means of a lifting cylinder 25. As soon as the blocks 11 are lifted into the separating position and, as a result, the transport slide 7 is emptied, said transport slide is moved back again into the input station 1 from the pre-separation station 3, in order to receive three more ampule blocks 11 for the next conveying step.

In order to produce the pre-separation incisions at the blocks 11 located in the separating position, the pre-separation station 3 has a number of oscillation knives 27 that matches the number of parting lines 17. In the drawing only some of the oscillating knives 27, depicted in FIG. 3, are marked with reference numerals. Each oscillating knife 27 has a cutting edge 29 (not all of which are numbered) that is moved on a circular path for the pre-separation incision in that the oscillating knife 27 performs a swiveling motion. For this purpose, the oscillating knives 27 are mounted on a common drive shaft 31 that may be rotated by means of a drive unit 33. In the example under discussion, this drive unit is a rack and pinion drive, where the rack 35 is moved back and forth by hydraulic, pneumatic, or electric means and drives the shaft 31 via a pinion and a freewheeling coupling 37 (FIG. 2).

In the present example, where three blocks 11 with five ampules 13 each are brought simultaneously into the separating position in the pre-separation station 3 and thus twelve oscillating knives 27 are mounted on the shaft 31, a simultaneously ensuing pre-separation incision at all of the parting lines 27 would result in a very high demand for driving power for the drive shaft 31, especially if the ampules 13 are made of a synthetic plastic material that is relatively rigid, as, for example, in the case of polypropylene. In order to remedy this problem, the arrangement of the invention is configured such that the oscillating knives 27 are mounted on the drive shaft 31 in a specific arrangement, that is, such that the cutting edges 29 of some of the knives 27 are offset in relation to the cutting edges 29 of the other knives 27 on the shaft 31 by an angle of rotation. In the

apparatus according to the invention, the knives 27 are arranged, as a function of the three blocks 11, into three groups of knives 41, 43, and 45 (FIGS. 1 and 2), each group comprising four knives 27. Here, the orientation on the shaft 31 is selected such that the cut is produced simultaneously by four cutting edges 29, thus involving the knives 27 of two different groups 41, 43 45 in each case.

A comparison of FIGS. 1 and 2 shows that for this purpose the distribution of the rotational positions can be chosen such that the two center knives 27 of the adjacent groups 41 and 43 have the same orientation, as shown in FIG. 1. FIG. 2 shows a distribution, where the two external knives 27 of group 41 and the two internal knives of group 45 have the same orientation on the shaft 31.

FIG. 3 shows that when the shaft 31 rotates counter-clockwise, the cutting edges 29 are moved on a circular path and that, in so doing, the ends of the cutting edges 29 that lie radially the furthest on the outside move over most of the length of the ampules 13, but the radially outermost ends of the cutting edges 29 emerge from the ampule parting line 17 before the entire parting line 17 is severed. In other words, the radial length of the cutting edges 29 relative to the axis of rotation 31 and the position of the ampules 13 in the separating position define the length of the pre-separation incision, which is chosen in each case such that the ampules 13 are still adequately connected in the pre-cut blocks 11, a feature that is practical for packaging and shipping, and yet effortless separation of the ampules 13 is possible for putting them into use.

After the transport slide 7, which has been emptied by lifting out the blocks 11, is moved back again to the input station 1 and the lifting device releases the pre-cut blocks 11 by recessing downwards the lifting rails 21, the pre-cut blocks 11 reach a conveying track 47 by means of which they travel to the discharging station 5 in the direction of the arrow 49 of FIG. 1. For the final unloading of the pre-cut blocks 11 for packaging and shipping, the discharging station 5 has an

unloading conveyor 51, which unloads, as indicated by the arrow 53, the blocks 11 with a conveying direction extending transversely to the direction of the conveying track 47.

Patent Claims

1. An apparatus for conditioning plastic containers for putting the same into use, specifically containers, in particular ampules (13), which are molded to one another so as to form container blocks (11) side by side at parting lines (17) at which the containers (13) can be separated from one another for use, **characterized in that** there is a pre-separation station (13) into which the container blocks (11) can be moved in conveying steps and which provides an oscillating knife (27) for each of the parting lines (17), the oscillating knives (27) being coupled to a common drive (31, 33) for a cutting stroke in order to produce a pre-separation incision at the relevant parting line (17) in each case such that the cutting strokes of at least one oscillating knife (27) take place in a sequence that is offset in time in relation to the cutting strokes of at least one additional cutting knife (27).
2. The apparatus, according to claim 1, characterized in that in order for the cutting stroke of the cutting edge (29) of the oscillating knives to follow a circular path, the oscillating knives (27) are arranged radially projecting on a common blade shaft (31), which is connected to a rotary drive (33), and on which at least one oscillating knife (27) is mounted so as to be offset relative to at least one additional oscillating knife (27) by an angle of rotation for the time offset sequence of the cutting stroke.
3. The apparatus, according to claim 1 or 2, characterized in that in each conveying step more than one container block (11) can be moved into the pre-separation station (3) and that each block (11) that is to be provided with the pre-separation incisions has a group (41, 43, 45) of oscillating knives (27), and that these oscillating knives are oriented on the blade shaft (31) such that the pre-separation incisions take place simultaneously at more than one block (11).

4. The apparatus, according to claim 3, characterized in that three blocks (11) with five ampules (13) each can be moved into the pre-separation station (3) in each conveying step, and that the four oscillating knives (27) of each of three groups (41, 43, 45) are arranged on the blade shaft (31) such that in each case the four oscillating knives (27) that belong to two different groups (41, 43, 45) perform the cutting stroke at the same time.
5. The apparatus, according to claim 4, characterized in that the conveying device (7, 8, 47) can move the container blocks (11) from an input station (1) to the pre-separation station (3) and from said pre-separation station into a discharging station (5) that is used to remove the container blocks (11) provided with pre-separation incisions.
6. The apparatus, according to claim 5, characterized in that the conveying device has a guide track (8), along which can be moved a transport slide (7) that has a frame (9) for the container blocks (11) that are to be conveyed into the pre-separation station (3).
7. The apparatus, according to claim 6, characterized in that the transport slide (7) in the linearly running guide track (8) can be moved so as to shuttle back and forth between the input station (1) and the pre-separation station (3).
8. The apparatus, according to claim 7, characterized in that the pre-separation station (3) has a lifting device (21) that can lift the container blocks (11) out of the transport slide (7) into a separating position for the pre-separation incisions.

9. The apparatus, according to claim 8, characterized in that the conveying device has a conveying track (47) for moving the blocks, which are provided with the pre-separation incisions, into the discharging station (5).
10. The apparatus, according to claim 9, characterized in that the discharging station (5) has an unloading conveyor (51), which discharges the container blocks (11) with a conveying direction extending transversely to the direction of the conveying track (47).