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(54) MACHINE AND METHOD FOR PACKAGING CAPSULES FOR PRODUCING BEVERAGES

(57) A machine (1) for simultaneously packaging a plurality of capsules (C) for producing beverages, for example espresso, is provided, comprising a carousel (2) adapted for transporting capsules (C) along a circular direction during packaging, wherein the capsules are housed on the carousel (2) in suitable seats (8),a transportation device (3) for transporting a film (4) along a linear sliding direction (X), cutting means (11) adapted for cutting closing elements (5), for closing the capsules (C), from the film (4) and closing means (21) configured to apply the closing elements (5) to the capsules (C) when the capsules (C) are housed on the carousel (2). The sliding direction (X) lies on a plane (P) parallel to the carousel (2). The imprints (6) of the cutting of the closing elements (5) on the film (4) are arranged along two or more rows (7) that are mutually parallel and offset. Moreover, a method for simultaneously packaging a plurality of capsules is provided.

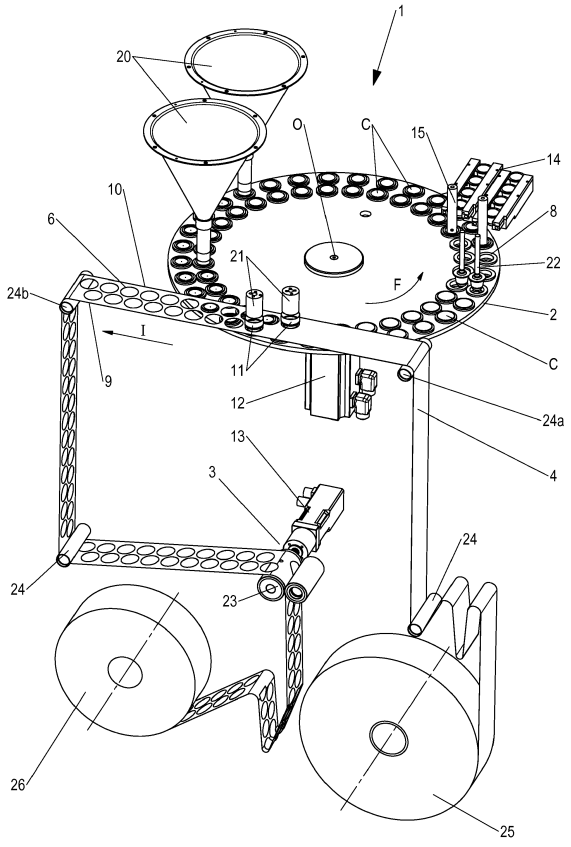

Fig. 2

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Description

TECHNOLOGICAL FIELD

[0001] The present invention concerns the field of machines for packaging capsules for producing beverages. More specifically, the present invention concerns the field of machines for simultaneously closing a plurality of capsules for producing beverages by means of closing elements cut from a film.

STATE OF THE ART

[0002] In the state of the art different types of machines for packaging, more specifically for simultaneously closing, a plurality of capsules are known. These machines generally foresee cutting of closing elements, from a film of suitable material, which are applied to the capsules to close them.

[0003] Known machines do, however, have some drawbacks. Often, the capsules to be closed are transported on tracks that are parallel to one another and not offset. Often, in these cases, the closing elements, which are applied to the capsules to close them, are also cut from the film of suitable material, which moves on a plane parallel to the transportation plane of the capsules and in the same direction, at the capsules themselves, and thus along parallel rows, which are not offset. In this way, the arrangement of the closing elements on the film is such that the waste of material from which the film is made is very high. This clearly causes in increase in production costs.

[0004] In order to avoid the problem just quoted, many known machines have adopted the solution of tilting the sliding direction of the film from which the closing elements are cut with respect to the direction in which the capsules are transported. In this way, the arrangement of the closing elements on the film is still such as to correspond to the arrangement of the capsules, but the material waste is reduced since the closing elements are arranged on parallel rows, but offset from one another. In this case, however, known machines have the drawback of being very bulky.

[0005] Therefore, the purpose of the present invention is to at least partially solve the aforementioned problems.

[0006] More specifically, the purpose of the present invention is to provide a machine for packaging capsules that wastes little material to make the closing elements and that is compact and efficient.

SUMMARY

[0007] The present invention is based on the idea of making a machine of the type with a carousel for simultaneously packaging a plurality of capsules for producing beverages in which the capsules are transported on a carousel during the packaging steps and in which the imprints of the cutting of the closing elements on the film are arranged along two or more rows that are parallel to each other and offset. In this way, it is possible to use a compact machine and to avoid needless material waste.

[0008] According to an embodiment of the present invention a machine for simultaneously packaging a plurality of capsules for producing beverages, for example espresso is provided, comprising a carousel, adapted for transporting capsules along a circular direction during packaging, wherein the capsules are housed on the carousel in suitable seats, and a transportation device for transporting a film along a linear sliding direction, wherein the machine also comprises cutting means adapted for cutting closing elements, to close a surface of the capsules, from the film wherein the sliding direction of the film lies on a plane parallel to the carousel and wherein the cutting means are adapted for cutting the closing elements so that the imprints of the cutting of the closing elements on the film are arranged along two or more rows that are parallel to one another and offset, so that the space occupied by two or more imprints that are mutually adjacent and belong to two or more distinct rows, respectively, measured along the direction perpendicular to the sliding direction, is less than or equal to the sum of the dimensions of each of the adjacent imprints measured individually along said same direction and wherein the machine further comprises closing means configured to apply the closing elements to the capsules when the capsules are housed on the carousel. In this way, it is ensured both that the machine is compact thanks to the use of the carousel to transport capsules during the packaging steps, and that the use of the film from which the closing elements are cut is optimised, substantially decreasing the material waste and thus lowering the production costs. The expression "transportation of the capsules along a circular direction during packaging" means that the capsules are transported by the carousel along the circular direction of advancement of the machine so as to carry out the various packaging steps of the capsules while the capsules are housed on the carousel. In other words, the carousel, with its rotation in the circular direction of advancement of the machine, makes it possible to bring the capsules to the various operative stations of the machine so as to carry out the packaging of the capsules while the capsules are housed on the carousel. The expression "plane parallel to the carousel" means a plane parallel to the plane defined by the upper surface of the carousel, i.e. the surface, generally circular in shape, on which the seats for housing the capsules are made.

[0009] According to an embodiment of the present invention a machine for simultaneously packaging a plurality of capsules for producing beverages, for example espresso, is made, comprising a carousel comprising seats for the capsules so as to transport the capsules along a circular direction during packaging, transportation means for transporting capsules open towards the carousel and for inserting them in the seats of the carousel, a transportation device for transporting a film along

a linear sliding direction that lies on a plane parallel to the carousel, cutting means for cutting closing elements from the film in the section in which it slides along the linear sliding direction and closing means configured to apply the closing elements to the capsules when the capsules are housed on the carousel, wherein the cutting means are adapted for cutting the closing elements so that the imprints of the cutting of the closing elements on the film are arranged along two or more rows that are parallel to each other and offset, so that the space occupied by two or more imprints that are mutually adjacent and belong to the two or more distinct rows, respectively, measured along la direction perpendicular to the sliding direction, is less than or equal to the sum of the dimensions of each of the adjacent imprints measured individually along the same direction perpendicular to the sliding direction.

[0010] According to a further embodiment of the present invention, the machine further comprises dosers for filling the capsules housed in the seats of the carousel. The dosers can be advantageously arranged between the transportation means and the closing means along the circular direction of advancement of the machine defined by the carousel.

[0011] According to a further embodiment of the present invention, the machine further comprises extraction means for extracting the packaged capsules from the carousel. The extraction means can be advantageously arranged between the closing means and the transportation means along the circular direction of advancement of the machine defined by the carousel.

[0012] According to an embodiment of the present invention, a machine is provided in which the spatial arrangement of the imprints on the film corresponds to the spatial arrangement of the seats of the capsules on the carousel. In this way, for example, the closing elements can be cut and applied to the capsule to be closed, in a single operation.

[0013] According to a further embodiment of the present invention a machine is provided in which two or more imprints of the cutting of the closing elements that are mutually adjacent and belong to two or more distinct rows, respectively, are arranged along a direction forming an angle comprised between 35° and 55°, preferably between 40° and 50°, preferably 45°, with respect to the sliding direction of the film. This particular arrangement of the imprints on the film ensures that the waste of material used is decreased.

[0014] According to a further embodiment of the present invention, a machine is provided in which the transportation device of the film is configured so that, during the transportation along the linear sliding direction, the film at least partially overlaps the carousel. For example, defining the edge of the film parallel to the sliding direction that is furthest from the centre of the carousel with respect to the second edge of the film as first edge of the film, the system can be configured so that the first edge of the film coincides with a line parallel and close to the tangent to the carousel parallel to the sliding direction. In this way, since the film and the carousel overlap, the compactness of the machine is ensured.

[0015] According to a further embodiment of the present invention a machine is provided in which the transportation device of the film is configured so that, during the transportation of the film along the linear sliding direction, the film does not overlap the carousel. For example, the system can be configured so that the film is arranged so that the second edge of the film, i.e. the edge closest to the centre of the carousel with respect to the first edge of the film, is a lateral distance from the centre of the carousel that is greater than the radius of the carousel.

[0016] According to a further embodiment of the present invention a machine is provided in which the seats of the capsules are arranged on two or more concentric circles, centred on the centre of the carousel. This arrangement of the seats is particularly advantageous for making a compact machine.

[0017] According to a further embodiment of the present invention a machine is provided in which the seats are arranged on the two or more concentric circles in phase, i.e. so that each n-th capsule on an outermost circle corresponds to the n-th capsule on an innermost circle, adjacent to the n-th capsule on the outermost circle. In other words, the pairs of adjacent seats of different circles are arranged along the same radius of the carousel.

[0018] According to a further embodiment of the present invention a machine is provided in which the seats are arranged on the two concentric circles out of phase, i.e. so that each seat of one of the circles is positioned between two seats of the other circle.

[0019] According to a further embodiment of the present invention a machine is provided in which the cutting means are arranged so as to cut closing elements for capsules not adjacent to one another. In this way, a contribution is made to decreasing material waste.

[0020] According to a further embodiment of the present invention a machine is provided in which the cutting means are arranged so as to cut closing elements not adjacent to one another. In this way, a contribution is made to decreasing material waste and to increasing the compactness of the machine.

[0021] According to a further embodiment of the present invention, a machine is provided in which closing means are welding means, i.e. adapted for applying the closing means to the capsules by welding.

[0022] According to a further embodiment of the present invention, a machine is provided in which the closing means are arranged so as to apply closing elements to capsules not adjacent to one another. In this way a contribution is made to decreasing material waste and to increasing the compactness of the machine. According to a further embodiment of the present invention a machine is provided in which the welding means are arranged in a non-contiguous manner with respect to the

direction perpendicular to the sliding direction of the film. In this way a contribution is made to decreasing material waste and to increasing the compactness of the machine.

[0023] According to a further embodiment of the present invention a method is provided for simultaneously packaging a plurality of capsules for producing beverages, for example espresso, by means of a machine comprising a carousel adapted for transporting capsules, housed on the carousel in suitable seats, along a circular direction and a transportation device for transporting a film along a linear sliding direction, wherein the method comprises the following steps: **a)** transporting the capsules along the circular direction, by means of the carousel during packaging; **b)** transporting the film along the linear sliding direction on a plane parallel to the carousel, by means of the transportation device; **c)** cutting closing elements, adapted for closing a surface of the capsules, from the film, so that the imprints of the cutting of the closing elements on the film are arranged along two or more rows that are parallel to each other and offset, so that the space occupied by two or more imprints that are mutually adjacent and belong to two or more distinct rows, respectively, measured along the direction perpendicular to the sliding direction, is less than or equal to the sum of the dimensions of each of the adjacent imprints measured individually along the same direction; and **d)** applying the closing elements to the capsules so as to close them when the capsules are housed on the carousel. This method makes it possible to close a plurality of capsules simultaneously in an efficient manner and without needless waste of material.

[0024] According to a further embodiment of the present invention a method is provided for simultaneously packaging a plurality of capsules for producing beverages, for example espresso, by means of a machine comprising a carousel comprising seats for the capsules so as to transport the capsules along a circular direction during packaging comprising the following steps: a) arranging open capsules in the seats of the carousel; b) transporting a film along a linear sliding direction that lies on a plane parallel to the carousel; c) cutting closing elements from the film in the section in which it slides along the linear sliding direction; d) applying the closing elements to the capsules when the capsules are housed on the carousel; in which the cutting of the closing elements from the film in the section in which it slides along the linear sliding direction is done so that the imprints of the cutting of the closing elements on the film are arranged along two or more rows that are parallel to one another and offset, so that the space occupied by two or more imprints that are mutually adjacent and belong to the two or more distinct rows, respectively, measured along the direction perpendicular to the sliding direction, is less than or equal to the sum of the dimensions of each of the adjacent imprints measured individually along the same direction perpendicular to the sliding direction.

[0025] According to a further embodiment of the present invention, the method further comprises the step of filling the capsules housed in the seats of the carousel with the desired product.

[0026] According to a further embodiment of the present invention, the method further comprises the step of extracting the packaged capsules from the carousel.

[0027] According to a further embodiment of the present invention a method is provided in which the spatial arrangement of the imprints for cutting on the film corresponds to the spatial arrangement of the seats of the capsules on the carousel.

[0028] According to a further embodiment of the present invention a method is provided in which two or more imprints of the cutting of the closing elements that are mutually adjacent and belong to two or more distinct rows, respectively, are made so as to be arranged along a direction forming an angle comprised between 35° and 55°, preferably between 40° and 50°, preferably 45°, with respect to the sliding direction of the film. This particular arrangement of the imprints ensures a decrease in waste.

[0029] According to a further embodiment of the present invention a method is provided in which the cutting of the closing elements takes place at the seats. In this way, the cutting of the closing elements and their application to the capsules can take place in a single operation.

[0030] According to a further embodiment of the present invention a method is provided in which the cutting of the closing elements does not take place at the seats, so that the closing elements must subsequently be transported to the seats, to close the capsules.

[0031] According to a further embodiment of the present invention a method is provided in which the seats of the capsules are arranged on two or more concentric circles, centred on the centre of the carousel.

[0032] According to a further embodiment of the present invention a method is provided in which the seats are arranged on the two concentric circles in phase, i.e. so that each n-th capsule on an outermost circle coincides with the n-th capsule on an innermost circle, adjacent to the n-th capsule on the outermost circle.

[0033] According to a further embodiment of the present invention a method is provided in which the seats are arranged on the two concentric circles out of phase, i.e. so that each seat on one of the circles is positioned between two seats on the other circle.

[0034] According to a further embodiment of the present invention, a method is provided that further comprises the step of filling the capsules with the soluble and/or infusion product for producing the desired beverage when the capsules are housed on the carousel.

BRIEF DESCRIPTION OF THE FIGURES

[0035] The present invention will be described with reference to the attached figures in which the same reference marks and/or numerals indicate the same parts and/or similar and/or corresponding parts of the system.

Fig. 1 a schematically illustrates a 3D view of an open capsule.

Fig. 1b schematically illustrates the capsule of Fig. 1 a closed.

Fig. 2 schematically illustrates a 3D view of a machine for packaging capsules for producing beverages according to an embodiment of the present invention.

Fig. 3 schematically illustrates a view from above of a detail of the machine shown in Fig. 2.

Fig. 4 schematically illustrates a view from above of a detail of a machine for packaging capsules for producing beverages according to a further embodiment of the present invention.

Fig. 5 schematically illustrates a view from above of a detail of a machine for packaging capsules for producing beverages according to a further embodiment of the present invention.

Fig. 6a schematically illustrates the imprints of the cutting of the closing elements, according to the state of the art.

Fig. 6b schematically illustrates the imprints of the cutting of the closing elements, according to an embodiment of the present invention.

Fig. 7 schematically illustrates a detail of a machine according to the present invention.

Fig. 8 schematically illustrates a further detail of a machine according to the present invention

Fig. 9 schematically illustrates a further detail of a machine according to the present invention

Fig. 10 schematically illustrates a further detail of a machine according to the present invention.

DETAILED DESCRIPTION

[0036] Hereinafter, the present invention is described with reference to particular embodiments, as illustrated in the attached tables of drawings. However, the present invention is not limited to the particular embodiments described in the following detailed description and represented in the figures, but rather the described embodiments simply exemplify the various aspects of the present invention, the purpose of which is defined by the claims. Further modifications and variations of the present invention will be clear to those skilled in the art.

[0037] Figures 1a and 1b schematically show capsules C for producing beverages that can be packaged by means of the machine and/or the method according to the present invention. The capsules C can, for example, contain soluble and/or infusion products like, for example, ground coffee, milk and/or powdered cocoa, tea leaves or similar. The capsule shown in figure 1a is open and comprises a capsule body 16 comprising a capsule bottom 17 and a side wall that define the containment volume of the capsule. On the opposite side to the capsule bottom 17, the capsule C is open so as, for example, to be able to insert the product from which the desired beverage is obtained. The side wall of the capsule comprises a projecting edge that defines a surface S on the opposite side to the capsule bottom 17. The projecting edge surrounds and also defines the opening G of the capsule. The capsule C shown in figure 1a is frusto-conical in shape, so that the surface S is circular, but alternatively the capsule C and therefore the surface S can have any other shape, for example polygonal.

[0038] Figure 1b shows the capsule C of figure 1a closed by means of a closing element 5. The closing element 5 was applied to the projecting edge of the capsule. The closing element can preferably be welded to the projecting edge, for example thermo-welded. Alternatively, the closing element 5 can be glued to the projecting edge. The closing element 5 can be adapted for hermetically closing the capsule, so as to optimise the conservation of the organoleptic properties of the product contained in the capsule. For example, the closing element 5 can be made of aluminium. Alternatively, the closing element 5 can for example be a filtering element, for example filter paper or similar. In this case, the closing element 5 prevents the product contained in the capsule C from coming out from the capsule, but allows for example the passage of gas and/or liquid through its surface.

[0039] Figure 2 schematically illustrates a 3D view of a machine 1 for packaging capsules C for producing beverages according to an embodiment of the present invention.

[0040] The machine 1 comprises a carousel 2 adapted for transporting the capsules C, housed on the carousel 2 in suitable seats 8, along a circular direction, during the packaging steps. As shown schematically in the figures and as described in detail hereinafter, indeed, the various operative stations of the machine 1 are positioned so as to operate on the capsules C housed in the seats 8 of the carousel 2. In the case shown in the figures, the circular direction of advancement of the machine is in the anti-clockwise direction and is schematically indicated by the arrow F.

[0041] While the machine 1 is in use, the carousel 2 rotates around its centre O. The rotation of the carousel 2 can, for example, be actuated by a first motor 12. In the embodiment shown in figure 2 the carousel 2 rotates in the anti-clockwise direction along the direction F.

[0042] Figure 2 shows that the seats 8 of the capsules C are arranged on the carousel 2 on two concentric circles A and B centred on the centre O of the carousel 2.

According to the present invention, moreover, the seats 8 can be arranged on the carousel 2 also on more than two concentric circles centred on the centre O of the carousel, for example on 3, 4, 5 or on a greater number of concentric circles.

[0043] As shown in figures 2, 3 and 4, the seats 8 can be arranged on the two or more concentric circles in phase. In particular, the seats 8 can be arranged on the carousel 2 so that each n-th capsule CA(n) on the circle A, for example the outermost one, corresponds to the n-th capsule CB(n) on the circle B, for example the innermost one, adjacent to the n-th capsule CA(n). The corresponding seats 8, i.e. for the capsules CA(n) and CB(n), on the two concentric circles, respectively, are, in this way, located substantially along the same radius of the carousel 2 as shown in figure 3 or in figure 4. In other words, the seats 8 are arranged side-by-side in pairs along the perimeter of the carousel 2 so as to form two concentric circles, an outer one A, i.e. with larger diameter, and an inner one B, i.e. with a smaller diameter, and so that the two corresponding seats of the same pair belonging to the two distinct circles are arranged substantially along the same radius of the carousel 2. This characteristic of the seats arranged in phase on the various circles can also be implemented with a number greater than two of concentric circles.

[0044] Alternatively, according to an alternative embodiment of the present invention, the seats 8 can be arranged on the two or more concentric circles out of phase, as shown schematically in figure 5. In this way, each of the seats 8, for example for the capsule CA(n) on one of the circles, for example on the outermost circle A, is positioned between two seats 8, for the capsules CB(n-1) and CB(n) on the inner circle B. In other words, in this configuration, the seats 8 are side-by-side in pairs along the perimeter of the carousel 2 so as to form two concentric circles, an outer one A, i.e. with a larger diameter, and an inner one B, i.e. with a smaller diameter, and so that the two corresponding seats of the same pair belonging to the two circles are not arranged along a radius of the carousel 2 but along a chord thereof. This characteristic of the seats arranged out of phase on the various circles can also be implemented with a number of concentric circles greater than two. According to alternative embodiments of the invention, moreover, it is possible to foresee mixed configurations with more than two concentric circles in which on two or more of the circles the seats are arranged in phase whereas with respect to one or more of the other circles the seats are arranged out of phase.

[0045] The shape of the seats 8 shown in the figures is circular, but they can be of any shape, for example polygonal, compatible with the shape of the capsules C to be packaged.

[0046] The machine 1 shown in figure 2 also comprises a transportation device 3 for transporting a film 4, at least partially along a linear sliding direction X that lies on a plane parallel to the carousel 2. The expression "plane parallel to the carousel 2" means a plane parallel to the plane defined by the upper surface of the carousel 2 on which the seats 8 for the capsules are arranged. The device 3 can, for example, comprise a roller pulling system for unwinding the film 4 from an unwinding reel 25 to a winding reel 26. In the embodiment shown in figure 2, the film 4 moves in the direction indicated by the arrow I. The transportation device 3 can comprise one or more pulling rollers 23 and one or more rollers that rotate idly 24. The pulling rollers 23 are the rollers that actuate the movement of the film 4. The rollers that rotate idly 24 are rollers that rotate freely under the pulling action of the film 4 due to the action of the pulling rollers 23. For example, as shown in figure 2, the pulling roller 23 can be actuated by a second motor 13 of the machine 2 so as to unwind the film 4 from the unwinding reel 25 and to wind it back up into the winding reel 26. In alternative embodiments, the motor 12 that sets the carousel 2 in motion is the same one that sets the transportation device 3 in motion.

[0047] Moreover, as shown schematically in figure 2, the rollers that rotate idly 24 can be arranged so as to define the path of the film 4 from the unwinding reel 25 to the winding reel 26. For example, as shown in figure 2, the system can comprise a first roller that rotates idly 24a and a second roller that rotate idly 24b arranged substantially on the same level so as to define at least one section of the path of the film 4 parallel to the plane of the carousel 2. In figure 2 this section is the section between the roller 24a and the roller 24b.

[0048] The film 4 is preferably made of flexible material. The film 4 can be made of aluminium, paper, filter paper, multi-layer materials, impermeable materials, filtering materials, or similar.

[0049] As shown in figures 2, 3, 4 and 5 the film 4 comprises a first edge 9 and a second edge 10 that, in the section of path parallel to the carousel 2, are parallel to the sliding direction X. The term first edge 9 is meant to indicate the edge that, in this section of path, is furthest from the centre O of the carousel 2 with respect to the second edge 10, which, on the other hand, is closer to the centre O thereof.

[0050] As shown in figures 2, 3, 4 and 5, the relative position of the carousel 2 and of the film 4 in the section of path parallel to the carousel 2 can vary according to alternative embodiments of the present invention. In particular, during the transportation along the sliding direction X parallel to the carousel 2, the film 4 can at least partially or completely overlap the carousel 2. Alternatively, the film 4, in this section of its path in which it slides parallel to the carousel 2, may not overlap the carousel itself but slides laterally with respect to the carousel 2.

[0051] Figures 2, 3 and 5 show configurations in which the film 4 completely overlaps the carousel 2 in the section of path in which it slides parallel to the carousel 2. In particular, in these cases, the transportation device 3 of the machine 1 is configured so that, during transportation, the film 4 overlaps the carousel 2 so that the first

edge 9 of the film 4 coincides with a line parallel and close to the tangent to the carousel 2 parallel to the sliding direction X. Preferably, the first edge 9 of the film 4 coincides with a line intersecting the carousel 2, parallel to the tangent to the carousel 2 parallel to the direction X. This configuration promotes the compactness of the machine 1.

[0052] According to the embodiment shown, on the other hand, in figure 4, the transportation device 3 is configured so that, during transportation along the sliding direction X parallel to the carousel 2, the film 4 is arranged so that the second edge 10 is a distance from the centre O of the carousel 2 greater than the radius R of the carousel 2, so that the film 4 does not overlap the carousel 2. In this case, the film 4 slides laterally with respect to the carousel 2.

[0053] The machine 1 according to the present invention also comprises cutting means 11, adapted for cutting closing elements 5, for closing the capsules C, from the film 4. The cutting means 11 can for example comprise blade shearing systems, toothed blade shearing systems, die punch or laser cutter. As shown in the figures, the cutting means 11 are configured so as to cut the closing elements 5 from the film 4 in the section in which the film 4 slides along the sliding direction X parallel to the carousel 2. When the cutting means 11 cut the closing elements 5 from the film 4 imprints for cutting the film 4 are made. In particular, upstream of the cutting means 11 in the sliding direction X the film 4 is intact, whereas downstream of the cutting means 11 in the sliding direction X the film 4 has the imprints of the cutting due to the cutting of the closing elements 5 from the film 4 by the cutting means 11. The cutting means can comprise first cutting means 111 for a first row 7I of imprints of the cutting 6 on the film 4 and second cutting means 11II for a second row 7II of imprints of the cutting 6 on the film 4 (see for example figure 7).

[0054] Figures 6a and 6b schematically show the imprints of the cutting of the closing elements in a film, respectively according to the state of the art and according to the present invention.

[0055] As can be seen clearly in figure 6b, the cutting means 11 according to the present invention are adapted for cutting the closing elements 5 so that the imprints 6 of the cutting of the closing elements 5 on the film 4 are arranged along two or more parallel rows, i.e. along at least one first row 7I and a second row 7II. The two rows 7I and 7II are also parallel to the sliding direction X. Moreover, the two rows 7I and 7II are offset, so that the space occupied by two imprints 6 that are mutually adjacent and belong to the two distinct rows 7I and 7II, respectively, measured along the direction Y perpendicular to the sliding direction X, is less than or equal to the sum of the dimensions of each of the adjacent imprints 6, measured individually along the same direction Y. For example, as shown schematically in figure 6b, two imprints 6 of the cutting of the closing elements 5 that are mutually adjacent and belong to the two distinct rows 7I and 7II, respectively, can be arranged along a direction E forming an angle α comprised between 35° and 55°, preferably between 40° and 50°, preferably 45°, with respect to the sliding direction X of the film 4.

[0056] Even if the number of rows of imprints 6 is equal to two in the attached figures, it is clear that the number of rows based on the present invention can be greater than two. In any case, based on the present invention, the cutting means 11 are adapted for cutting the closing elements 5 in the section in which the film 4 slides parallel to the carousel 2 along the sliding direction X so that the imprints 6 of the cutting of the closing elements 5 on the film 4 are arranged along two or more rows that are parallel to each other and offset, so that the space occupied by the two or more imprints 6 that are mutually adjacent and belong to the two or more distinct rows, respectively, measured along the direction Y perpendicular to the sliding direction X, is less than or equal to the sum of the dimensions of each of the adjacent imprints 6 measured individually along said same direction Y. In this way the distribution of the imprints of the cutting on the film 4 is optimised so as to minimise the amount of film 4 not used to form the closing elements 5.

[0057] On the other hand, as shown in figure 6a, the closing elements 5a, according to the state of the art, are cut along parallel rows that are not offset. In this way, the spatial arrangement of the imprints 6a is such that the unused space between them is very wide and consequently the material of the film that is wasted is high.

[0058] A further advantage of the optimised arrangement of the imprints 6 of the cutting of the closing elements 5 on the film 4 according to the present invention, is that of allowing a film 4 to be used having a smaller width (i.e. dimension along the direction Y) with respect to the case in which the imprints 6 are arranged along parallel rows that are not offset to cut closing elements 5 having the same dimensions. This further reduces the amount of material of film 4 required.

[0059] The imprints 6 can be circular in shape, as shown in figure 6b, in the case in which the surface S to be closed of the capsule C is circular. Alternatively, the imprints can be of any other shape, for example polygonal, compatible with the shape of the surface S of the capsule C to be closed.

[0060] From what has been stated above, it can be worked out that, in the case in which the imprints 6 are circular in shape with diameter D, they are arranged on the film 4 so that the lateral distance, i.e. measured along the direction Y, between the centres of adjacent imprints 6 belonging to different rows 7I and 7II, is less than or equal to the diameter D of a single imprint 6.

[0061] As shown in figure 7, the cutting means 11 can be arranged so as to cut closing elements 5 not adjacent to one another. If for example a first cutting means 11I cuts the n-th closing element 5I(n) of the row 7I, a second cutting means 11II can be arranged so as to cut the (n+1)-th closing element 5II(n+1) of the row 7II and not the n-th closing element 5II(n) of the row 7II. Cutting

means 11 arranged so as to cut closing elements 5 that are mutually adjacent, indeed, would have to be distanced apart, due to the bulk thereof, with the consequent increase in distance of the imprints 6 of the closing elements 5 on the film 4 and thus an increase in material waste.

[0062] If, as shown in the embodiments of figures 2, 3 and 5e explained above, the transportation device 3 is configured so that the film 4 overlaps the carousel 2, the cutting means 11 arranged so as to cut closing elements 5 that are not adjacent to one another are also arranged so as to cut closing elements 5 that are applied to capsules C that are not adjacent to one another. If for example the first cutting means 11I cuts the n-th closing element 5I(n) of the row 7I, for the n-th capsule CA(n) on the outermost concentric circle A, the second cutting means 11II cuts the (n+1)-th closing element 5II(n+1) of the row 7II, for the capsule CB(n+1) on the inner concentric circle B and not the n-th closing element 5II(n) of the row 7II, for the capsule CB(n) adjacent to the capsule CA(n).

[0063] Once the closing elements 5 have been cut by the cutting means 11, they can be applied to the surface S of the capsule C by closing means 21, so as to close the capsules C. The closing means 21 are configured to apply the closing elements 5 to the capsules C when the capsules C are housed on the carousel 2. The closing means can comprise first closing means 21I for a first row A of seats 8 of capsules C on the carousel 2 and second cutting means 11II for a second row B of seats 8 of capsules C on the carousel 2 (see for example figure 7).

[0064] Preferably, the closing means 5 are thermowelded to the capsules by the closing means 21. The closing means 21 can thus comprise welding means, for example thermowelders. In the embodiments shown in figure 7, the closing means 21 are at the cutting means 11. In particular, the first closing means 21I are at the first cutting means 11I and the second closing means 21II are at the second cutting means 11II. As a result, the closing means 5 can be cut from the film 4 and applied to the capsules C in a single operation.

[0065] The shape of the cutting means 11 and of the closing means 21 can be any one that is compatible with the shape of the surface S of the capsule C to be closed.

[0066] As shown in figure 7, the closing means 21 can be arranged so as to apply the closing elements 5 to capsules C that are not adjacent to one another in an analogous manner to what is explained above with reference to the cutting means. If for example the first closing means 21I apply a closing element 5 to the capsule CA(n) on the outermost concentric circle A, the second welding means 21II are positioned to apply a closing element 5 to the capsule CB(n+1) on the inner concentric circle B and not to the capsule CB(n) adjacent to the capsule CA(n).

[0067] In the cases shown in figures 2, 3 and 5 in which the film 4 overlaps the carousel 2 in the section of path in which it slides parallel to the carousel 2, it should be observed that the spatial arrangement of the imprints 6 on the film 4 corresponds to the spatial arrangement of the seats 8 of the capsules C on the carousel 2. More specifically, the seats 8 of the capsules C are arranged so as to overlap the imprints 6 on the film 4 in the direction Y in the point of tangency between the carousel 2 and the first edge 9 of the film 4. In this way, the closing elements 5 can be cut and applied to the capsule C in a single operation. It should also be noted that in this case the angular speed with which the carousel 2 rotates is synchronous with the speed with which the film 4 slides, so that as the film 4 slides, the capsules C in the seats 8 suitably rotate.

[0068] On the other hand, in the case shown in figure 4 in which the film 4 does not overlap the carousel in the section of path in which it slides parallel to the carousel 2, the spatial arrangement of the imprints 6 on the film 4 may not correspond to the spatial arrangement of the seats 8 of the capsules C on the carousel 2 even if in the figures this correspondence is shown. According to this embodiment, indeed, the closing elements 5 are first cut from the film 4 and are then transported to the seats 8 to be applied to the capsules C to close them. In this transportation step it is possible to correct any discrepancy between the spatial arrangement of the imprints 6 on the film 4 and the spatial arrangement of the seats 8 on the carousel 2.

[0069] The machine 1 according to the present invention can also comprise transportation means for transporting onto the carousel 2 the open capsules C that must be packaged and for positioning them in the seats 8 of the carousel 2. Figure 8 shows for example a pair of conveyor belts 14, adapted for transporting the capsules C, oriented in an orderly manner, close to the carousel 2. The conveyor belts 14 can, for example, be positioned, with respect to the carousel 2, so that the capsules C, at the end of their journey along the conveyor belts 14, fall automatically into the seats 8 of the carousel. In particular, a first conveyor belt is adapted for transporting the capsules C into the seats 8 of a first circle whereas a second conveyor belt is adapted for transporting the capsules C into the seats 8 of the second circle. Moreover, as shown schematically in the figures, the machine 1 can further comprise mobile elements 15, for example mobile arms or thrusting punches for the insertion of the capsules C in the seats 8 on the carousel 2. The open capsules transported by the conveyor belts 14 can for example come from a tank of open capsules or directly from a machine that produces the open capsules. An example of the positioning of the conveyor belts in the architecture of the machine 1 is shown schematically in figure 2.

[0070] As shown schematically in figure 9, the machine 1 can also comprise dosers 20, for filling the capsules C with the desired soluble and/or infusion product when the capsules are housed in the seats 8 of the carousel 2, in the case in which they arrive on the carousel 2 empty. In order to reduce the overall bulk of the machine it is pref-

erable, as shown in the figures, in the case in which the machine comprises two dosers 20, i.e. one for each circle of seats 8 of the carousel 2, for the two dosers to be arranged out of phase with respect to the direction of rotation of the carousel. In this case, one of the two dosers is further upstream in the direction of rotation of the carousel with respect to the second. The system can comprise different numbers of dosers, for example the system can comprise a single doser with many outlets, one for each of the circles of seats of the carousel. Alternatively, the system can comprise as many dosers as there are circles of seats of the carousel. An example of the positioning of the dosers 20 in the architecture of the machine 1 is shown schematically in figure 2. The dosers can be arranged between the transportation means of the capsules and the closing means along the direction F of advancement of the machine.

[0071] Figure 10 shows that the machine 1 according to the present invention can further comprise extractor means 22, for discharging the capsules C from the carousel 2, once they have been closed with the closing elements 5. The extractors 22 preferably comprise suction cups, adapted for hooking the capsules C and removing them suitably from their seats 8. The suction cups can for example grip onto the closing elements 5 of the capsules. An example of positioning of the extractor means 22 in the architecture of the machine 1 is shown schematically in figure 2. The extractor means can be arranged between the closing means and the transportation means of the capsules along the direction F of advancement of the machine.

[0072] The machine 1 shown in figure 2 thus comprises a carousel 2 comprising seats 8 for the capsules C so as to transport the capsules along a circular direction during packaging, transportation means 14 for transporting open capsules towards the carousel 2 and for inserting them in the seats 8 of the carousel 2, a transportation device 3 for transporting a film 4 along a linear sliding direction X that lies on a plane parallel to the carousel, cutting means 11 for cutting closing elements 5 from the film in the section in which it slides along the linear sliding direction X and closing means 21 configured to apply the closing elements 5 to the capsules C when the capsules are housed on the carousel 2, wherein the cutting means 11 are adapted for cutting the closing elements 5 so that the imprints 6 of the cutting of the closing elements 5 on the film 4 are arranged along two or more rows 7 that are parallel to each other and offset, so that the space occupied by two or more imprints 6 that are mutually adjacent and belong to the two or more distinct rows 7, respectively, measured along the direction Y perpendicular to the sliding direction X, is less than or equal to the sum of the dimensions of each of the adjacent imprints 6 measured individually along the same direction Y.

[0073] The machine 1 can optionally comprise dosers 20 to fill the capsules housed in the seats 8 of the carousel 2. As shown in figure 2 the dosers 20 can advantageously be arranged between the transportation means 14 and the closing means 21 along the circular direction of advancement F of the machine defined by the carousel 2.

[0074] The machine 1 can also further comprise extraction means 22 to extract the packaged capsules from the carousel 2. As shown in figure 2 the extraction means 22 can be advantageously arranged between the closing means 21 and the transportation means 14 along the circular direction of advancement F of the machine defined by the carousel 2.

[0075] According to the present invention a method is also provided for packaging capsules C for producing beverages, for example espresso, by means of a machine 1 comprising a carousel 2 adapted for transporting capsules C, housed on the carousel 2 in suitable seats 8, along a circular direction and a transportation device 3 for transporting a film 4 along a linear sliding direction X.

[0076] The method foresees the transportation of the capsules C along the circular direction, by means of the carousel 2 during packaging; the transportation of the film 4 along the linear sliding direction X on a plane parallel to the carousel 2, by means of the transportation device 3; the cutting of closing elements 5, adapted for closing a surface S of the capsules C from the film 4 so that the imprints 6 of the cutting of the closing elements 5 on the film 4 are arranged along two or more rows 7 that are parallel to each other and offset, so that the space occupied by two or more imprints 6 that are mutually adjacent and belong to two or more said distinct rows 7, respectively, measured along the direction Y perpendicular to the sliding direction X, is less than the sum of the dimensions of each of the adjacent imprints 6 measured individually along the same direction Y; the application of the closing elements 5 to the capsules C so as to close them when the capsules C are housed on the carousel 2.

[0077] The transportation of the capsules along the circular direction by means of the carousel during packaging indicates that the capsules are transported by the carousel along the circular direction of advancement so as to carry out the various steps of the packaging of the capsules while the capsules are housed on the carousel. In other words, the carousel, with its rotation in the circular direction of advancement of the machine, allows the capsules to be brought to the various operative stations of the machine so as to carry out the steps of the method for packaging the capsules while the capsules are housed on the carousel.

[0078] The carousel 2 comprising the seats 8, the transportation device 3, the film 4, the cutting means 11 and the welding means 21 can have the characteristics already described earlier, with reference to the machine 1 for simultaneously packaging a plurality of capsules C for producing beverages.

[0079] Preferably, the capsules C are loaded onto the carousel 2. More specifically, the capsules C are brought into the seats 8 on the carousel 2. For example, this can occur by means of one or more conveyor belts 14, which carry the capsules C, oriented in an orderly manner and open, close to the carousel 2. The conveyor belts 14 can,

for example, be positioned, with respect to the carousel 2, so that the capsules C, at the end of their journey, fall automatically in their seats 8. An example of this step is shown schematically in figure 8.

[0080] Mobile arms 15 can, for example, take care of the subsequent insertion of the capsules C in the seats 8 of the carousel 2.

[0081] Before the capsules C are closed, they can be filled with the soluble and/or infusion product P for producing the desired beverage, by means of, for example, the use of suitable dosers 20. In the embodiment shown in figure 9, the dosers 20 are shaped like inverted cones, but any other shape is suitable for being used. The dosers 20 ensure that the correct amount of product that must be contained in the capsule C itself is deposited inside the capsule C. This step of the method, an example of which is shown schematically in figure 9, only takes place in the case in which the capsules C arrive on the carousel 2 empty. In this case, if the surface S of the capsule C is the only open surface of the capsule C, it is, indeed, necessary to fill them before the surface S is closed by the closing elements 5.

[0082] Therefore, the closing elements 5, previously cut by the cutting means 11 from the film 4, are preferably applied to the capsules C, so as to close, for example hermetically, the surface S. The application of the closing elements 5 can take place, for example, by thermowelding, by means of the welding means 21. An example of this step is schematically illustrated in figure 7 in the case in which the film 4 and the carousel 2 overlap. In this case, indeed, in figure 7 it is also possible to see the step of cutting the closing elements 5 from the film 4.

[0083] Finally, the capsules C are preferably discharged from the carousel 2, by means of the extractors 22. The extractors 22 can comprise suction cups adapted for gripping the capsules C and removing them suitably from their seats 8. In this way, the seats 8 are freed from the closed capsules C, so that new open capsules C can be loaded onto the carousel 2. An example of this step is schematically illustrated in figure 10.

[0084] Even if the present invention has been described with reference to the embodiments described above, it is clear to those skilled in the art that it is possible to make different modifications, variations and improvements of the present invention in light of the teaching described above and in the attached claims, without departing from the object and the scope of protection of the invention.

[0085] For example, the shape of the surface S of the capsules C and therefore the shape of the imprints 6 that the cutting means 11 produce on the film 4 can be whatever is suitable. Moreover, cases have been shown in which the imprints of the cuts are arranged on two rows that are parallel and offset, but the number of rows can be greater than two. It is clear that in analogy also the number of concentric centres A, B on which the seats 8 for the capsules C on the carousel 2 are arranged can be greater than two.

[0086] Finally, that which is deemed to be known by those skilled in the art has not been described in order to avoid needlessly excessively overshadowing the described invention.

[0087] Consequently, the invention is not limited to the embodiments described above, but it is only limited by the scope of protection of the attached claims.

Claims

1. Machine (1) for simultaneously packaging a plurality of capsules (C) for producing beverages, for example espresso, comprising a carousel (2) adapted for transporting said capsules (C) along a circular direction (F) during packaging, wherein said capsules (C) are housed on said carousel (2) in suitable seats (8), and a transportation device (3) for transporting a film (4) along a linear sliding direction (X); said machine (1) further comprising cutting means (11) adapted for cutting closing elements (5), for closing a surface (S) of said capsules (C), from said film (4); wherein said sliding direction (X) lies on a plane (P) parallel to said carousel (2), wherein said cutting means (11) are adapted for cutting said closing elements (5) so that the imprints (6) of the cut of said closing elements (5) on said film (4) are arranged along two or more rows (7) parallel to one another and offset, so that the space occupied by two or more imprints (6) that are mutually adjacent and belong to said two or more distinct rows (7), respectively, measured along the direction (Y) perpendicular to said sliding direction (X), is less than or equal to the sum of the dimensions of each of said adjacent imprints (6) measured individually along said same direction (Y) and wherein said machine (1) further comprises closing means (21) configured to apply said closing elements (5) to said capsules (C) when said capsules (C) are housed on said carousel (2).

2. Machine (1) according to claim 1, **characterised in that** the spatial arrangement of said imprints (6) on said film (4) corresponds to the spatial arrangement of said seats (8) of said capsules (C) on said carousel (2).

3. Machine (1) according to one of the previous claims, **characterised in that** two or more of said imprints (6) for cutting said closing elements (5) that are mutually adjacent and belong to said two or more distinct rows (7), respectively, are arranged along a direction (I) forming an angle (α) comprised between 35° and 55°, preferably between 40° and 50°, preferably 45°, with respect to said sliding direction (X) of said film (4).

4. Machine (1) according to one of the previous claims, **characterised in that** said transportation device (3)

of said film (4) is configured so that, during the transportation along said sliding direction (X), said film (4) at least partially overlaps said carousel (2), for example so that the first edge (9) of said film (4) coincides with a line parallel and close to the tangent to said carousel (2) parallel to said sliding direction (X), wherein said first edge (9) of said film (4) is the edge (9) of said film (4) parallel to the sliding direction (X) that is further from the centre (O) of said carousel (2) with respect to the second edge (10) of said film (4).

5. Machine (1) according to one of claims 1 to 3, **characterised in that** said transportation device (3) of said film (4) is configured so that, during the transportation along said sliding direction, said film (4) does not overlap said carousel (2), for example so that said film (4) is arranged so that the second edge (10) of said film (4), i.e. the edge (10) closest to the centre (O) of said carousel (2) with respect to the first edge (9) of said film (4), is at a distance from the centre (O) of said carousel (2) greater than the radius (R) of said carousel (2).

6. Machine (1) according to one of the previous claims, **characterised in that** said seats (8) of said capsules (C) are arranged on two or more concentric circles (A, B), centred on the centre (O) of said carousel (2).

7. Machine according to claim 6, **characterised in that** said seats (8) are arranged on the two concentric circles (A, B) in phase, i.e. so that each n-th capsule (CA(n)) on an outermost circle (A), coincides with the n-th capsule (CB(n)) on an innermost circle (B), adjacent to the n-th capsule (CA(n)) on said outermost circle (A).

8. Machine (1) according to claim 6, **characterised in that** said seats (8) are arranged on the two concentric circles (A, B) out of phase, i.e. so that each of said seats (8), for example, for the capsule (CA(n)), of one of said circles (A, B) is positioned between two seats (8), for example for the capsules (CB(n-1)) and (CB(n)), of the other circle (B, A).

9. Machine (1) according to one of the previous claims, **characterised in that** said cutting means (11) are arranged so as to cut closing elements (5) that are not adjacent to one another.

10. Machine (1) according to one of the previous claims, **characterised in that** said closing means (21) are arranged so as to apply closing elements (5) to capsules (C) that are not adjacent to one another.

11. Method for simultaneously packaging a plurality of capsules (C) for producing beverages, for example espresso, by means of a machine (1) comprising a carousel (2) adapted for transporting said capsules (C), housed on said carousel (2) in suitable seats (8), along a circular direction (F) and a transportation device (3) for transporting a film (4) along a linear sliding direction (X), **characterised in that** it comprises the following steps:

- transporting said capsules (C) along said circular direction, by means of said carousel (2) during packaging;
- transporting said film (4) along said linear sliding direction (X) on a plane parallel to said carousel (2), by means of said transportation device (3);
- cutting closing elements (5), adapted for closing a surface (S) of said capsules (C), from said film (4), so that the imprints (6) for cutting said closing elements (5) on said film (4) are arranged along two or more rows (7) parallel to one another and offset, so that the space occupied by said two or more imprints (6) that are mutually adjacent and belong to said two or more said distinct rows (7), respectively, measured along the direction (Y) perpendicular to said sliding direction (X), is less than or equal to the sum of the dimensions of each of said adjacent imprints (6) measured individually along said same direction (Y)
- applying said closing elements (5) to said capsules (C), so as to close them, when said capsules (C) are housed on said carousel (2).

12. Method according to claim 11, **characterised in that** the spatial arrangement of said imprints (6) on said film (4) corresponds to the spatial arrangement of said seats (8) of said capsules (C) on said carousel (2).

13. Method according to one of claims 11 or 12, **characterised in that** two or more of said imprints (6) for cutting said closing elements (5) that are mutually adjacent and belong to said two or more said distinct rows (7), respectively, are made so as to be arranged along a direction (I) forming an angle (α) comprised between 35° and 55°, preferably between 40° and 50°, preferably 45°, with respect to said sliding direction (X) of said film (4).

14. Method according to one of claims 11 to 13, **characterised in that** cutting said closing elements (5) takes place at said seats (8).

15. Method according to one of claims 11 to 13, **characterised in that** cutting said closing elements (5) does not take place at said seats (8), and said closing elements (5) are subsequently transported to said seats (8) to close said capsules (C).

16. Method according to one of claims 11 to 15, **characterised in that** said seats (8) of said capsules (C) are arranged on two or more concentric circles (A, B), centred on the centre (O) of said carousel (2).

17. Method according to claim 16, **characterised in that** said seats (8) are arranged on the two concentric circles (A, B) in phase, i.e. so that each n-th capsule (CA(n)) on an outermost circle (A), coincides with the n-th capsule (CB(n)) on an innermost circle (B), adjacent to the n-th capsule (CA(n)) on said outermost circle (A).

18. Method according to claim 16, **characterised in that** said seats (8) are arranged on the two concentric circles (A, B) out of phase, i.e. so that each of said seats (8), for example, for the capsule (CA(n)), of one of said circles (A, B) is positioned between two seats (8), for example for the capsules (CB(n-1)) and (CB(n)) of the other circle (B, A).

19. Method according to one of claims 11 to 18, **characterised in that** said film (4) comprises flexible material.

20. Method according to one of claims 11 to 19, **characterised in that** it further comprises the step of:

    • filling said capsules (C) with the soluble and/or infusion product (P) for producing the desired beverage when said capsules (C) are housed on said carousel (2).

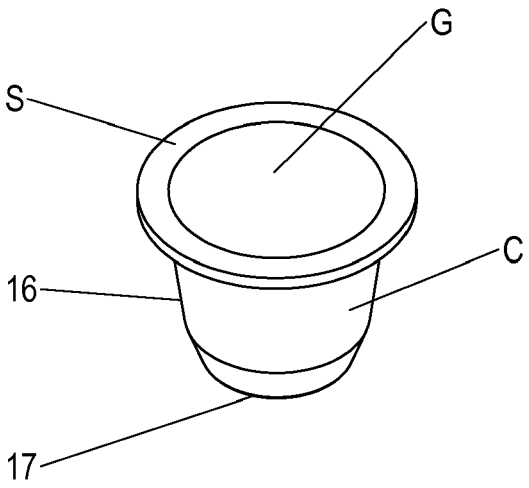

Fig. 1a

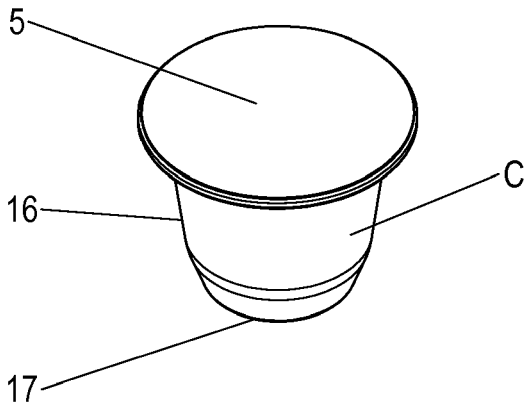

Fig. 1b

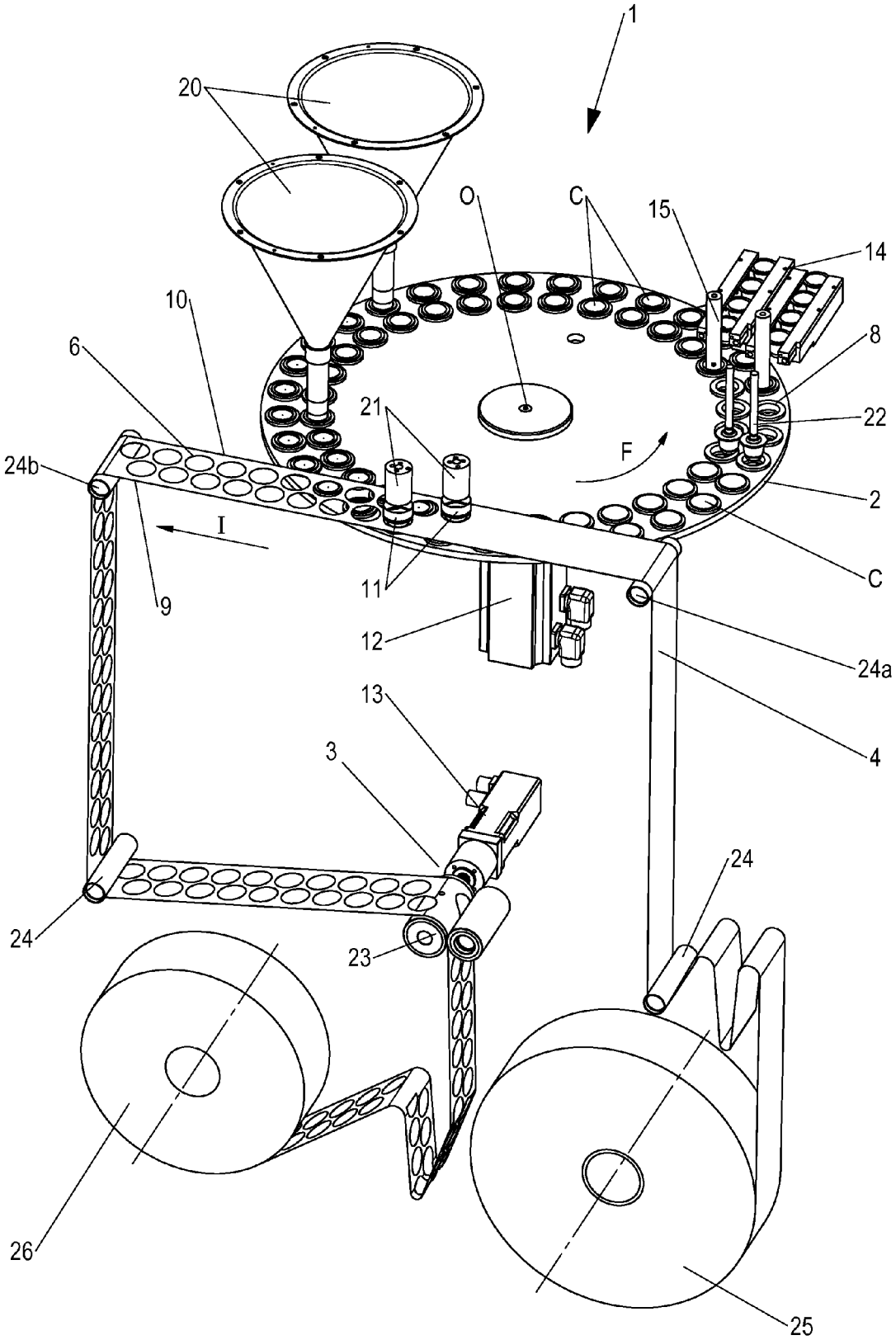

Fig. 2

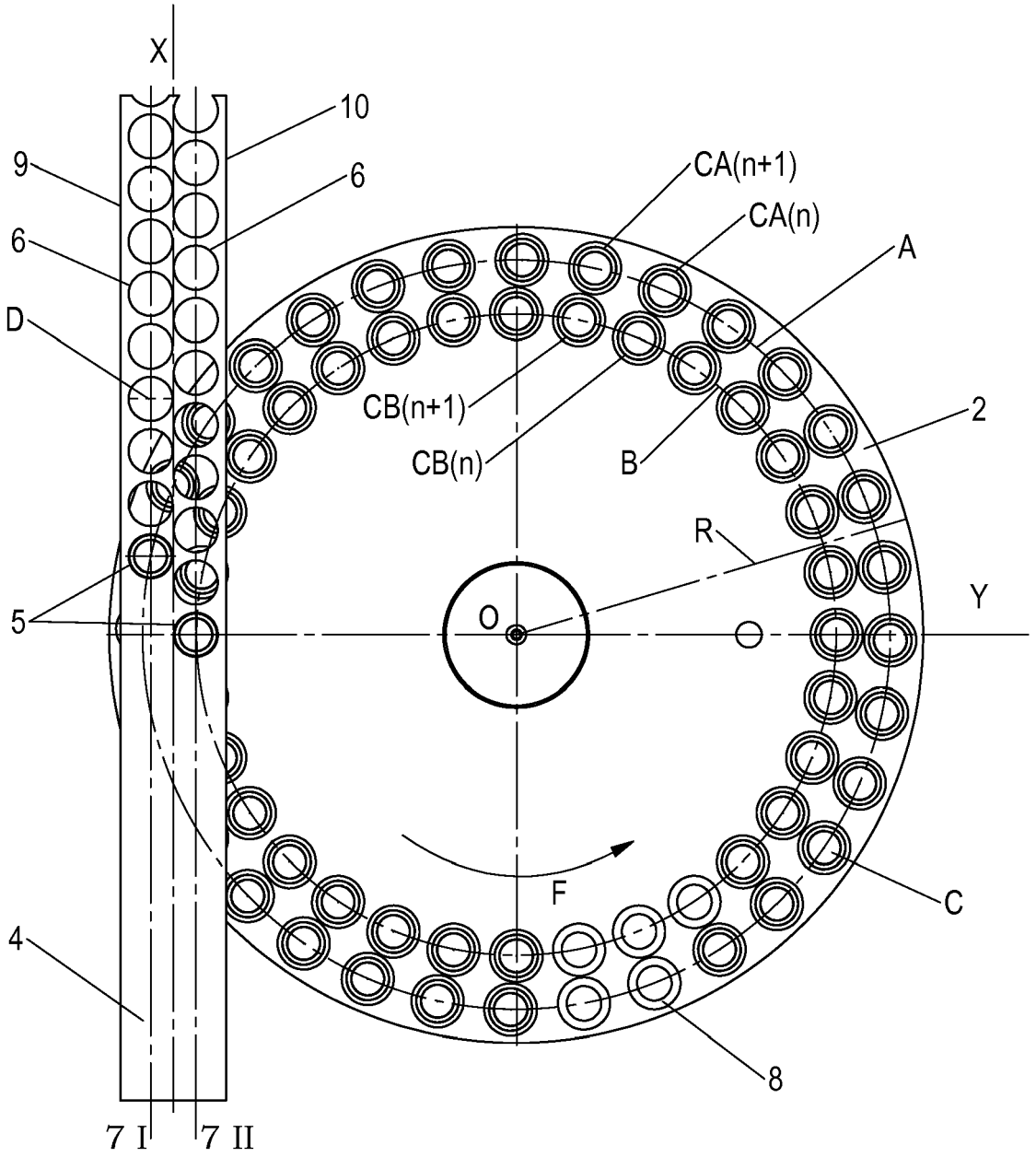

FIG. 3

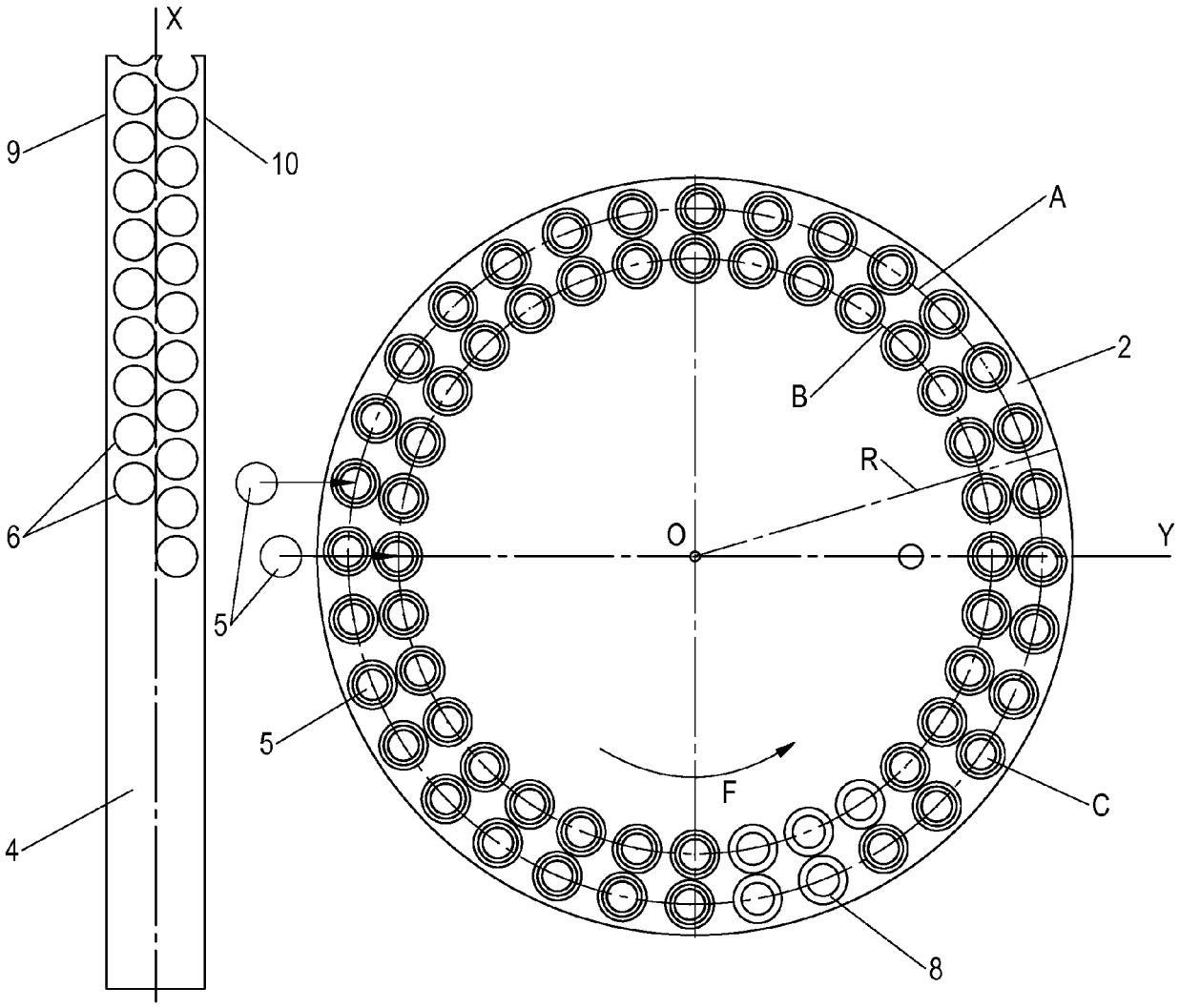

Fig. 4

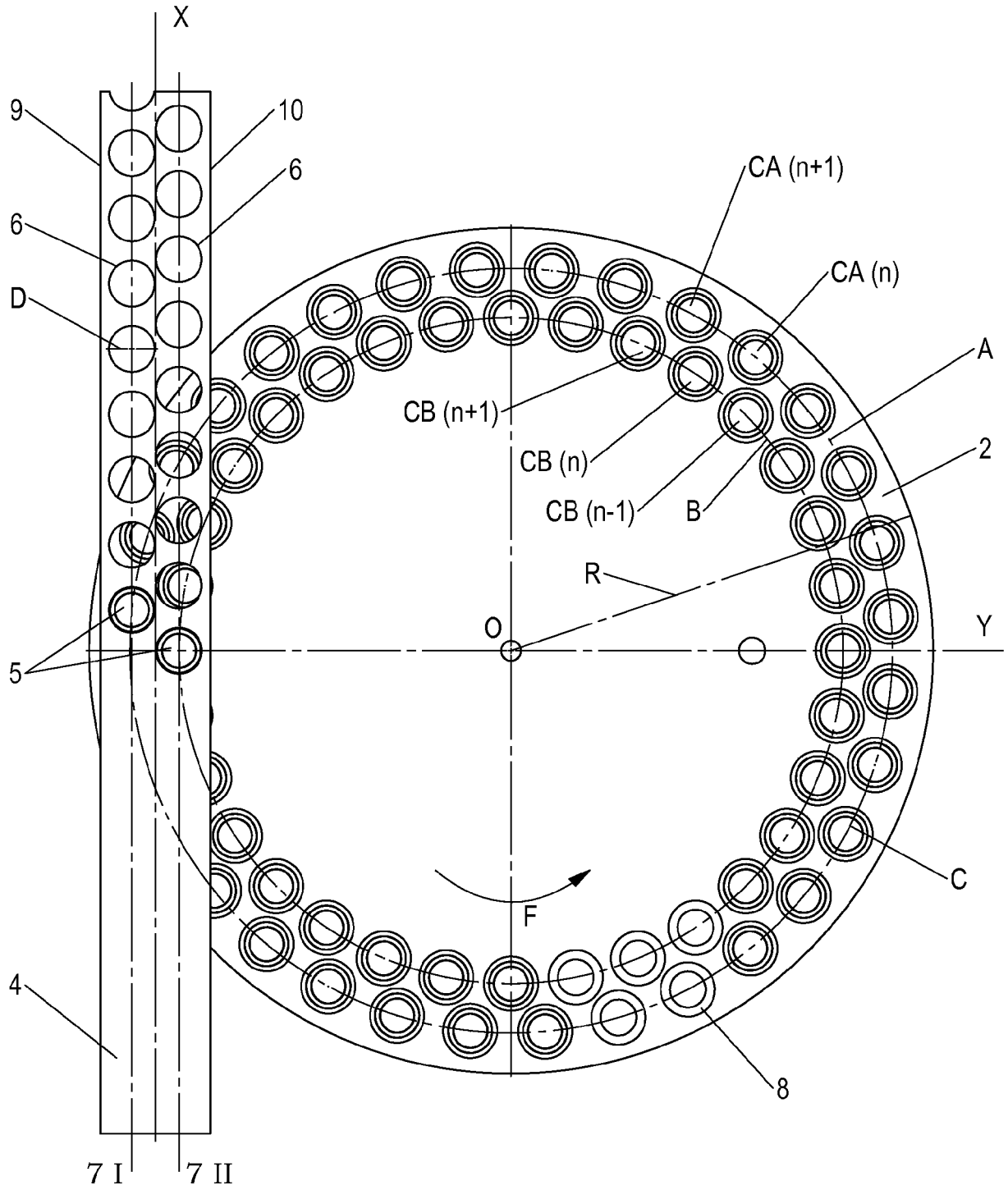

Fig.5

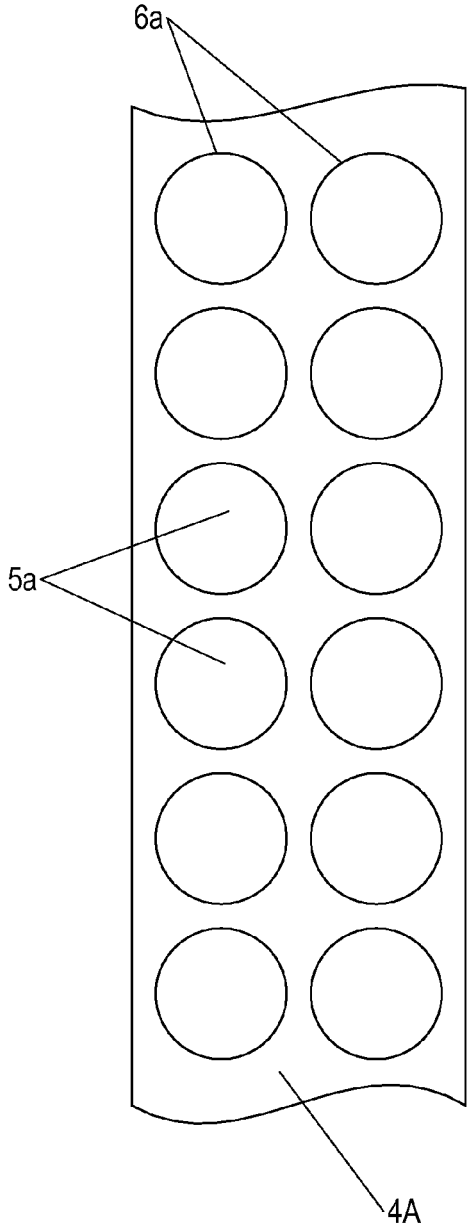

Fig. 6a

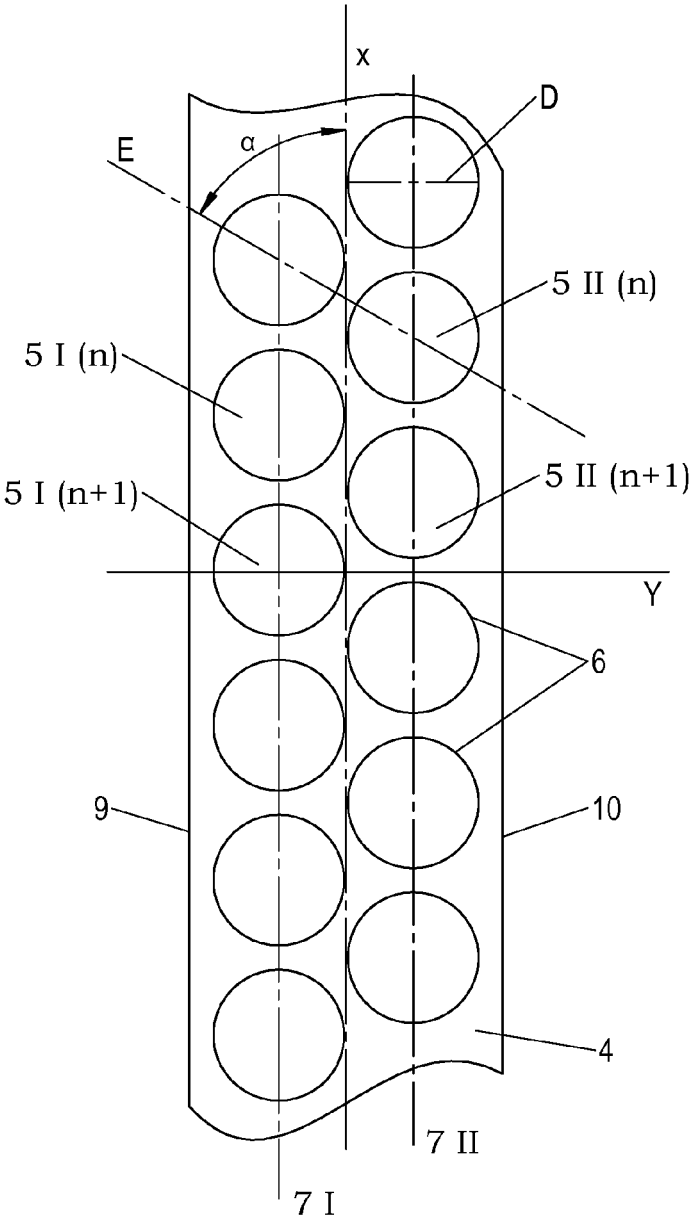

Fig. 6b

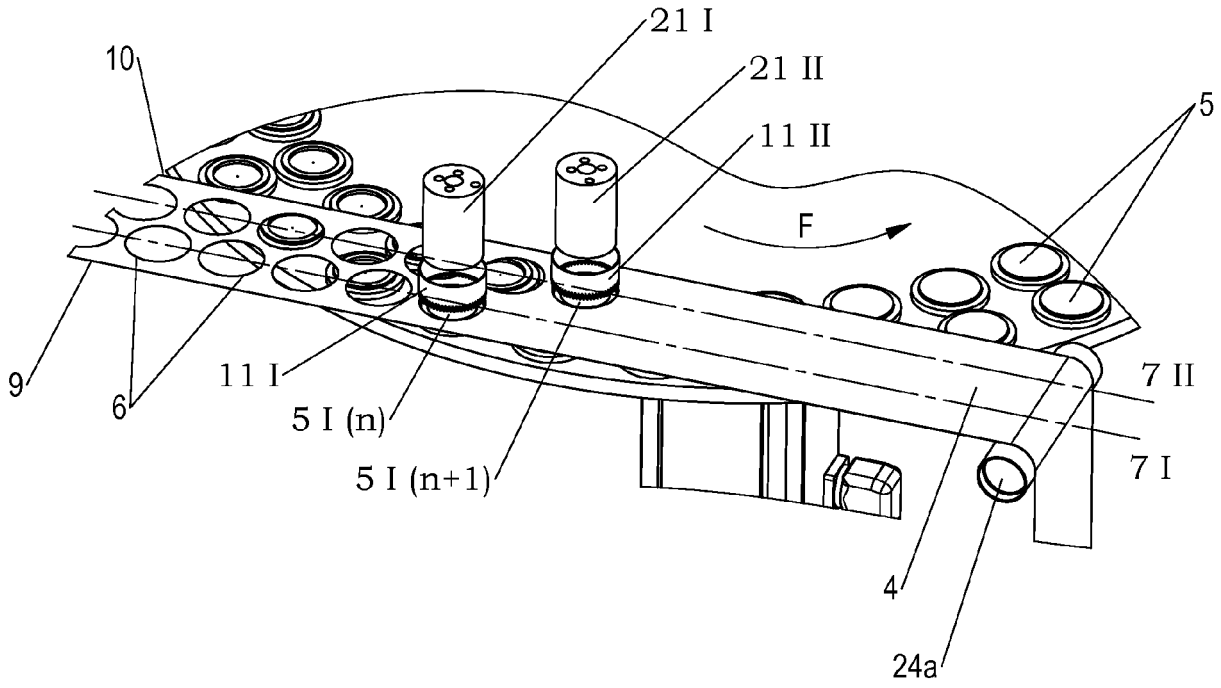

Fig. 7

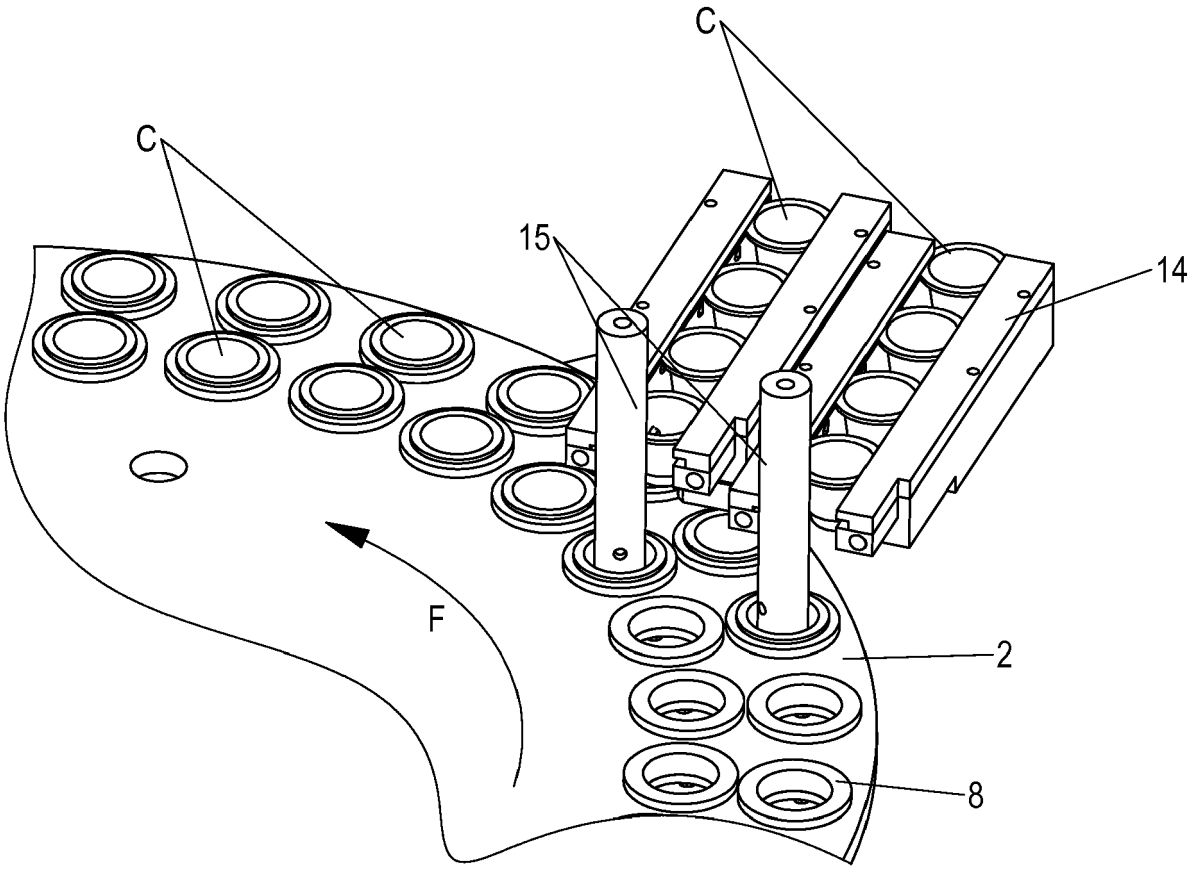

Fig. 8

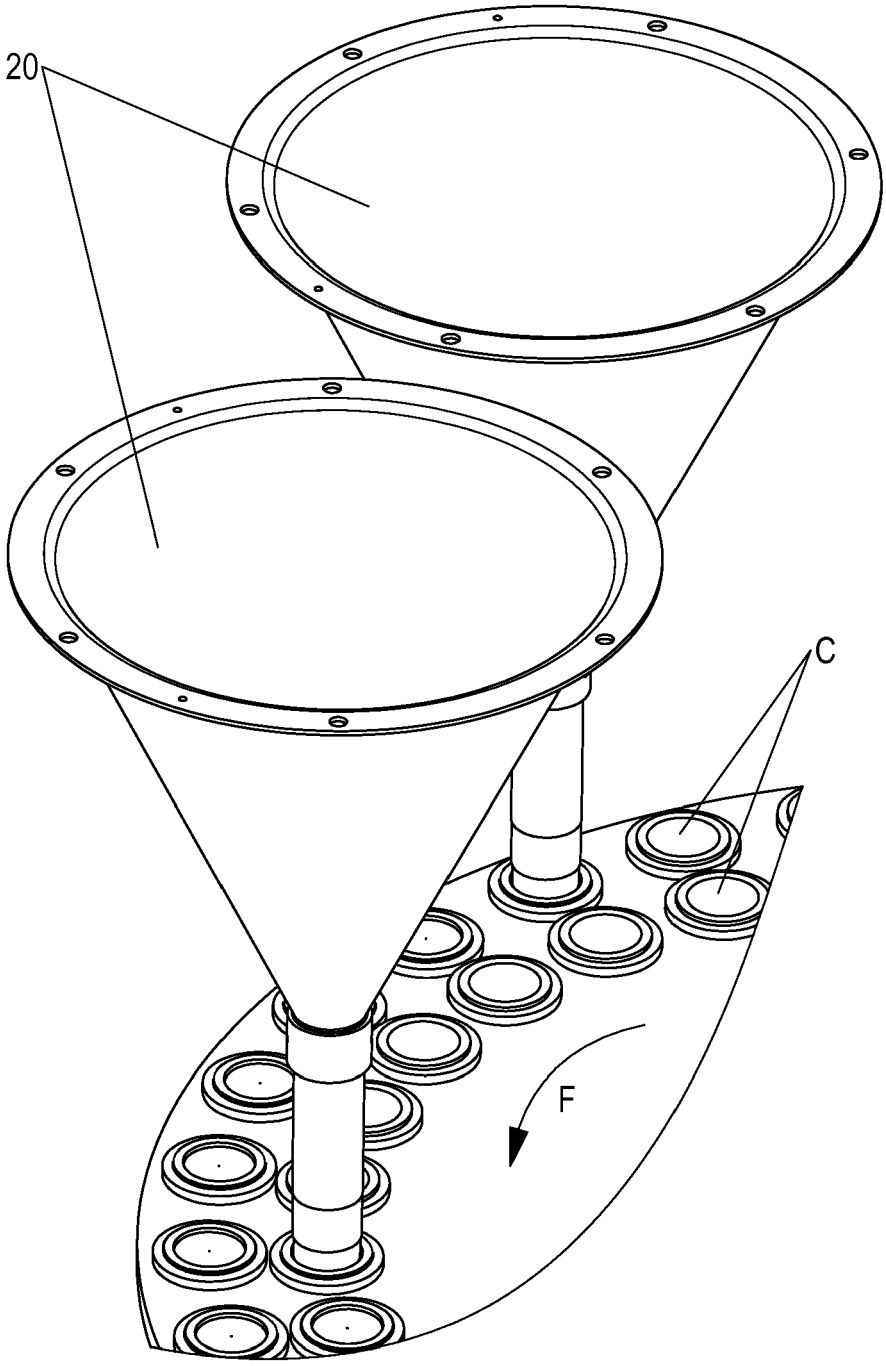

Fig. 9

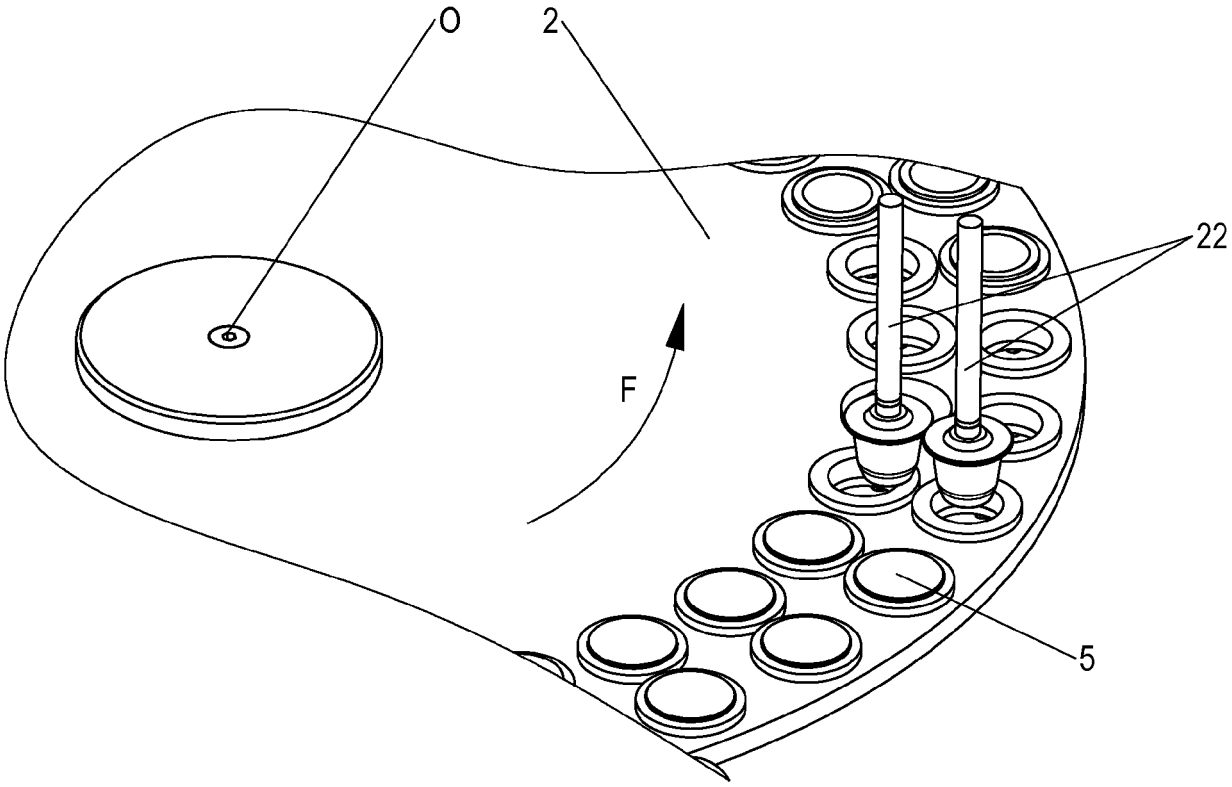

Fig.10

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EUROPEAN SEARCH REPORT

Application Number
EP 15 20 2092

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	WO 2011/039709 A2 (IMA FLAVOUR SRL [IT]; CONTI ROBERTO [IT]) 7 April 2011 (2011-04-07) * page 4, line 7 - page 15, line 12 * * figures 1,8,9 *	1-20	INV. B65B29/02 B65B43/50 B65B65/00 B65B7/16
A	EP 1 564 143 A1 (HANS RYCHIGER AG [CH]) 17 August 2005 (2005-08-17) * paragraph [0001] - paragraph [0045] * * figures 1-6 *	1-20	
A	AT 505 545 A4 (MAREK CHRISTIAN [AT]) 15 February 2009 (2009-02-15) * page 1 - page 15 * * figures 1-11 *	1-20	
			TECHNICAL FIELDS SEARCHED (IPC) B65B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	12 April 2016	Rodriguez Gombau, F

CATEGORY OF CITED DOCUMENTS

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E : earlier patent document, but published on, or after the filing date
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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 15 20 2092

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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12-04-2016

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2011039709 A2	07-04-2011	EP 2483160 A2	08-08-2012
		ES 2452215 T3	31-03-2014
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