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Supply tube for tablets

Field of the invention

The present invention refers to a supply tube for supplying tablets, pills, capsules, dragées and similar products from a reservoir under the effect of gravity to a receptacle through a channel formed in the supply tube, said channel having a substantially rectangular cross-section.

Description of the prior art

Pharmaceutical products, as for instance tablets, capsules, pills, suppositories, dragées etc. are usually packed in bottles, bags, blisters, folding boxes and similar containers. Blisters consist of a plastics sheet in which a plurality of deep-drawn cups is formed, each being filled with pills and being collectively sealed by a cover sheet. The filling of pills or tablets into the packages, particularly into blisters, is carried out by automatically operating machines, which are capable of inserting the respective products accurately and precisely at high speed. Conventional packaging machines include for this purpose several supply tubes and grooves which convey the pills or tablets from a reservoir in the direction towards their receptacles. A precise alignment and introduction of pills may be critical, particularly if the pills shall be inserted into the cups of a blister.

When supplying the pills through supply tubes in which they fall downwards caused by the effect of gravity, the pills might get stuck if, caused by the required dosage conditions, the pills come to a stop and partially overlap in that they stand up obliquely. One therefore speaks of a "shingling" of the pills.

US 2004/0035878 A1 discloses a supply tube, which shall avoid the above-mentioned shingling. The supply tube has a helically extending channel, which extends between the inlet end and the outlet end of the tube.

This helical channel has a substantially rectangular cross-section, which is larger than the cross-section of the pills to be conveyed. "Substantially rectangular" in this case means a cross-section, where the largest extension of a first side of the rectangle in a first direction is larger than the largest extension of a second side in a second direction perpendicular to the first direction but where both sides do not necessarily have to be



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straight but may also be adapted to the cross-sectional shape of the tablets, pills and similar products to be conveyed through. This also applies to the present invention. When the pills fall through the channel, the pills perform a rotation due to the shape of the channel, but they do not rotate with respect to the channel. Within the channel the pills have a limited mobility with respect to the channel walls. This mobility shall prevent the jamming of the pills in the channel caused by shingling.

Relatively complex tools and molds are required for manufacturing a supply tube of the above-mentioned kind. It is the object of the invention to provide a supply tube, which prevents jamming of the products conveyed therein as a result of shingling and which can be manufactured in a simple manner.

This object is solved by the features defined in claim 1. Advantageous embodiments of the invention and a method of manufacturing a supply tube are subject matter of further claims.

Summary of the invention

The conveying channel in the supply tube according to the invention has sections, which are basically formed as sections of a thread, which, however, have opposing inclination directions in successive sections. When falling through the conveying channel caused by the effect of gravity, the tablets, pills, capsules, dragées and similar products, hereinafter referred to as "pills", perform a dual-lurching movement. From a radial perspective successive sections of the conveying channel are inclined alternately in different directions with respect to a longitudinal plane of the supply tube thereby enclosing an angle of less than 45° with the longitudinal plane, and from an axial perspective the cross-section of said successive sections is distorted about an angle of up to 90° around the longitudinal plane.

The reversal of the lurching movement takes place at the transition points between successive channel sections, with the consequence that successive pills inevitably move relative to one another. The individual pills virtually move in a dual-lurching manner when they pass through the supply tube. Thus, a jamming of successive pills as a result of the shingling effect is surely avoided even if the movement of the pills through the supply channel is interrupted due to dosage conditions.

The movement course of the pills in the conveying channel in the supply tube according to the invention therefore fundamentally differs from the one that is shown in the mentioned US 2004/0035878 A1, since there the pills may fundamentally keep their position with respect to each other.

Besides the preference of the greater safety against a jamming of the pills caused by the effect of shingling the invention has the advantage over the prior art that the supply tube can be manufactured in a very simple manner, either by machining a massive component or by an injection molding process.

In a preferred embodiment of the invention the supply tube consists of a core body, which has a groove having sections extending in an inclined direction with respect to the longitudinal plane of the core body, said sections having opposite inclination directions at successive sections, and a cladding tube which surrounds the core body and which laterally closes the groove for forming a conveying channel.

The groove may be machined in the core body by a method comprising the following steps: providing a longitudinal massive rod, a longitudinal rotating end mill and a longitudinal cladding tube; penetrating the rod with the rotating end mill in a radial direction thereby forming a groove in the rod which is in parallel to a central longitudinal plane of the rod; moving the rod and the rotating end mill against each other in a longitudinal direction of the rod while rotating the rod in sections back and forth about up to 90° around said longitudinal plane; enveloping the rod with the cladding tube. The rotation of the core body may be up to approximately 90°. The end mill thereby leaves a groove in the core body, which, depending on the control of the movement courses on the surface of the core body, extends more or less wavelike or in a zigzag course. To obtain relatively sharp edges in the case of a zigzag-shaped course an end mill with a respectively small diameter may possibly be used, wherein, however, multiple milling processes are to be carried out with mutual offset of the individual milling grooves with respect to the core body.

Thus, complex molds do not have to be built for this manufacturing process. Only a machine control program of the simple kind is required which is to be input into a program-controlled milling machine.

A manufacture in injection molding technology is also simple. A supply tube manufactured by injection molding consists of two half-shells, which are joined at a joint face extending in the longitudinal direction of the supply tube and which each comprise a groove that forms a partial cross-section of the conveying channel.

The invention will now be explained in detail with reference to the embodiment shown in the drawings.

Short description of the drawings

Fig. 1 shows the core body of a two-piece supply tube.

Fig. 2 shows the cladding tube determined for accommodating the core body of Fig. 1.

Fig. 3 is a top view of the core body of Fig. 1.

Fig. 4 shows the two matching shells of a two-piece supply tube according to an alternative embodiment.

Fig. 5 shows the two matching shells of a two-piece supply tube according to another alternative embodiment and a number of tablets in successive positions that they take when passing through the conveying channel in the supply tube formed by the two shells.

Detailed description of preferred embodiments of the invention

Fig. 1 and 2 show the two portions of a supply tube, Fig. 1 showing a core body K of circular cross-section provided with a substantially longitudinal groove N, and Fig. 2 showing a cladding tube H determined for accommodating the core body K.

The groove N formed in the core body K substantially extends along and on both sides of a central longitudinal plane. It reveals a straight section 1 in the lower part of the core body K, and sections 1a and 1b in the upper portion of the core body K which are alternately inclined towards the longitudinal plane thereby enclosing an angle with said longitudinal plane from a radial perspective. In the present example, this angle is approximately 30° so that two adjacent sections 1a and 1b enclose an angle of

approximately 120° . In the radial perspective, the groove N in the core body K therefore extends in the partial portion determined by sections 1a and 1b in a zigzag shape on both sides of a the longitudinal plane which is defined by the straight section 1.

In an axial perspective, said sections 1a and 1b have cross-sections, which are distorted against each other in alternate directions, wherein the angle of distortion is determined by the inclination of the groove sections 1a and 1b with respect to the longitudinal plane. This is the result of a preferred type of manufacture, according to which the longitudinal core body K having a circular cross-section is moved along a longitudinal rotating end mill in a longitudinal direction of the core body while the core body is rotated in sections back and forth about up to 90° around said longitudinal plane. In the example shown, this distortion is approximately $\pm 20^\circ$, which is shown by the angle α in Fig. 3. In the area of the groove sections 1a and 1b, the groove N is therefore not only defined by a two-dimensioned wave or zigzag line but also has a third, namely a rotary, component, which results from the fact that the end mill is kept stationary during rotation and translational displacement of the core body.

This produces a conveying channel, in which a product conveyed through it, for instance a pill, does not only perform an see-saw movement but also a lurching movement in which the pill oscillates around two axes perpendicular to one another. The angle of rotation α , about which the core body K is rotated during the milling process around its longitudinal plane, can well be seen in Fig. 3.

It can be seen in Fig. 3 that the channel is in partial areas thereof restricted by inclined wall sections 2a and 2b. In the top view onto the core body K, which is shown in Fig. 3, the first inclined wall section 2a can be seen, which belongs to the groove section 1a, followed by the inclined wall section 2b arranged in offset fashion behind the groove section 1a, said wall section 2b belonging to the following groove section 1b which has a inclination in a direction opposite to the first groove section 1a.

The inclination of the groove sections 1a and 1b with respect to the longitudinal plane in a radial view is determined by the ratio of the angle of rotation α and the speed of the translational displacement of the core body during manufacturing. The inclination must be sufficiently large that at the transition points from the channel section having the one inclination direction to the channel section having the other inclination direction a smooth passage of the pills through the conveying channel is ensured, and in the case of a

zigzag-like extending groove, the inclination should be selected so that the angle enclosed by two successive groove sections 1a and 1b is obtuse. In the example shown, the overall angle of rotation α is approximately 40° , i.e. when producing the groove sections 1a and 1b, the core body K in the present example is rotated about up to 20° in the one and the other direction with respect to the longitudinal plane, i.e. the position that it has when milling the axially extending groove section 1.

The cladding tube H shown in Fig. 2 is in the assembled state of the supply tube slid over the core body K to laterally close the groove N and to thereby complete the conveying channel so that the products conveyed through the groove N cannot escape from the supply tube in an uncontrolled manner. The cladding tube H does not have to be explained in more detail.

The core body K may be made of any suitable material which has a sufficient stability, e.g. of aluminum or plastics, possibly of glass fiber reinforced plastics. The same applies to the cladding tube H.

Fig. 4 shows a second embodiment of a supply tube according to the invention. This tube consists of two matching shells 3 and 4, which are determined to be joined at their joint faces 5 and 6. Both shells 3 and 4 have grooves 7 and 8, which in the joined state of the shells 3 and 4 form a conveying channel. The course of the grooves is not zigzag-shaped like the groove N in the example of Fig. 1, but it is wavelike. At its lower end the one shell 3 has a plug portion 9, whereas the other shell 4 has a matching receptacle portion 10. At their upper ends the shells 3 and 4 are provided with half-flanges 11 and 12, which in the joined state form a circular contour and are suitable to be inserted into a respective receptacle of a circular cross-section, for instance an outlet opening of a reservoir.

Since in the embodiment according to Fig. 4 the conveying channel formed by the two grooves 7 and 8 has a course wound in alternating directions, pills moving through this conveying channel perform dual-lurching movements when passing through the channel in which the pills oscillate about two axes that are perpendicular with respect to each other. This movement course prevents successive pills from shingling and getting jammed.

Fig. 5 shows another alternative embodiment of a supply tube according to the invention consisting of two matching shells 3 and 4, which are determined to be joined at joint faces 5 and 6. In this embodiment, the grooves 7 and 8 in the shells 3 and 4 are formed such that the conveying channel formed by the joining of the shells 3 and 4 has a course that is similar to the one that is realized in the embodiment according to Fig. 1. Contrary to Fig. 1, the conveying channel is, however, arranged centrically in the supply tube formed by the joined shells 3 and 4.

Moreover, Fig. 5 shows a temporary position of five tablets T that these take with respect to each other when they pass through the conveying channel of the embodiment of Fig. 5. As can be seen, in the positions shown the individual tablets T are distorted against each other, which is determined by the course of the conveying channel. In a subsequent phase (not shown) all tablets must rotate in the position that was taken by the previous tablet. The tablets T must therefore rotate with respect to each other on their edges, which prevents the shingling described above.

The shells 3 and 4 shown in Fig. 4 and 5 can be manufactured by injection molding. For this purpose, slide-less injection molds can be used, which may require a proper selection of the position and the course of the joint faces 5 and 6.

The supply tubes according to the invention may be inserted in an apparatus as it is described in the above-mentioned US 2004/0035878 A1 without further modifications having to be made on this apparatus. Regarding the further function, particularly with respect to the dosing mentioned, reference is made to US 2004/0035878 A1.

Claims

1. Supply tube having a conveying channel formed therein, said conveying channel having a substantially rectangular cross-section for supplying tablets, pills, capsules, dragées and similar products from a reservoir under the effect of gravity successively to a receptacle, wherein a central longitudinal plane is defined in a longitudinal direction of the supply tube, wherein the conveying channel comprises a plurality of successively arranged sections (1a, 1b) adjoining one another, wherein from a radial perspective successive sections (1a, 1b) are inclined alternately in different directions with respect to the longitudinal plane of the supply tube thereby enclosing an angle of less than 45° with the longitudinal plane, and wherein from an axial perspective the cross-section of said successive sections (1a, 1b) is distorted about an angle of up to 90° around the longitudinal plane.
2. Supply tube as claimed in claim 1, further consisting of two shells (3, 4) joined at a joint face (5, 6) extending in a longitudinal direction of the tube, said shells having a groove (7, 8) extending in said longitudinal direction in a non-linear manner, said grooves each forming a partial cross-section of the conveying channel.
3. Supply tube as claimed in claim 1, further consisting of a core body (K) and a cladding tube (H) enclosing the core body (K), wherein the conveying channel in the core body (K) is formed by a groove (N), said groove having sections (1a, 1b) extending in an inclined direction with respect to the longitudinal plane of the core body (K), said sections having opposite inclination directions at successive sections (1a, 1b), and wherein said cladding tube (H) laterally closes the groove (N).
4. A method of producing the supply tube of claim 3 including the steps of:

providing a longitudinal massive rod for forming the conveying channel, a longitudinal rotating end mill and a longitudinal cladding tube;

penetrating the rod with the rotating end mill in a radial direction thereby forming a groove in the rod for the conveying channel which is in parallel to a central longitudinal plane of the rod;

moving the rod and the rotating end mill against each other in a longitudinal direction of the rod while rotating the rod in sections back and forth to form successive sections that, from an axial perspective, are distorted about an angle of up to 90° around said longitudinal plane and that, from a radial perspective, are inclined alternately in different directions with respect to the longitudinal plane of the supply tube thereby enclosing an angle of less than 45° with the longitudinal plane;

enveloping the rod with the cladding tube to enclose the core body.

5. A method as claimed in claim 4, wherein the rod is processed successively several times by an end mill of a diameter that is smaller than the width of the groove to be cut in the rod, wherein the intersecting grooves formed by the end mill are offset with respect to each other.