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(54) Title: APPARATUS AND METHOD FOR FEEDING ROD-SHAPED ARTICLES

(57) Abstract: An apparatus is provided for arranging rod-shaped articles to be fed into pockets on an endless conveyor operable to travel in a conveyance direction, the apparatus comprising: \( \text{a hopper (2) operable to receive rod-shaped articles and to arrange the rod-shaped articles to be fed into the pockets on the endless conveyor; a main feeder (700,800) positioned vertically above the hopper and operable to feed a mass flow of first rod-shaped articles downwards into the hopper; a lateral feeder spaced laterally from the hopper (2) in the conveyance direction, wherein the lateral feeder is connected to a feeding tube terminating in a feeding outlet, wherein the feeding tube (F) is operable to feed second rod-shaped articles into the apparatus via the feeding outlet.} \)
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Apparatus and Method for Feeding Rod-Shaped Articles

The invention relates to an apparatus for the forming of collations of rod-shaped articles, in particular smoking articles. The invention further relates to a method of forming a collation of rod-shaped articles and to a container comprising rod-shaped articles, which have been formed into a collation by the inventive method.

Devices for forming groups of rod-shaped articles are known. For example, US-A-5,775,054 discloses an apparatus wherein three layers of cigarettes are fed subsequently from a hopper into pockets on a conveyor belt. EP 2 008 935 A1 discloses a packing machine for cigarettes, wherein only one type of smoking article can be packaged in one container.

It is known in the art that different types of rod-shaped articles can be arranged in a predetermined arrangement of rod-shaped articles, a so-called "collation" of rod-shaped articles. However, the arrangement of rod-shaped articles is restricted to the provision of a whole different layer or column of rod-shaped articles in the respective pockets, and the arrangement is in particular limited in that different smoking articles cannot be provided in the center of the collation of the smoking articles. EP 0 141 629 A1 discloses a packing machine, which enables to separately wrap two smoking article groups, which can then be packed together in one container.

WO 201 4/01 5940 discloses an apparatus that enables a predetermined collation of rod-shaped articles comprising at least two different types of rod-shaped articles to be formed. All possible collations of rod-shaped articles may be manufactured using this apparatus.

It is an object of the invention to provide an apparatus and associated method which allows the more efficient utilisation of space along the path of a production line and the improved utilisation of the space available in a production facility, as
well as an arrangement for making a predetermined collation comprising first and second rod-shaped articles which incorporates such an apparatus.

According to a first aspect of the invention, an apparatus is provided for arranging rod-shaped articles to be fed into pockets on an endless conveyor operable to travel in a conveyance direction, the apparatus comprising:

- a hopper operable to receive rod-shaped articles and to arrange the rod-shaped articles to be fed into the pockets on the endless conveyor;
- a main feeder positioned vertically above the hopper and operable to feed a mass flow of first rod-shaped articles downwards into the hopper;
- a lateral feeder spaced laterally from the hopper in the conveyance direction, wherein the lateral feeder is connected to a feeding tube terminating in a feeding outlet, wherein the feeding tube is operable to feed second rod-shaped articles into the apparatus via the feeding outlet.

The term "spaced laterally from the hopper in the conveyance direction" means that the lateral feeder is spaced laterally from the hopper as seen in the conveyance direction or spaced laterally in a direction transverse to the conveyance direction, respectively. The conveyance direction of the endless conveyor is preferably parallel to the path of a production line.

The orientation of the longitudinal extension of the rod-shaped articles when being in the hopper is preferably orthogonal to the conveyance direction of the endless conveyor. Accordingly, the lateral feeder may be spaced laterally from the hopper in a direction parallel to the orientation of the longitudinal extension of the rod-shaped articles when being in the hopper. The longitudinal extension of the rod-shaped article is the main extension direction of the rod-shaped article.

For arranging the rod-shapes articles, the hopper may comprise a plurality of hopper vanes spaced apart from each other in a side-by-side configuration. Accordingly, the lateral feeder may be spaced laterally from the hopper as seen in direction along the side-by-side configuration of the hopper vanes or spaced
laterally in a direction transverse to a direction along the side-by-side configuration of the hopper vanes, respectively.

By locating the lateral feeder in a position as defined according to the first aspect of the invention, the space in the path of the production line may be utilised more effectively, which may reduce the cost and effort of constructing the production line and allow improved access to machinery located in the path of the production line for maintenance and other purposes. In addition, un- and under-utilised space in other areas of a production facility may more effectively be used. In some circumstances, it may be appropriate to locate the lateral feeder remotely from the hopper in a distant part of the production facility. In other circumstances, it may be appropriate to locate the lateral feeder immediately adjacent to and on one side or the other of the hopper in the conveyance direction, if space is available.

Preferably, an output of the lateral feeder is connected to the feeding tube terminating in the feeding outlet, wherein the feeding tube is operable to feed second rod-shaped articles into the apparatus, in particular into the hopper, via the feeding outlet.

According to one aspect of the apparatus of the first aspect of the invention, the feeding tube may be operable to feed second rod-shaped articles into the hopper via the feeding outlet. In one embodiment, the hopper has a proximal wall located adjacent to the endless conveyor, the proximal wall defining a proximal plane, and a distal wall located laterally of the proximal wall in a direction orthogonal to the conveyance direction, the distal wall defining a distal plane. According to this embodiment, the feeding tube traverses the proximal plane or the distal plane. Advantageously, the feeding tube traverses the respective plane at an angle which is orthogonal to that plane, to feed the second rod-shaped articles into the hopper via the feeding outlet.

According to another embodiment of the apparatus of the first aspect of the invention, the feeding outlet is positioned beneath the main feeder. Alternatively,
the feeding tube may enter the main feeder and is operable to feed the second rod-shaped articles into the mass flow of the first rod-shaped articles in the main feeder via the feeding outlet. In these cases, the apparatus may additionally comprise a deflector positioned above the feeding outlet to deflect the mass flow of the first rod-shaped articles from the feed of the second rod-shaped articles. Feeding the second rod-shaped articles into the mass flow of the first rod-shaped articles in the main feeder via the feeding outlet may allow randomized feeding of first and second rod-shaped articles into the pockets. The degree of randomization may depend upon how far the feeding outlet is positioned above the bottom of the main feeder. Alternatively or additionally, randomization may be achieved by feeding second rod-shaped articles intermittently into the main feeder.

According to one aspect of the apparatus of the first aspect of the invention, the feeding tube may have an interior diameter which is greater than the exterior diameter of the second rod-shaped articles that it is intended to convey by an amount sufficient to allow single ones of the second rod-shaped articles to be conveyed in series end-to-end, but not by an amount sufficient to allow more than one of the second rod-shaped articles to be conveyed in parallel.

According to a further aspect of the apparatus of the first aspect of the invention, the lateral feeder may be positioned offset above the hopper, such that it is operable to feed the second rod-shaped articles into the hopper under gravity. Gravity-feeding is generally less energy-intensive than alternative methods and therefore environmentally-friendly. In such a case, the lateral feeder is disposed to feed rod-shaped articles at an angle to the horizontal, since it is offset from the hopper by virtue of being displaced laterally from it. Advantageously, the angle to the horizontal is less than or equal to 30 degrees, preferably less than or equal to 15 degrees more preferably less than or equal to 10 degrees.

Alternatively or additionally, the apparatus according to the first aspect of the invention may comprise transport means operable to transport the second rod-shaped articles in a feeding direction through the lateral feeder, and said
transport means may comprise pneumatic conveyancing means, mechanical conveyancing means, or a combination thereof.

If the rod-shaped articles are transported only by transport means, then according to one embodiment of the apparatus according to the first aspect of the invention, the transport means may be turned on and off intermittently, to supply the second rod-shaped articles also intermittently, for example so that the second rod-shaped articles are available to be fed only to every other pocket, every third pocket and so on.

The pneumatic conveyancing means may comprise a source of gas, preferably air, operable to move in the feeding direction to pneumatically convey the second rod-shaped articles through the lateral feeder and into the hopper.

The mechanical conveyancing means may comprise vibrating means, preferably ultrasonic vibrating means. Such vibrating means may also facilitate the smooth transport of rod-shaped articles and prevent blockages of rod-shaped articles as a result of static friction. Optionally, one or more sources of gas, preferably air, may additionally be present. According to one embodiment, at least a component of the source of gas or each source of gas being operable to move in at least one of:

(a) the feeding direction to assist the mechanical conveyancing means by additionally pneumatically conveying the second rod-shaped articles through the lateral feeder and into the hopper;

(b) a direction counter to the feeding direction to provide an air cushion to reduce friction between the second rod-shaped articles and the lateral feeder as the second rod-shaped articles move in the feeding direction.

In some embodiments, it is possible to employ two or more sources of gas moving in different, even opposed directions, if each flow of gas is present in different, localised parts of the lateral feeder. For example, one source of gas may be provided in the center of the lateral feeder to move in the conveyance
direction, while other sources of gas may be provided at the sides to move in a direction counter to the conveyance direction. Alternatively, the converse configuration may be advantageous, and sources of gas at the sides may move in the conveyance direction, while a source of gas in the center may move counter to the conveyance direction. In a further embodiment, any source of gas may move in a direction which is neither fully in the conveyance direction or counter to the conveyance direction, such that only a component of the gas flow is in the conveyance direction or counter to it.

According to a further aspect of the apparatus according to the first aspect of the invention, the main feeder is operable to feed the first rod-shaped articles into the hopper under gravity. Additionally, or alternatively, other transport means as described in relation to the lateral feeder may be provided.

According to a second aspect of the invention an arrangement is provided for forming a predetermined collation of rod-shaped articles, in particular smoking articles, comprising the apparatus of the first aspect of the invention, rod-shaped articles and pockets. According to this arrangement of the second aspect of the invention, each pocket is adapted to house a predetermined number of rod-shaped articles in the predetermined collation and in the predetermined collation each rod-shaped article has a predetermined position within the pocket. Furthermore, the hopper comprises a plurality of hopper vanes and each hopper vane of the plurality of hopper vanes is at least associated with one predetermined position in the pocket. The main feeder is adapted to provide first rod-shaped articles to a first subset of hopper vanes of the plurality of hopper vanes. According to the arrangement of the second aspect of the invention, the feeding tube is adapted to provide second rod-shaped articles to a second subset of hopper vanes of the plurality of hopper vanes. In the arrangement according to the second aspect of the invention, the apparatus comprises an additional feeder, and the additional feeder is adapted to provide third rod-shaped articles to a third subset of hopper vanes of the plurality of hopper vanes.
As used herein, the term "vane" refers to a chute, into which rod-shaped articles may be fed at one end and from which rod-shaped articles may be removed at the other, and which is sufficiently enclosed on all sides to retain rod-shaped articles therein such that they may only be fed and removed at the ends.

According to the arrangement of the second aspect of the invention, each of the first, second and third rod-shaped articles may be the same as one another or they may be different from one another. Advantageously, at least one of the first, second and third rod-shaped articles is different from the other two types of rod-shaped article. Alternatively, each type of rod-shaped article may be different from each other type of rod-shaped article, such that the first rod-shaped articles are different from the second and third rod-shaped articles and the second rod-shaped articles are different from the third rod-shaped articles.

According to one aspect of the arrangement according to the second aspect of the invention, the additional feeder may also be spaced at least partially laterally from the hopper. Furthermore, the additional feeder may be operable to feed the third rod-shaped articles into the hopper under gravity. Additionally, or alternatively, transport means as described in relation to the lateral feeder may be provided.

According to the second aspect of the invention, each layer of rod-shaped articles in a predetermined collation of rod-shaped articles is advantageously provided at a separate transfer location of the hopper vanes specific to that layer, referred to herein as a "transfer location". The transfer locations are provided at sequential positions adjacent to the endless conveyor in the conveyance direction, such that a first layer is provided at a first transfer location, a second layer is provided over the first layer at a second transfer location, a third layer is provided over the second layer at a third transfer location, and so on if additional layers are provided at additional transfer locations.

Preferably, according to one aspect of the arrangement according to the second aspect of the invention, the first, second and third subsets of hopper vanes and
the separate transfer locations of the hopper vanes are different, such that different types of rod-shaped articles may be comprised in a layer of the different layers of rod-shaped articles fed into a pocket (if the rod-shaped articles fed into the different subsets of hopper vanes that supply a transfer location are also different from one another). In other words, transfer locations may comprise hopper vanes of more than one subset of hopper vanes. Thus, if each subset of hopper vanes provides different rod-shaped articles, different types of rod-shaped articles may be provided by one transfer location of hopper vanes, and accordingly a layer fed into the pocket will comprise more than one type of rod-shaped article. Thus, according to a preferred embodiment of the second aspect of the invention, a collation of up to three different types of rod-shaped articles can be arranged in a pocket, each type of rod-shaped article being provided at a predetermined location within the collation.

Advantageously, according to one aspect of the arrangement according to the second aspect of the invention, each hopper vane is associated with one collation column or one collation layer. The hopper vane may provide several rod-shaped articles, which form a collation column or a collation layer. Alternatively, the hopper vane may provide only one rod-shaped article, which is part of a collation column or collation layer, while other hopper vanes provide the remaining rod-shaped articles of the collation column or collation layer.

Preferably, the number of hopper vanes of the plurality of hopper vanes in the hopper corresponds to the number of rod-shaped articles in the predetermined collation such that each hopper vane is associated with a predetermined position for a rod-shaped article in the predetermined collation. This allows the greatest number of variations of collations of rod-shaped articles which may be formed, because any collation may be formed, as the type of each rod-shaped article in the pocket can be determined individually.

Advantageously, according to a further aspect of the arrangement according to the second aspect of the invention, the pocket and the hopper vanes are adapted to be moved relative to one another after feeding a layer of rod-shaped articles
into the pocket. This allows the feeding of several layers of rod-shaped articles into the pocket, from transfer locations being arranged at different, sequential positions in the conveyance direction. The transfer locations may be provided at differing heights for transferring the respective rod-shaped articles to the pocket. More particularly, a first transfer location of hopper vanes may be provided at a lower height than a second transfer location of hopper vanes in the conveyance direction, and the second transfer location of hopper vanes may be provided at a lower height than a third transfer location of hopper vanes in the conveyance direction and so forth.

According to one aspect of the arrangement according to the second aspect of the invention, the pocket may be movable between the transfer locations on the endless conveyor. Additionally, the hopper vanes may themselves be movable with respect to the pocket in the conveyance direction or in the opposite direction. Furthermore, the hopper vanes may be movable vertically with respect to the pocket.

A plurality of pockets is provided on the endless conveyor. The endless conveyor is operable to move in the conveyance direction and bring each pocket into alignment with and stop beside a transfer location adjacent to the endless conveyor, in order to be fed a layer of rod-shaped articles. Each pocket is then moved to the sequentially next transfer location where it stops, to receive a further layer of rod-shaped articles, and so on. Each pocket stops consecutively at each of the transfer locations, for receiving a layer of rod-shaped articles from each of the transfer locations, although it may receive a column instead. The conveyor may be a belt, chain or any other suitable conveyor. The respective layers after the first layer may be provided consecutively one on top of the other.

According to the second aspect of the invention, one or more further feeders may be provided, each of which being configured to feed rod-shaped articles which are the same or different to rod-shaped articles fed by one or more of the main feeder, the lateral feeder and the additional feeder. Further subset(s) of hopper vanes may be provided for each additional feeder.
With regard to the hopper vanes, these may extend substantially in the vertical direction and be arranged in groups, each group corresponding to a transfer location, whereby a group may or may not be the same as a "subset of hopper vanes" and is preferably not the same. Typically, each hopper vane in a group of hopper vanes has an inlet at the end closer to the feeder(s) and an outlet at the end closer to the endless conveyor, the outlets advantageously being arranged adjacent to each other at the same height. The hopper vanes may be slightly inclined with respect to one another, such that the distance between the hopper vanes of each transfer location of hopper vanes is reduced towards their downstream end, such that rod-shaped articles which are transferred together from a transfer location to form a layer in the pocket may be packed relatively close to one another. However, at the upstream end of the hopper vanes, all hopper vanes of each subset, or of all transfer locations are preferably substantially equidistant. This facilitates the feeding of the rod-shaped articles from the feeder arrangement to the hopper vanes. As used herein, the term "downstream" refers to a position displaced from a given position in the conveyance direction and the term "upstream" refers to a position displaced from a given position in the opposite direction to the conveyance direction.

Preferably, the lower ends of the hopper vanes at a transfer location are at the same level as the layer of rod-shaped articles provided by this transfer location of hopper vanes into the pocket. A pushing means is adapted to push the rod-shaped articles into the pockets. The pushing movement is preferably substantially in the direction of the longitudinal extension of the rod-shaped articles.

Preferably each chute has a width slightly larger than the diameter of the rod-shaped articles. Thus, only one rod-shaped article may be arranged at the same height in each chute, while several rod-shaped articles may be provided parallel and adjacent to each other in the extension direction of the hopper vane. Preferably, the depth of the hopper vane is slightly larger than the length of the rod-shaped articles in the longitudinal direction. Thus, the rod-shaped articles are
provided in defined positions in the hopper vanes.

The maximum number of hopper vanes preferably corresponds to the maximum number of rod-shaped articles provided in one pocket, as each hopper vane is preferably assigned to a specific position in the pocket.

The rod-shaped articles may be transferred in one or several steps to the pocket.

According to the one aspect of the arrangement according to the second aspect of the invention, the pocket may be rectangular, trapezoid or triangular in cross-section, but is preferably rectangular. The pocket may, for example, be cuboid, or trapezoid in shape, and is preferably a rectangular cuboid.

It will be appreciated that, through an appropriate choice of its dimensions, the pocket may house different total numbers of rod-shaped articles or different arrangements of rod-shaped articles, referenced herein with the term "collation". For example, the pocket may house a total of between ten and thirty rod-shaped articles. The rod-shaped articles may be arranged in different collations, depending on the total number of rod-shaped articles. For example, the rod-shaped articles may be arranged in a single layer of six, seven, eight, nine or ten. Alternatively, the rod-shaped articles may be arranged in two or more layers. The two or more layers may contain the same number of rod-shaped articles or may contain different numbers of rod-shaped articles to each other.

By means of the arrangement according to the invention different types of rod-shaped articles can be provided in different, predetermined layers and columns within the pocket to form a predetermined collation. The different types of rod-shaped articles may relate to rod-shaped smoking articles of different length, diameter, filter construction, brands, colors and combinations thereof.

The predetermined collation may comprise up to three different parts, being the first, second and third rod-shaped articles, when all three are different from one another. It may even contain more than three if additional feeders feeding further
types of rod-shaped articles are present. Typically, the pocket has a substantially rectangular cross-section defining an opening through which rod-shaped articles may be fed when a pocket is filled and subsequently removed by a consumer of the rod-shaped articles. When viewed after filling, the collation may comprise layers of rod-shaped articles extending along the longer side of the rectangle and columns of rod-shaped articles extending substantially along the shorter side of the rectangle. Typically, each layer comprises five to seven rod-shaped articles and each column comprises three rod-shaped articles. Thus, the pockets typically contain fifteen to twenty-one rod-shaped articles.

Rod-shaped articles may be omitted from the columns and/or layers in a pocket. Protrusions or place holders may be provided for this purpose. In addition, or alternatively, spacers may be provided, which may take the place of one or more rod-shaped articles. A spacer may have the size and shape of one rod-shaped article or of a plurality of rod-shaped articles or it may be cup-shaped. In cross-section, it may be circular, semi-circular, oval, hexagonal, triangular, or have any other suitable shape. In one embodiment, a spacer may have the size and shape of an odd number of rod-shaped articles, such as three or five rod-shaped articles, which may be arranged as a pyramid. The spacer may comprise a folded blank, a resilient material, such as a foam, may be at least partially hollow or may comprise a mixture thereof.

The columns of rod-shaped articles may not always be straight, but the rod-shaped articles in each of the layers may be offset from one another to allow for tighter packing of the rod-shaped articles. Preferably, the rod-shaped articles in one layer are offset by the radius of a rod-shaped article from the rod-shaped articles in each adjacent layer.

The rod-shaped articles may be longitudinally extending smoking articles. The longitudinal extension of the smoking article is the main extension direction of the smoking article. In particular, the smoking article is cylindrical and the longitudinal axis is its central axis. Where the rod-shaped articles have a substantially cylindrical form, the nappe is preferably parallel to the longitudinal extension.
direction. In particular, the rod-shaped articles are cigarettes, filter cigarettes, cigars, or components for smoking devices. Components for smoking devices may be longitudinally extending smoking material rods, which are inserted into a heating device, such as an electrical or carbonaceous heating device, and which are heated but not burned during consumption. The rod-shaped articles may also be other rod-shaped articles of similar size and dimensions including, for example, smoking accessories, such as flavor-reservoirs or elongate ash-trays that are arranged in substitution for one or several smoking articles in the collation. In particular, a smoking accessory may be arranged such that it occupies the space which would be usually allocated to one or several smoking articles in the collation. Furthermore, rod-shaped spacer elements may be included in a collation. Such spacer elements may be cylindrical, but need not be and may instead have a square, a triangular or other suitable cross-section. In addition, such spacer elements may occupy the volume of a single rod-shaped article or the volume of a plurality of rod-shaped articles. For example, a triangular spacer may occupy the volume of three or five of the rod-shaped articles which are otherwise comprised within a pocket.

According to a third aspect of the invention, a method is provided for arranging rod-shaped articles to be fed into pockets on an endless conveyor travelling in a conveyance direction, the method comprising:

- providing a hopper;
- providing a main feeder positioned vertically above the hopper, the main feeder comprising first rod-shaped articles and feeding the first rod-shaped articles downwards into the hopper;
- providing a lateral feeder spaced laterally from the hopper in the conveyance direction, the lateral feeder being connected to a feeding tube terminating in a feeding outlet, the lateral feeder comprising second rod-shaped articles;
- feeding the second rod-shaped articles from the second feeder, through the feeding tube and into the apparatus via the feeding outlet;
- whereby the hopper receives the rod-shaped articles and arranges them to be fed into the pockets on the endless conveyor.
According to one aspect of the method according to the third aspect of the invention, the method additionally comprises the step of transporting the second rod-shaped articles in a feeding direction through the feeding tube by pneumatic means, by mechanical means, or by a combination thereof.

According to a fourth aspect of the invention a container comprising rod-shaped articles is provided, which rod-shaped articles have been formed into a predetermined collation by the method according to the third aspect of the invention or by an arrangement of the second aspect of the invention, such that the container comprises at least two different types of rod-shaped articles, wherein the container comprises columns and rows with different types of rod-shaped articles.

Embodiments of the invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 illustrates a frontal cross-section of a prior art apparatus;

Figure 2 illustrates a side view of the prior art apparatus of Figure 1;

Figure 3 illustrates a perspective view of an embodiment of an apparatus according to the first aspect of the invention and an arrangement according to the second aspect of the invention;

Figure 4 illustrates a side view of another embodiment of an apparatus according to the first aspect of the invention and an arrangement according to the second aspect of the invention; and

Figure 5 illustrates a side view of another embodiment of an apparatus according to the first aspect of the invention and an arrangement according to the second aspect of the invention.
With reference to Fig. 1, the feeder arrangement 1 comprises a first feeder 6, a second feeder 7, and a third feeder 8. Each of the feeders 6, 7, 8 provides rod-shaped articles to the hopper 2. The three feeders, 6, 7, 8, are arranged in a linear fashion in the conveyance direction along the production line, parallel to the endless conveyor.

The hopper 2 comprises a plurality of hopper vanes 9, wherein a first subset 10 of hopper vanes 9 is assigned to the first feeder 6, a second subset 11 of hopper vanes 9 is assigned to the second feeder 7, and a third subset 12 of hopper vanes 9 is assigned to the third feeder 8. In particular, the first feeder 6 is arranged above the first subset 10 of hopper vanes 9, the second feeder 7 is arranged above the second subset 11 of hopper vanes 9, and the third feeder 8 is arranged above the third subset 12 of hopper vanes 9. Each of the feeders 6, 7, 8, respectively provides different types of rod-shaped articles 13, 14, 15 to the different hopper vanes 9.

The hopper vanes 9 are arranged substantially in an equal distance at their upper edge, which is adjacent to the feeders 6, 7, 8 of the feeder arrangement 1. In the downstream direction, the feeder vanes 9 are inclined towards each other to provide separate transfer locations at their downstream ends. In particular, the hopper vanes 9 are grouped into a first transfer location 16, a second transfer location 17, and a third transfer location 18. Each of the transfer locations 16, 17, 18 of hopper vanes 9 provide one layer of rod-shaped articles 13, 14, 15 into the pockets 3, 4, 5. The pockets 3, 4, 5 are arranged on an endless conveyor, which is a conveyor belt 19. After the pocket 3 has received the first layer of rod-shaped articles, comprising a first type of rod-shaped articles 13 and a second type of rod-shaped articles 14, the pocket 3 moves on the conveyor belt 19 to the further downstream position as shown for pocket 4, such that it can receive rod-shaped articles 14, 15 from the second transfer location 17 of hopper vanes 9. The second transfer location 17 of hopper vanes 9 provides rod-shaped articles of the second type 14 and of a third type 15. After having received the second layer of rod-shaped articles 14, 15 from the second transfer location 17 of hopper vanes 9, the pocket 4 moves into the further downstream position as shown for pocket 5.
in figure 1 by means of the conveyor belt 19. Then, the third transfer location 18 provides a third layer of rod-shaped articles to the pocket, wherein the hopper vanes 9 of the third transfer location 18 only comprise rod-shaped articles of the third type 15.

Thus, finally, three layers of rod-shaped articles 13, 14, 15 are provided in the pocket 3, 4, 5, wherein the first layer comprises one smoking article of the first type 13 in the rightmost position, and the remaining rod-shaped articles of the first layer are rod-shaped articles of the second type 14. The middle layer of the rod-shaped articles in the pocket is comprised of rod-shaped articles of the second type 14 and the third type 15, and the third layer of the rod-shaped articles in the pocket is comprised of rod-shaped articles of the third type 15 only. Thus, depending on the arrangement of the feeders 6, 7, 8 above the hopper vanes 9 defining the subsets 10, 11, 12, any combination of rod-shaped articles can be provided in the pockets. The smoking article of the first type 13 forms a first part of the collation, the smoking articles of the second type 14 form a second part of the collation, and the smoking articles of the third type 15 form a third part of the collation.

In Figure 2, a cross section of the rightmost feeder 6, hopper vane 9, and pocket 3 as seen in the side view is shown. The rod-shaped articles of the first type 13 fall from the first feeder 6 into the rightmost hopper vane 9, wherein they are arranged on top of each other in a single column of rod-shaped articles 13. The lowermost smoking article 13 is engaged by a pushing means 20, in particular in the form of a linear drive, which comprises a protruding pushing element 21 that can be moved linearly in the direction of the pocket 3 and transfers the smoking article 13 into the pocket 3 along the smoking article's longitudinal direction. In particular, the pushing means 20 may engage all rod-shaped articles 13, 14 of the transfer location of hopper vanes, such that all rod-shaped articles of one layer are transferred at the same time into the pocket 3. The same applies regarding the transfer of the rod-shaped articles 14, 15 of the second and third layer into the pockets 4 and 5.
Figure 3 illustrates an embodiment of a device and an arrangement according to the invention. In this figure, identical reference numbers used in Figure 3 denote identical elements to those denoted by the reference number in Figure 1 or Figure 2. This embodiment functions in the same way as the embodiment of Figure 1, but is configured differently to remove one of the feeders from the production line and move it into unoccupied space located laterally of the production line, thereby creating space in the path of the production line. The feeder arrangement 100 comprises a lateral feeder (not shown) connected to a feeding tube F, a main feeder 700, and an additional feeder 800. Each of the feeders provides rod-shaped articles to the hopper 2. In this embodiment, two of the three feeders, 700, 800, are arranged in the path of the production line; the lateral feeder, on the other hand, is located in unoccupied space located to the side of the path of the production line and is connected to the feeding tube, F which feeds rod-shaped articles into the apparatus. In this embodiment, it is shown to feed at right angles to the side of the apparatus.

Figure 4 illustrates a side view of an embodiment of a device and an arrangement according to the invention. In this figure, identical reference numbers used denote identical elements to those denoted by the reference number in Figures 1-3. In this embodiment, rod-shaped articles (13) are fed through the feeding tube F and via the feeding outlet into one or more specific vanes 9 of the hopper 2 to generate a predetermined collation.

Figure 5 illustrates a side view of an embodiment of a device and an arrangement according to the invention which is an alternative to the embodiment of Figure 4. In this figure, identical reference numbers used denote identical elements to those denoted by the reference number in Figures 1-4. In this embodiment, rod-shaped articles 13 are fed through the feeding tube F and via the feeding outlet into the mass flow of rod-shaped articles descending through feeder 700.

According to this embodiment, rod-shaped articles 13 alternate with rod-shaped articles 14. Alternatively, this configuration may be used to generate a more or less random configuration. Increasing the height H between the point of entry of the feeding tube F and the bottom of feeder 700 may increase the degree of
randomness of the configuration. To increase the degree of randomness further, the flow of rod-shaped articles 13 may be made intermittent.
CLAIMS

1. An apparatus for arranging rod-shaped articles to be fed into pockets on an endless conveyor operable to travel in a conveyance direction, the apparatus comprising:
   a hopper operable to receive rod-shaped articles and to arrange the rod-shaped articles to be fed into the pockets on the endless conveyor;
   a main feeder positioned vertically above the hopper and operable to feed a mass flow of first rod-shaped articles downwards into the hopper;
   a lateral feeder spaced laterally from the hopper in the conveyance direction, wherein the lateral feeder is connected to a feeding tube terminating in a feeding outlet, wherein the feeding tube is operable to feed second rod-shaped articles into the apparatus via the feeding outlet.

2. The apparatus of claim 1, wherein the feeding tube is operable to feed second rod-shaped articles into the hopper via the feeding outlet.

3. The apparatus of claim 2 comprising an endless conveyor, wherein the hopper has a proximal wall located adjacent to the endless conveyor, the proximal wall defining a proximal plane, and a distal wall located laterally of the proximal wall in a direction orthogonal to the conveyance direction, the distal wall defining a distal plane, and wherein the feeding tube traverses the proximal plane or the distal plane, preferably at an angle which is orthogonal to the respective plane, to feed the second rod-shaped articles into the hopper via the feeding outlet.

4. The apparatus of any one of the preceding claims, wherein the feeding outlet is positioned beneath the main feeder.

5. The apparatus of any one of claims 1 to 3, wherein the feeding tube enters the main feeder and is operable to feed the second rod-shaped articles into the mass flow of the first rod-shaped articles in the main feeder via the feeding outlet.
6. The apparatus of claim 4 or claim 5, additionally comprising a deflector positioned above the feeding outlet to deflect the mass flow of the first rod-shaped articles from the feed of the second rod-shaped articles.

7. The apparatus of any one of the preceding claims, wherein the feeding tube has an interior diameter which is greater than the exterior diameter of the second rod-shaped articles that it is intended to convey by an amount sufficient to allow single ones of the second rod-shaped articles to be conveyed in series end-to-end, but not by an amount sufficient to allow more than one of the second rod-shaped articles to be conveyed in parallel.

8. The apparatus of any one of the preceding claims, wherein the lateral feeder is positioned above the hopper and is operable to feed the second rod-shaped articles through the feeding tube under gravity to enter the hopper via the feeding outlet.

9. The apparatus of any one of claims 1 to 7, additionally comprising transport means operable to transport the second rod-shaped articles in a feeding direction through the feeding tube, said transport means comprising pneumatic conveyancing means, mechanical conveyancing means, or a combination thereof.

10. The apparatus of claim 9, wherein the pneumatic conveyancing means comprises a source of gas, preferably air, operable to move in the feeding direction to pneumatically convey the second rod-shaped articles through the feeding tube and into the hopper via the feeding outlet.

11. The apparatus of claim 9, wherein the mechanical conveyancing means comprises ultrasonic vibrating means and, optionally, one or more sources of gas, preferably air, at least a component of the source of gas or each source of gas being operable to move in at least one of:
(a) the feeding direction to assist the mechanical conveyancing means by additionally pneumatically conveying the second rod-shaped articles through the feeding tube and into the hopper via the feeding outlet; and
(b) a direction counter to the feeding direction to provide an air cushion to reduce friction between the second rod-shaped articles and the feeding tube as the second rod-shaped articles move in the feeding direction.

12. The apparatus of any one of the preceding claims, wherein the main feeder is operable to feed the first rod-shaped articles into the hopper under gravity.

13. An arrangement for forming a predetermined collation of rod-shaped articles, in particular smoking articles, comprising the apparatus of any one of the preceding claims, rod-shaped articles and pockets;
   wherein each pocket is adapted to house a predetermined number of rod-shaped articles in the predetermined collation and wherein in the predetermined collation each rod-shaped article has a predetermined position within the pocket;
   wherein the hopper comprises a plurality of hopper vanes and wherein each hopper vane of the plurality of hopper vanes is at least associated with one predetermined position in the pocket;
   wherein the main feeder is adapted to provide first rod-shaped articles to a first subset of hopper vanes of the plurality of hopper vanes;
   wherein the feeding tube is adapted to provide second-rod-shaped articles to a second subset of hopper vanes of the plurality of hopper vanes;
   wherein the apparatus comprises an additional feeder, and wherein the additional feeder is adapted to provide third rod-shaped articles to a third subset of hopper vanes of the plurality of hopper vanes.

14. The arrangement of claim 13, wherein the additional feeder is spaced laterally from the hopper in the conveyance direction.

15. The arrangement of claim 13 or claim 14, wherein the number of hopper vanes of the plurality of hopper vanes in the hopper corresponds to the number of
rod-shaped articles in the predetermined collation such that each hopper vane is associated with a predetermined position for a rod-shaped article in the predetermined collation.

5 16. The arrangement of any one of claims 13 to 15, wherein separate transfer locations of the hopper vanes provide different layers of rod-shaped articles in the collation, and wherein the first, second and third subsets of hopper vanes and the separate transfer locations of the hopper vanes are different, such that different types of rod-shaped articles are comprised in a layer of the different layers of rod-shaped articles in the pocket.

17. The arrangement of claim 16, wherein the pocket is movable between the separate transfer locations on the endless conveyor.

15 18. The arrangement of claim 17, wherein the pockets on the endless conveyor are adapted to stop consecutively at each of the separate transfer locations, the apparatus being adapted to transfer one layer of rod-shaped articles from each transfer location into each pocket.

19. A method for arranging rod-shaped articles to be fed into pockets on an endless conveyor travelling in a conveyance direction, the method comprising:
- providing a hopper;
- providing a main feeder positioned vertically above the hopper, the main feeder comprising first rod-shaped articles and feeding the first rod-shaped articles downwards into the hopper;
- providing a lateral feeder spaced laterally from the hopper in the conveyance direction, the lateral feeder being connected to a feeding tube terminating in a feeding outlet, the lateral feeder comprising second rod-shaped articles;
- feeding the second rod-shaped articles from the second feeder, through the feeding tube and into the apparatus via the feeding outlet;
- whereby the hopper receives the rod-shaped articles and arranges them to be fed into the pockets on the endless conveyor.
20. The method of claim 19, additionally comprising the step of transporting the second rod-shaped articles in a feeding direction through the feeding tube by pneumatic means, by mechanical means, or by a combination thereof.

21. Container comprising rod-shaped articles, which have been formed to a predetermined collation by the method of any one of claims 19 or 20, or by an arrangement of any one of claims 13 to 18, such that the container comprises at least two different types of rod-shaped articles, wherein the container comprises columns and rows with different types of rod-shaped articles.
### A. CLASSIFICATION OF SUBJECT MATTER

INV. B65B19/02 B65B19/04 B65B19/10 B65B19/12 B65B19/14
A24C5/35 B65D85/10

### ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

### B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B65B A24C B65D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

### C. DOCUMENTS CONSIDERED TO BE RELEVANT

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## INTERNATIONAL SEARCH REPORT

Information on patent family members

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