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(54) **Title:** FEEDING MODULE FOR FEEDING SEGMENTS, APPARATUS FOR MANUFACTURING MULTI-SEGMENT ARTICLES AND METHOD OF FEEDING THE SEGMENTS FOR THE MANUFACTURING OF MULTI-SEGMENT ARTICLES

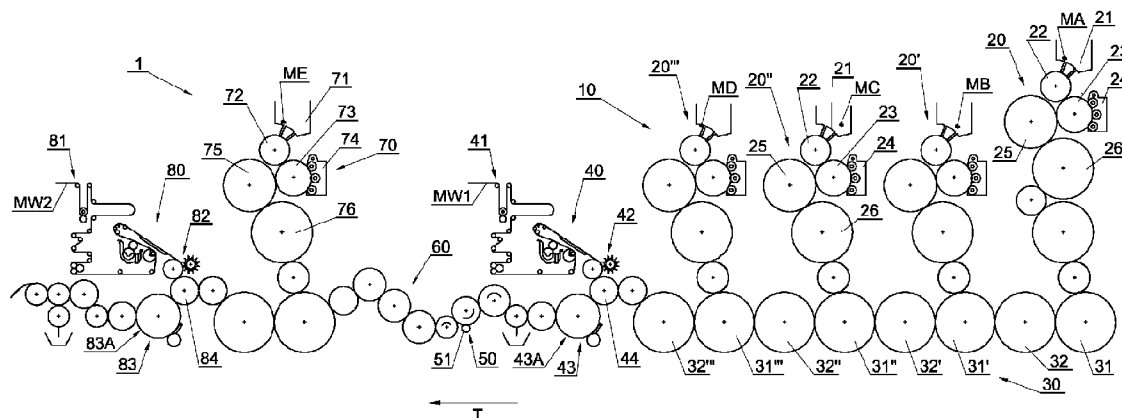


Fig. 1

(57) **Abstract:** A feeding module (20, 70) for feeding segments for the manufacture of multi-segment articles adapted to cut a rod (MA, ME) into segments (A, E) and to feed the segments (A, E), comprising a hopper (21, 71) for storing the rods (MA, ME), a receiving drum (22, 72) for receiving the rods (MA, ME) from the hopper (21, 71), a cutting head (24, 74) for cutting the rod (MA, ME) into individual segments (A, E), a shifting drum (25, 75) for varying the mutual position of the segments (A), an aligning drum (26, 76) for forming at least one stream of the segments (A, E), characterised in that the feeding module (20, 70) is provided with feeding channels (110, 116) extending from the hopper (21, 71) to the receiving drum (22, 72), and a filling sensor (115) generating an empty flute (28) signal when the flute (28) of the receiving drum (22, 72) remains empty in the measuring area of the filling sensor (115), furthermore, the feeding module (20, 70) is adapted to feed the rod (MA, ME) into the empty flute (28) of the receiving drum (22,

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72) by means of a feeding apparatus (118) situated downstream of the filling sensor (115) in response to a signal of an empty flute (28) of the receiving drum (22, 72).

FEEDING MODULE FOR FEEDING SEGMENTS, APPARATUS FOR MANUFACTURING MULTI-SEGMENT ARTICLES AND METHOD OF FEEDING THE SEGMENTS FOR THE MANUFACTURING OF MULTI-SEGMENT ARTICLES

The object of this application is a feeding module for feeding segments, an apparatus for manufacturing multi-segment articles and a method of feeding the segments for the manufacturing of multi-segment articles.

At present, the tobacco industry manufactures rod-like articles comprising a plurality of elements, namely tobacco elements containing tobacco or material containing processed tobacco, filter elements, elements containing flavouring substances, distance elements used for example to cool tobacco smoke. In this application, these various elements will be referred to as segments and articles containing such segments as multi-segment articles or multi-segment rods.

An apparatus for assembling groups of filter segments wherein the rods are fed from a hopper by means of a multi-channel system. For example, the publication WO 2014188306 describes an apparatus feeding the rods from a hopper provided with several independent channels feeding a receiving drum.

In tobacco industry machines, there is a need to convey rod-like articles in single-layer streams or multi-layer streams, and there is a need of temporary bulk storage of such articles in hoppers. There is a need for semi-finished products within the production process to be conveyed in such a way that their quality is not reduced. When designing the hoppers as well as the mass flow channels, it must be taken into account that this type of storage and conveying of articles carries a risk of deformation of the articles. The risk of deformation of the articles arises, among others, when the rod-like articles are received from the hopper into the flutes of the receiving drum in the machines for manufacturing multi-segment rods because the flutes of the receiving drum move into the lowest area of the hopper where the pressures are highest. A solution to the problem is to use multiple channels to feed the articles to the receiving drum. However, there is a need for an apparatus for multi-channel feeding of the rods from the hopper which ensures that the flutes are filled up to highest possible extent when one of the conveying channels becomes blocked or out of service.

The object of the invention is a feeding module for feeding segments for the manufacture of multi-segment articles adapted to cut a rod into segments and to feed the segments, comprising a hopper for storing the rods, a receiving drum for receiving the rods from the hopper, a conveying drum for conveying the rods, a cutting head, situated at the conveying drum, for cutting the rod into individual segments, a shifting drum for varying the mutual position of the segments, an aligning drum for forming at least one stream of the segments. The feeding module is characterised by being provided with feeding channels extending from the hopper to the receiving drum, and a filling sensor generating an empty flute signal when the flute of the receiving drum remains empty in the measuring area of the filling sensor, furthermore, the feeding module is adapted to feed the rod into the empty flute of the receiving drum by means of a feeding apparatus situated downstream of the filling sensor in response to the empty flute signal of the receiving drum.

The feeding module is characterised in that the feeding channel is provided with a blockage sensor, and the empty flute signal is generated by the flute filling sensor of the receiving drum or the blockage sensor of the feeding channel.

The feeding module is characterised in that the feeding channels are gravity channels.

The feeding module is characterised in that the walls of the feeding channels are formed by belts forcing the movement of the rods towards the receiving drum.

The feeding module is characterised in that the feeding apparatus is adapted to continuous feeding with the rods to replace the continuous feeding with the rods carried out by any of the feeding channels.

Furthermore, the object of the invention is an apparatus for manufacturing multi-segment articles, comprising at least two feeding modules according to the invention for feeding the segments formed by cutting the rods, an assembling unit provided with drum conveyors for receiving the segments from the feeding modules and forming a segment group, a first wrapping module for feeding a section of the first wrapping material and wrapping a segment group so as to form a multi-segment rod, a cutting unit for cutting the formed rod into half multi-segment rods, an additional feeding module for cutting an additional rod and feeding additional segments between half multi-segment rods according to the invention, a second wrapping module for feeding a section of a second wrapping material and wrapping a group including the additional segment and the half multi-segment rods so as to form the multi-segment rod.

The object of the invention is also a method of feeding the segments for the manufacture of multi-segment articles, comprising steps wherein the rod is fed to the hopper, the rod being a multiple of the segment, the rods are conveyed through at least two feeding channels to the receiving drum, the rod is received from the channel into the flute of the receiving drum, the rod is transferred from the flute of the receiving drum to the flute of the conveying drum, the rod is cut into individual segments when conveying the rod in the flute of the conveying drum by means of the cutting head situated at the conveying drum, the mutual position of the segments on the shifting drum is varied, at least one stream of the segments is formed on the aligning drum. The method according to the invention is characterised in that, in addition, the presence of the rod in the flute of the receiving drum is checked by means of the filling sensor, the empty flute signal is generated by means of the filling sensor when the flute of the receiving drum remains empty in the sensor's measuring area, and the rod is fed into the empty flute of the receiving drum by means of the feeding apparatus situated downstream of the filling sensor in response to the empty flute signal of the receiving drum.

An advantage of the invention is that, in the process of supplying the rods through the feeding channels, it is possible to temporarily disable one of the channels while maintaining the expected performance of the machine. The use of channels in which the flow of individual articles is ensured provides the possibility to check the quality of individual segments, for example to check the length of the segments or also the quality of the segment front since the access to each flowing article is ensured. In addition, it is possible to check the length of the rods. In the case of the supply of multi-segment rods, it is also possible to check the rods comprehensively. The supply of the rods through channels makes it possible to reduce the pressure on the lowest lying rods in the hopper, thus to eliminate the risk of deformation of the rods. In addition, the rods within the channel have fewer points of contact with adjacent rods so the likelihood of rods sticking together is reduced.

The object of the invention is described in more detail on the basis of embodiments shown in a drawing in which:

Fig. 1 shows an apparatus for manufacturing multi-segment articles,

Fig. 2a shows, in simplified terms, process stages of the manufacture of multi-segment articles in the first embodiment,

Fig. 2b shows, in simplified terms, process stages of the manufacture of multi-segment articles in the second embodiment,

Fig. 3 shows a feeding module in the first embodiment,

Fig. 3a shows a rod and a group of segments formed after cutting the rod,

Fig. 4 shows the feeding module in the second embodiment,

Fig. 5 shows the feeding module in the third embodiment, and

Fig. 6 shows the feeding module in the fourth embodiment.

An apparatus 1 for manufacturing multi-segment articles comprises an assembling apparatus 10, a first wrapping module 40, a cutting unit 50, a reorienting unit 60, an additional feeding unit 70, and a second wrapping module 80 (Fig. 1).

The assembling apparatus 10 comprises at least two feeding modules 20 and an assembling unit 30, in the embodiment shown, the assembling apparatus 10 comprises four feeding modules 20, 20', 20'', 20'''. The feeding module 20, 20', 20'', 20''' is adapted to cut rods of at least one type and to feed segments of at least one type. Feeding modules which are adapted to cut rods of two types and feed segments of two types are also known.

The feeding module 20 comprises a hopper 21 for the rods MA, a receiving drum 22 provided with circumferentially arranged flutes in which the rods MA from the hopper 21 are situated and drums for forming a stream of segments A formed by cutting the rod MA. The rods MA from the hopper 21 are supplied to the receiving drum 22 by means of feeding channels situated between the hopper 21 and the receiving drum 22, such feeding channels are discussed below in this description. The receiving drum 22 transfers the rods MA to the conveying drum 23. At the conveying drum 23, there is situated a cutting head 24 which is provided with one or more circular knives 24A for cutting the rods MA. The feeding module 20 comprises at least one shifting drum 25 and at least one aligning drum 26. The shifting drum 25 may also be referred to as cascading drum where successive segments are arranged in successive flutes of this drum.

The feeding module 20 feeds segments A in the form of at least one stream. In the embodiment shown, in the feeding modules 20, 20', 20'', 20''', the rod MA, MB, MC, MD is cut into segments A, B, C, D, respectively, the segments being fed in the form of streams to an assembling unit 30.

The rods MA stored in the hopper 21 are supplied through the feeding channels so as to fill the flutes 28 arranged circumferentially on the receiving drum 22 during the rotation of this drum (Fig. 3). The rods MA are held in the flutes 28 by means of a vacuum supplied through holes in the bottom of the flute 28. The receiving drum 22 conveys the rods MA at the point of transfer X to the flutes 29 of the conveying drum 23 in which the rods MA are also held by means of a vacuum. The rod MA being a multiple of the segment A is cut into individual segments A, whereas the segments A formed from one rod MA form a group G (Fig. 3a). Subsequent groups G of the segments A are transferred to the shifting drum 25 and further to the aligning drum 26 to form a stream of individual segments A.

The feeding module 20 is provided with feeding channels supplying the rods MA from the hopper 21 to the flutes 28 of the receiving drum 22. In the first embodiment shown in Fig. 3, the feeding module is provided with two feeding channels 110, the feeding channels being gravity feeding channels, at the end of the feeding channel 110 there is situated a filling apparatus 111 which comprises a rotating filling element 112 having two cavities 113, with the rod MA being placed in the cavity 113. The rotational movement of the filling element 112 is synchronised with the rotational movement of the receiving drum 22 so that the cavity 113 meets the flute 28 to transfer the rod MA. The movement of the filling apparatuses 111 and 111' is synchronised so that they feed the rods MA alternately into the successive flutes 28. The feeding module may be provided with any number of the feeding channels 110, in which case successive flutes are cyclically filled by successive filling apparatuses 110. The feeding module 20 is provided with a filling sensor 115 for checking the presence of the rod MA in the flute 28 of the receiving drum 22, the filling sensor 115 being

situated at the lateral surface of the receiving drum 22, the measuring area of the filling sensor covering at least one flute 28 of the receiving drum 22. In addition, the feeding module 20 is provided with a feeding apparatus 118 which comprises a filling apparatus 119 situated at the end of the channel 120 departing from the hopper 121. The feeding apparatus 118 is situated downstream of the filling sensor considering the direction of conveying of the rods MA in the flutes 28 of the receiving drum 22. When the absence of the rod MA in the flute 28 is detected by the filling sensor 115, the feeding apparatus 118 will be actuated so that the filling apparatus 119 makes a rotation to transfer the rod MA to the flute 28 of the receiving drum 22 when the empty flute 28 is within the operating area of the filling apparatus. A repeated absence of the rod MA will indicate that one of the feeding channels 110 is blocked.

Any number of feeding channels 110 may be applied, Fig. 4 shows the second embodiment of the feeding module provided with four feeding channels 110, the total feed capacity through the feeding channels 110 being equal to the required capacity of the receiving drum 22 which is dependent on the capacity of the downstream equipment in the production process. Each of the feeding channels 110 is provided with a blockage sensor 114 which checks whether the flow of the rods through the feeding channel 110 is taking place correctly. If a blockage in the feeding channel 110 is detected, a controller S receives a blockage detection signal. As in the previous embodiment, the feeding module 20 is provided with the filling sensor 115, whereas the filling sensor 115 checks the presence of the rod MA in the flute 28 of the receiving drum 22. The feeding module 20 may be provided with either the blockage sensor 114 or the filling sensor 115, or may be provided with both such sensor. The controller S receives information that some feeding channel 110 is not working properly and not all flutes 28 of the receiving drum 22 are filled based on the signal from the filling sensor 115 or based on the signal from the blockage sensor 114, these signals may be collectively referred to as an empty flute signal, i.e. the controller receives information that an empty flute has already occurred or will occur. A blockage of one of the channels can be seen in Fig. 4, namely every fourth flute 28 on the receiving drum 22 is unfilled. The feeding apparatus 118 is adapted to fill the single flutes 28 that have remained unfilled due to a momentary disturbance in the operation of the feeding channels 110. Furthermore, the feeding apparatus 118 is adapted to replace the feeding of any of the feeding channels 110, i.e. it is adapted to continuously feed the rods MA in order to replace the continuous feeding of the rods MA carried out by any of the feeding channels. For example, in case a blockage occurs in one of the feeding channels 110, the feeding apparatus 118 temporarily takes over the operation of such feeding channel 110 which has been blocked, until it is unblocked, so that the supply module 20 can operate continuously. Thus, it is possible to temporarily disable one of the feeding channels 110 when the feeding channel 110 itself is damaged and for the feeding apparatus 118 to take over the operation of such feeding channel 110 while the damaged feeding channel 110 is being repaired.

In the third embodiment shown in Fig. 5, the feeding module 20 is provided with five feeding channels 110. Similar to the previous embodiment, the feeding apparatus can both take over the operation of the feeding channel and fill up individual missing rods MA. The feeding module in the fourth embodiment shown in Fig. 6 is provided with three feeding channels 116, the feeding channel 116 in this embodiment having walls formed by belts 117. It is possible to embody a feeding module with a greater number of feeding channels. Similar to the above-discussed embodiments, the filling elements 112 of the individual feeding channels 116 are synchronised with one another and with the receiving drum 22. The functions of the feeding apparatus 118 are similar.

An assembling unit 30 comprises assembling drums 31, 31', 31'', 31''' and conveying drums 32, 32', 32'', 32''' which are provided with flutes in which segments are received and conveyed. The assembling drum 31, 31', 31'', 31''' is adapted to receive and to convey a stream of segments A, B, C, D, respectively. The first assembling drum 31 is adapted to receive only the segments A, while the assembling drum 31' is adapted to receive a stream of the segments A from the feeding module 20 via the conveying drum 32 and

to receive a stream of the segments B from the feeding module 20', the streams of the segments A and B being assembled on the assembling drum 31'. Similarly, on the assembling drum 31'', streams of the segments A, B are received together, and a stream of the segments C is received from the feeding module 20''. On the assembling drum 31''', streams of the segments A, B, C are received together and a stream of the segments D is received from the feeding module 20'''. In the assembling unit 30, streams of the segments A, B, C, D are arranged in such a way that adjacent segments in the flutes are spaced apart. The assembling unit 30 is adapted to feeding to the first wrapping module 40 for wrapping the group G1 comprising the segments A, B, C, D. The segments A, B, C, D of the group G1 are pushed together by means of known apparatuses for pushing rod-like articles together while they are conveyed on the drums, thus forming the group G2 comprising the segments A, B, C, D which have been pushed together.

The first wrapping module 40 comprises a feeding unit 41 for feeding the first wrapping material MW1, a cutting unit 42 for cutting the strand of the first wrapping material MW1 into sections of the first wrapping material W1 and a rolling unit 43 for wrapping the group of segments. The first wrapping module 40 comprises a conveying drum 44 which is adapted to convey the segment group G2. The rolling unit 43 is adapted to wrap the section of the first wrapping material W1 around the segment group G2. The rod thus formed is designated R (stage g).

The cutting unit 50 situated downstream of the first wrapping module 40 in the direction T of the process of manufacturing the multi-segment articles is provided with a circular knife 51 for cutting the multi-segment rod R into two halves, i.e. into two multi-segment half rods designated as R1 and R2 (stage h in Fig. 2a). The cutting is carried out so that the segment B of the multi-segment rod R is cut into two halves.

The reorienting module 60 is adapted to vary the orientation of the half multi-segment rods R1 and R2 relative to each other, i.e. to vary the mutual position of the rods R1 and R2 while they are conveyed. The reorienting module 60 may be provided with reorienting drums, known in the tobacco industry, which, in addition to circumferential conveying, reorient the conveyed rod-like articles axially and/or transversely to the axes of such articles. The reorienting module 60 may be provided with rotating drums known in the tobacco industry, which, in addition to circumferential conveying, rotate the conveyed rod-like articles around axes which are substantially perpendicular to the circumferential surface. The reorienting module 60 is adapted to vary the positioning of the rod-like articles R1 and R2 relative to each other. As a result of the operation of the reorienting module 60, the rods R1 and R2 are reoriented so that the segments D which are the ends of the rods R1 and R2, initially oriented away from each other, are oriented towards each other, while the half segments B, arranged opposite to the segments D in the rods R1 and R2, initially oriented towards each other, are oriented away from each other. In addition, the rods R1 and R2 become coaxially situated, and there will be a gap maintained between the rods R1 and R2.

The additional feeding module 70 comprises a hopper 71, a receiving drum 72 provided with circumferentially arranged flutes in which the rods ME from the hopper 71 are placed. The additional feeding module 70, similar to the feeding module 20 discussed above, is provided with feeding channels supplying the rods ME from the hopper 71 to the receiving drum 72, the structure of the additional feeding module 70 may be the same as of the feeding module 20. The rods ME are transferred to the conveying drum 73 similarly through the feeding channels as discussed for the feeding module 20. At the conveying drum 73, there is arranged a cutting head 74 which is provided with one or more circular knives for cutting the rods. The additional feeding module 70 comprises at least one shifting drum 75 and at least one aligning drum 76. The additional feeding module 70 is adapted to feed a stream of additional segments E. After feeding the additional segment E, a group S1 comprising the half multi-segment rod R1, the segment E and the half multi-segment rod R2 with spacing is formed. The elements of the group S1 are pushed together by means

of known apparatuses for pushing rod-like articles together when they are conveyed on drums, thus a group S2 comprising the elements R1, E, R2 which have been pushed together is formed.

The second wrapping module 80 comprises a feeding unit 81 for feeding a second wrapping material MW2, a cutting unit 82 for cutting the second wrapping material MW2 into sections of the second wrapping material W2, and a rolling unit 83. The second wrapping module 80 comprises a conveying drum 84 which is adapted to convey the group S2 which includes the half multi-segment rod R1, the segment E and the second half multi-segment rod R2. The conveying drum 84 is adapted to convey the group S2 of the elements R1, E, R2 pushed together, along with a section of the second wrapping material W2. The rolling unit 83 is adapted to wrap the section of the second wrapping material W2 around the group S2 on the rolling drum 83A. The rod thus formed is designated as P.

In the embodiment of the apparatus for the manufacture of multi-segment rods shown in Fig. 1, all feeding modules, namely the feeding modules 20 in the assembling apparatus 10 as well as the additional feeding module 70, are constructed similarly, i.e., the feeding channels 110 or 116 for feeding the rods to the receiving drum 22, 72, respectively, are situated below the hopper 21, 71. In the embodiment of the apparatus for the manufacture of multi-segment rods shown in Fig. 1a, only the additional feeding module 70 is provided with feeding channels 110 or 116 for feeding the rods.

In the process of manufacturing the multi-segment rod shown in simplified terms in Fig. 2a, the feeding module 20 cuts the rods MA into the segments A and feeds two segments A to the assembling unit 30 (stage a in Fig. 2a), the feeding module 20' cuts the rods MB and feeds the segment B (stage b), the feeding module 20'' cuts the rods MC and feeds two segments C (stage c), the feeding module 20''' cuts the rods MD and feeds two segments D (stage d). The segments A, B, C, D are conveyed in the assembling unit 30, whereas the assembling unit 30 supplies the segment group G1 comprising the segments A, B, C, D. The segments A, B, C, D are further conveyed and are pushed together, whereas the segments A, B, C, D which have been pushed together form the segment group G2 (step e). In the wrapping module 40, sections of the first wrapping material W1 are cut from the strand of the first wrapping material MW1 and are wrapped around the segment group G2 (stage f), after wrapping on the rolling drum 43A by means of the rolling unit 43B, the rod R is formed (stage g). The rod R is cut by the cutting unit 50 into two half multi-segment rods R1 and R2 (stage h), whereas the rods R1 and R2 are adjacent to each other with the half segments B and are positioned coaxially. The rods R1 and R2 are reoriented in the reorienting unit 60 (stages i, j, k, l, m, n) so that, after reorienting, they are again positioned coaxially, with a gap, with opposite ends than initially, namely the half segments B are oriented away from each other, while the segments D are oriented towards each other. In the process of reorienting the rods R1 and R2 shown in Fig. 2a, the reorientation is carried out by rotating the rods R1 and R2 shown in the stage k, and the stages j and l represent the movement of the rods before and after rotation, whereas these stages may be omitted. The additional feeding module 70 cuts the rods ME into the segments E and feeds the segments E between the rods R1 and R2, after inserting the segment E a group S1 including the rod R1, the segment E and the rod R2 is formed (stage o), with gaps between the rods R1, the rods R2 and the segment E being maintained. After pushing the rods R1, R2 and the segment E together, a group S2 with no gaps among the rods R1, R2 and the segment E is formed (stage p). In the second wrapping module 80, sections of the second wrapping material W2 are cut from the strand of the second wrapping material MW2 and are wrapped around the segment group S2 (stage r), after wrapping on the rolling drum 83A by means of the rolling unit 83, the rod P is formed (stage s).

In the process of manufacturing the multi-segment rod in the second embodiment shown in simplified terms in Fig. 2b, the feeding module 20 cuts the rods MB into the segments B and feeds the segment B to the assembling unit 30 (stage a in Fig. 2b), the feeding module 20' cuts the rods MA and feeds two segments A (stage b), the feeding module 20'' cuts the rods MD and feeds two segments D (stage c), the feeding module

20''' cuts the rods MC and feeds two segments C (stage d). The process stages e to h are carried out as described for the first embodiment. At the stages i, j the half multi-segment rods R1 and R2 are displaced transversely to the axis of the rods R1, R2, at the stages k, l, m the rods R1, R2 are reoriented so that after the axial displacement of the rods R1, R2 the half segments B are oriented away from each other, while the segments D are oriented towards each other. At the stages m and n the rods R1 and R2 are displaced transversely to their axes so that the rods R1 and R2 are positioned coaxially. The further process is carried out as in the first embodiment.

Patent claims

1. A feeding module (20, 70) for feeding segments (A, E) for manufacture of multi-segment articles, adapted to cut a rod (MA, ME) into segments (A, E) and to feed the segments (A, E), comprising
 - a hopper (21, 71) for storing the rods (MA, ME),
 - a receiving drum (22, 72) for receiving the rods (MA, ME) from the hopper (21, 71),
 - a conveying drum (23, 73) for conveying the rods (MA, ME),
 - a cutting head (24, 74), situated at the conveying drum (23, 73), for cutting the rod (MA, ME) into individual segments (A, E),
 - a shifting drum (25, 75) for varying mutual position of the segments (A, E),
 - an aligning drum (26, 76) for forming at least one stream of the segments (A, E),

characterised in that

the feeding module (20, 70) is provided with feeding channels (110, 116) extending from the hopper (21, 71) to the receiving drum (22, 72) and a filling sensor (115) generating a signal of an empty flute (28) when the flute (28) of the receiving drum (22, 72) remains empty in the measuring area of the filling sensor (115),

furthermore, the feeding module (20, 70) is adapted to feed the rod (MA, ME) into the empty flute (28) of the receiving drum (22, 72) by means of a feeding apparatus (118) situated downstream of the filling sensor (115) in response to the signal of an empty flute (28) of the receiving drum (22, 72).

2. The feeding module as in claim 1, characterised in that the feeding channel (110, 116) is provided with a blockage sensor (114) and the signal of an empty flute is generated by the flute (28) filling sensor (115) of the receiving drum (22, 72) or the blockage sensor (114) of the feeding channel (110, 116).

3. The feeding module as in claim 1 or 2, characterised in that the feeding channels (110) are gravity channels.
4. The feeding module as in any of the claims 1 to 3, characterised in that the walls of the feeding channels (116) are formed by belts (117) forcing the movement of the rods (MA, ME) towards the receiving drum (22, 72).
5. The feeding module as in any of the claims 1 to 4, characterised in that the feeding apparatus (118) is adapted to continuous feeding with the rods (MA, ME) to replace the continuous feeding with the rods (MA, ME) carried out by any of the feeding channels (110, 116).
6. An apparatus (1) for manufacture of multi-segment articles, comprising
 - at least two feeding modules (20) according to any of claims 1 to 5 for feeding the segments (A, B, C, D) formed by cutting the rods (MA, MB, MC, MD),
 - an assembling unit (30) provided with drum conveyors (31, 32) for receiving the segments (A, B, C, D) from the feeding modules (20) and forming a segment group (G1),
 - a first wrapping module (40) for feeding a section of a first wrapping material (W1) and wrapping a segment group (G2) so as to form a multi-segment rod (R),
 - a cutting unit (50) for cutting the formed rod (R) into half multi-segment rods (R1, R2),
 - an additional feeding module (70) for cutting an additional rod (ME) and feeding additional segments (E) between half multi-segment rods (R1, R2), according to any of claims 1 to 5.
 - a second wrapping module (80) for feeding a section of a second wrapping material (W2) and wrapping a group (S2) comprising the additional segment (E) and the half multi-segment rods (R1, R2) so as to form the multi-segment rod (P),
7. A method of feeding segments for manufacture of multi-segment articles, comprising steps wherein
 - a rod (MA, ME) is fed to the hopper (21, 71), the rod (MA, ME) being a multiple of a segment (A, E),
 - the rods (MA, ME) are conveyed through at least two feeding channels (110, 116) to a receiving drum (22, 72),
 - the rod (MA, ME) is received from the feeding channel (110, 116) into the flute (28) of the receiving drum (22, 72),
 - the rod (MA, ME) is transferred from the flute (28) of the receiving drum (22, 72) to the flute (29) of the conveying drum (23, 73),
 - the rod (MA, ME) is cut into individual segments (A, E) when conveying the rod (MA, ME) in the flute (29) of the conveying drum (23, 73) by means of a cutting head (24, 74) situated at the conveying drum (23, 73),
 - mutual position of the segments (A, E) on the shifting drum (25, 75) is varied,
 - at least one stream of the segments (A, E) is formed on an aligning drum (26, 76),

characterised in that

the presence of the rod (MA, ME) in the flute (28) of the receiving drum (22, 72) is checked by means of a filling sensor (115),

the empty flute signal (110, 116) is generated by means of the filling sensor (115) when the flute (28) of the receiving drum (22, 72) remains empty in the sensor's measuring area,

a rod (MA, ME) is fed into the empty flute (28) of the receiving drum (22, 72) by means of the feeding apparatus (118) located downstream of the filling sensor (115) in response to a signal of an empty flute (28) of the receiving drum (22, 72).

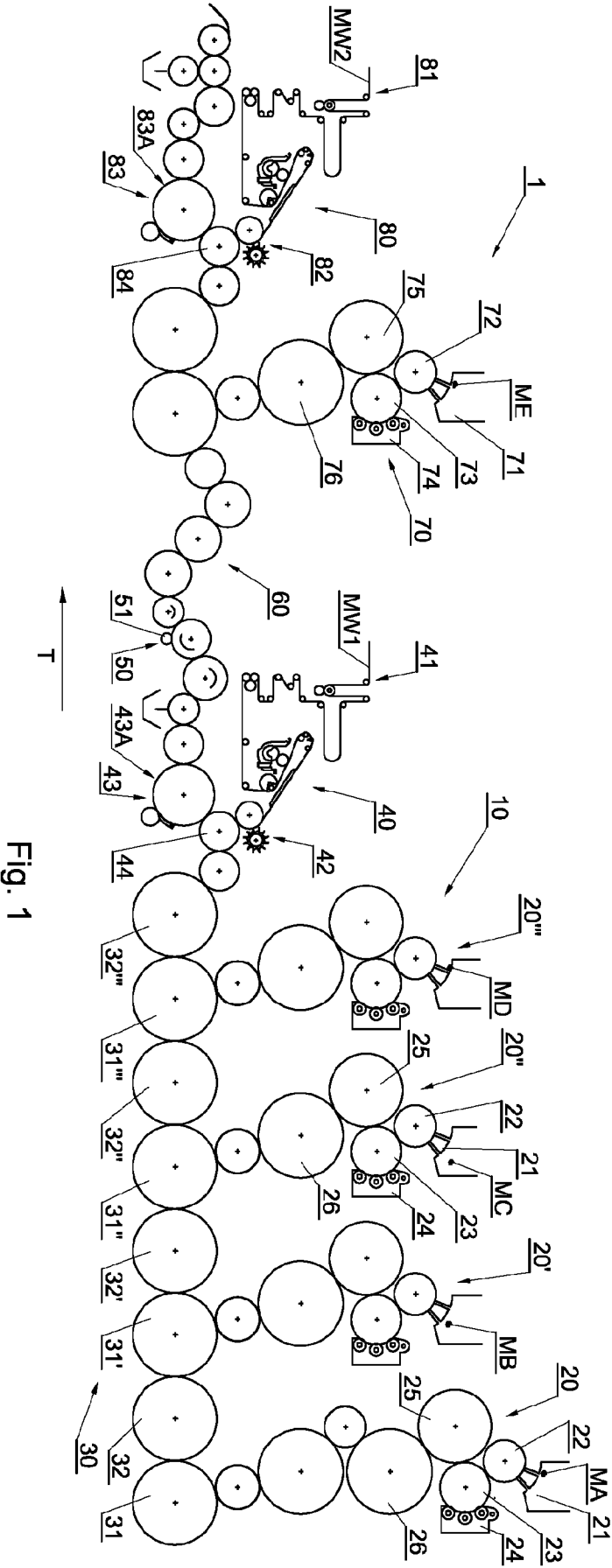
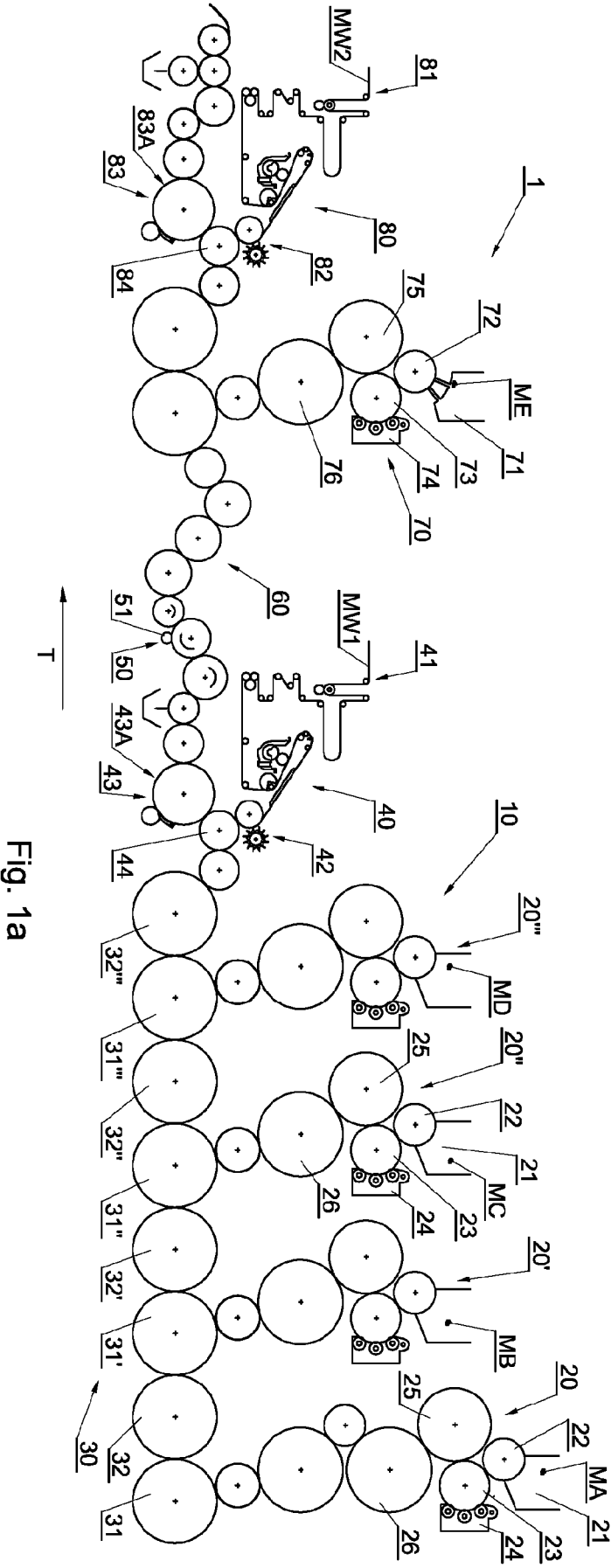


Fig. 1



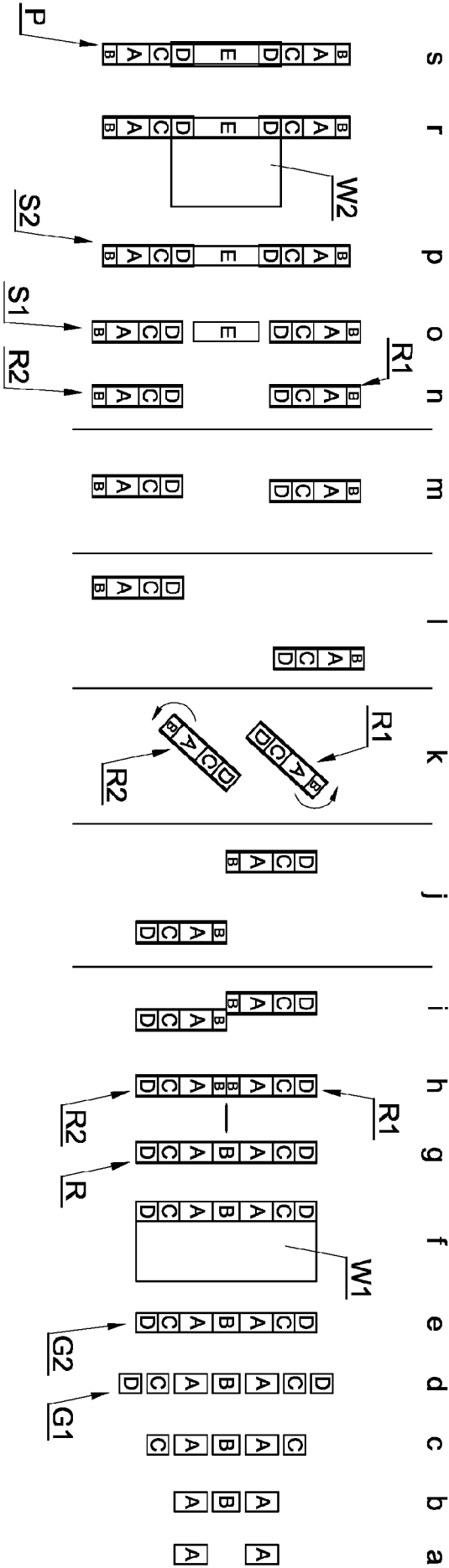


Fig. 2a

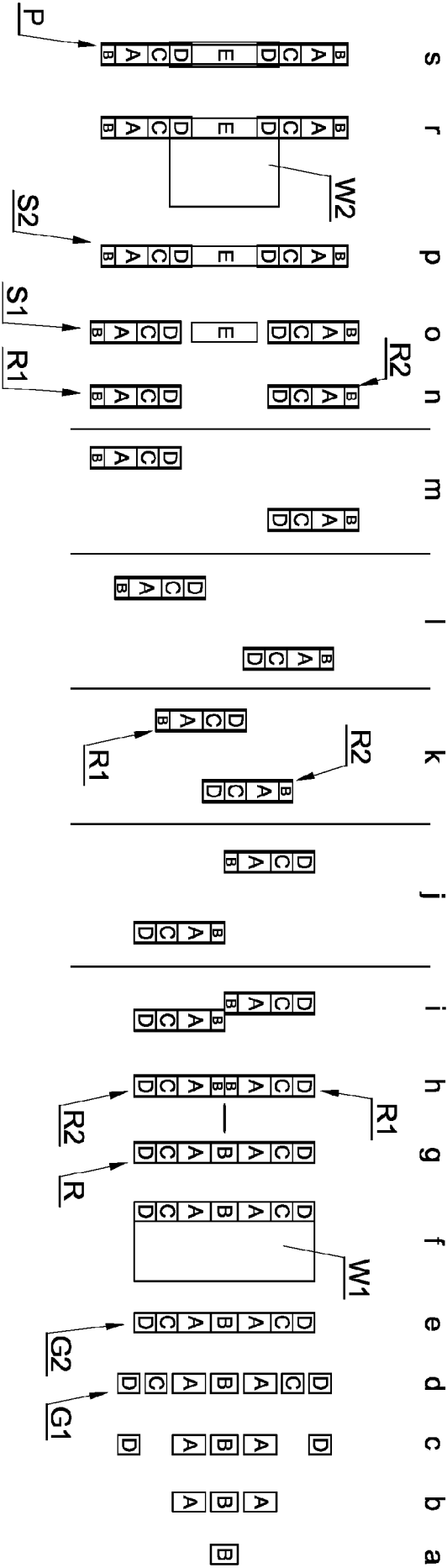


Fig. 2b

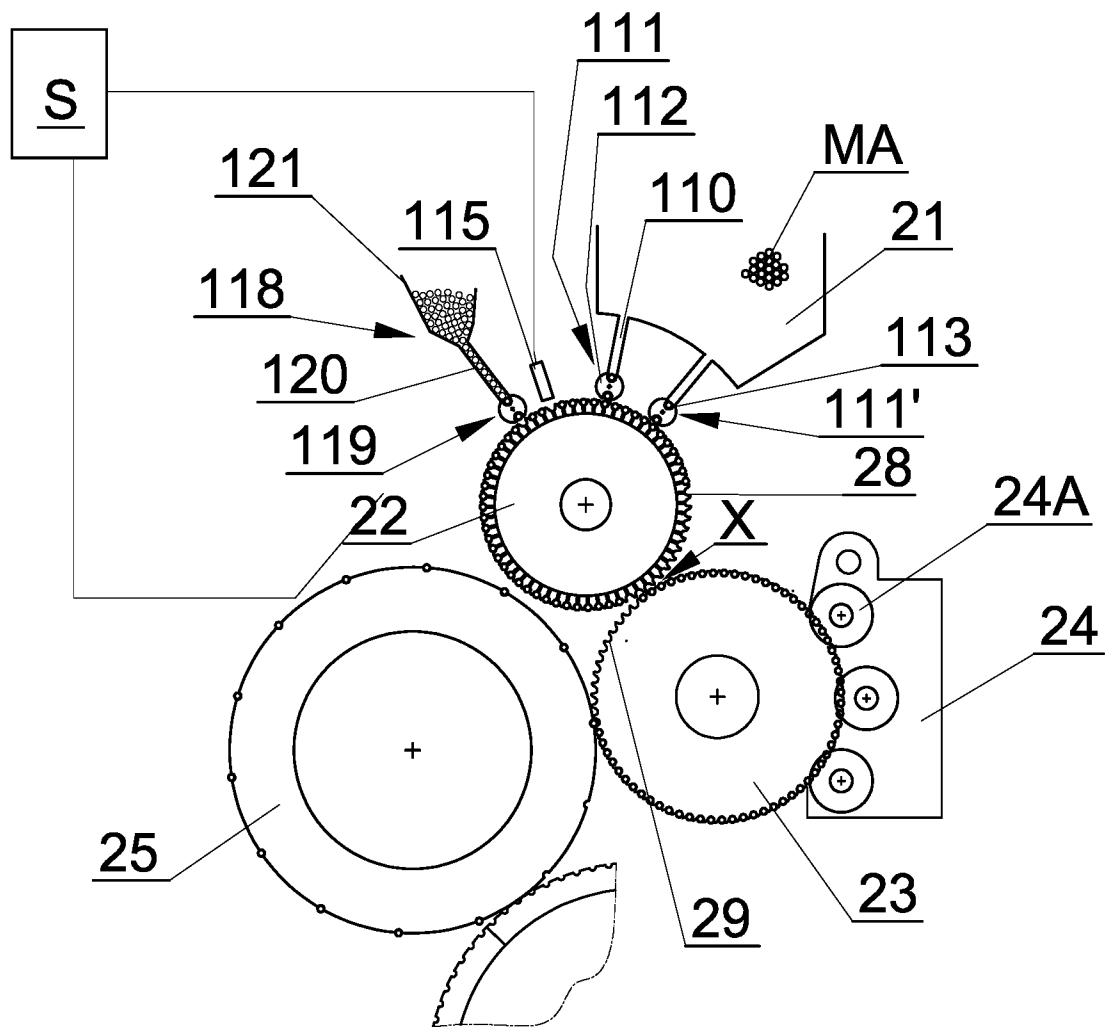


Fig. 3

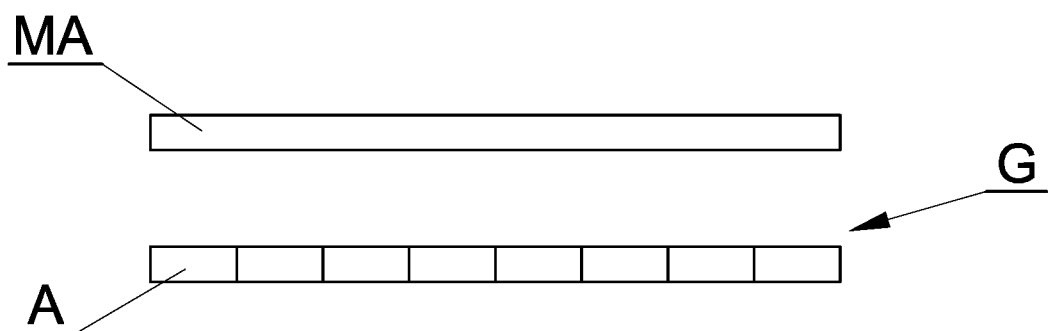


Fig. 3a

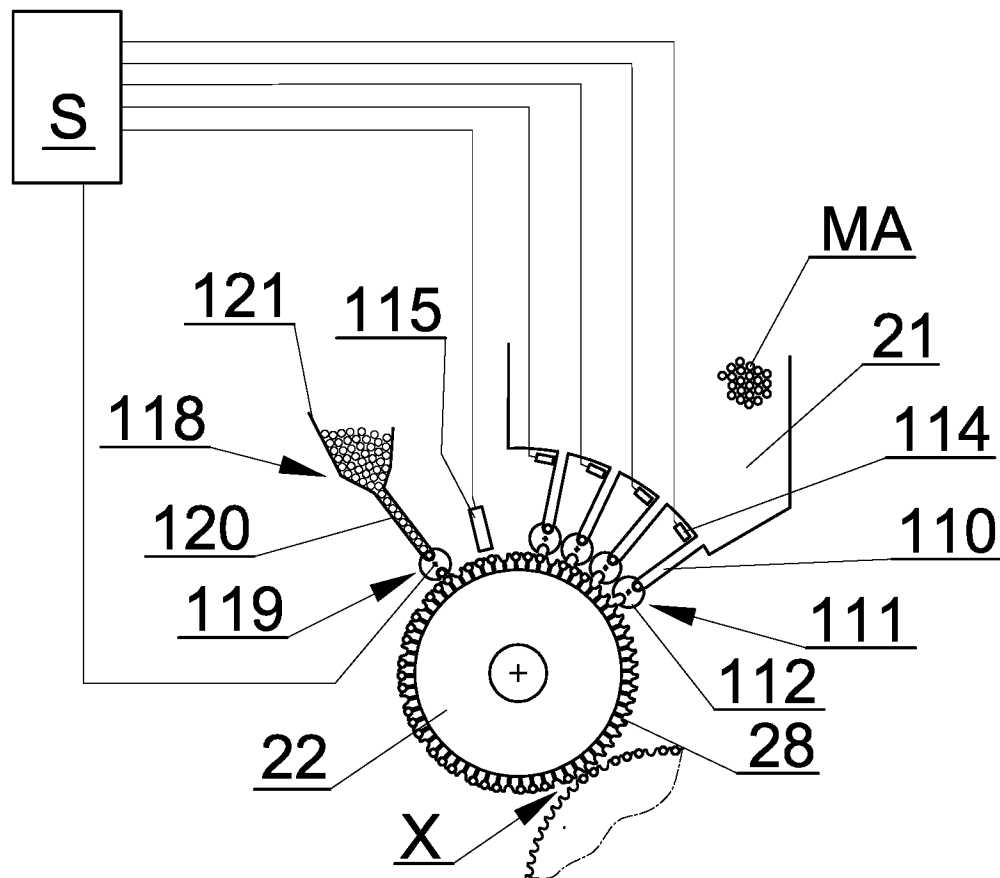


Fig. 4

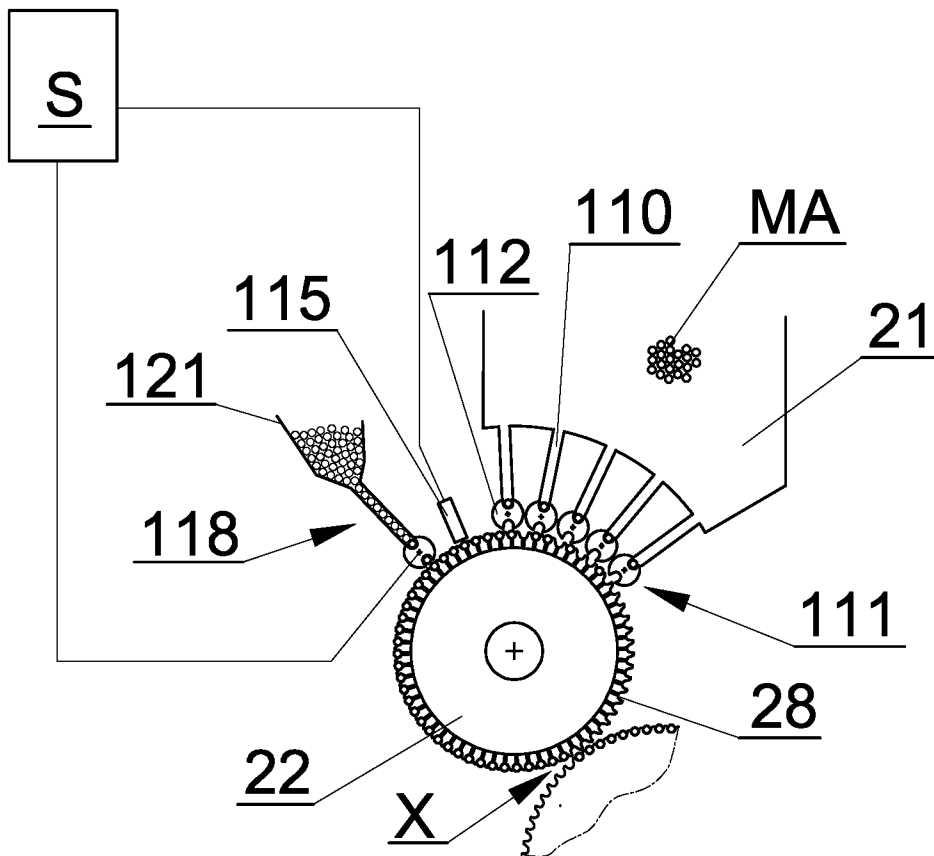


Fig. 5

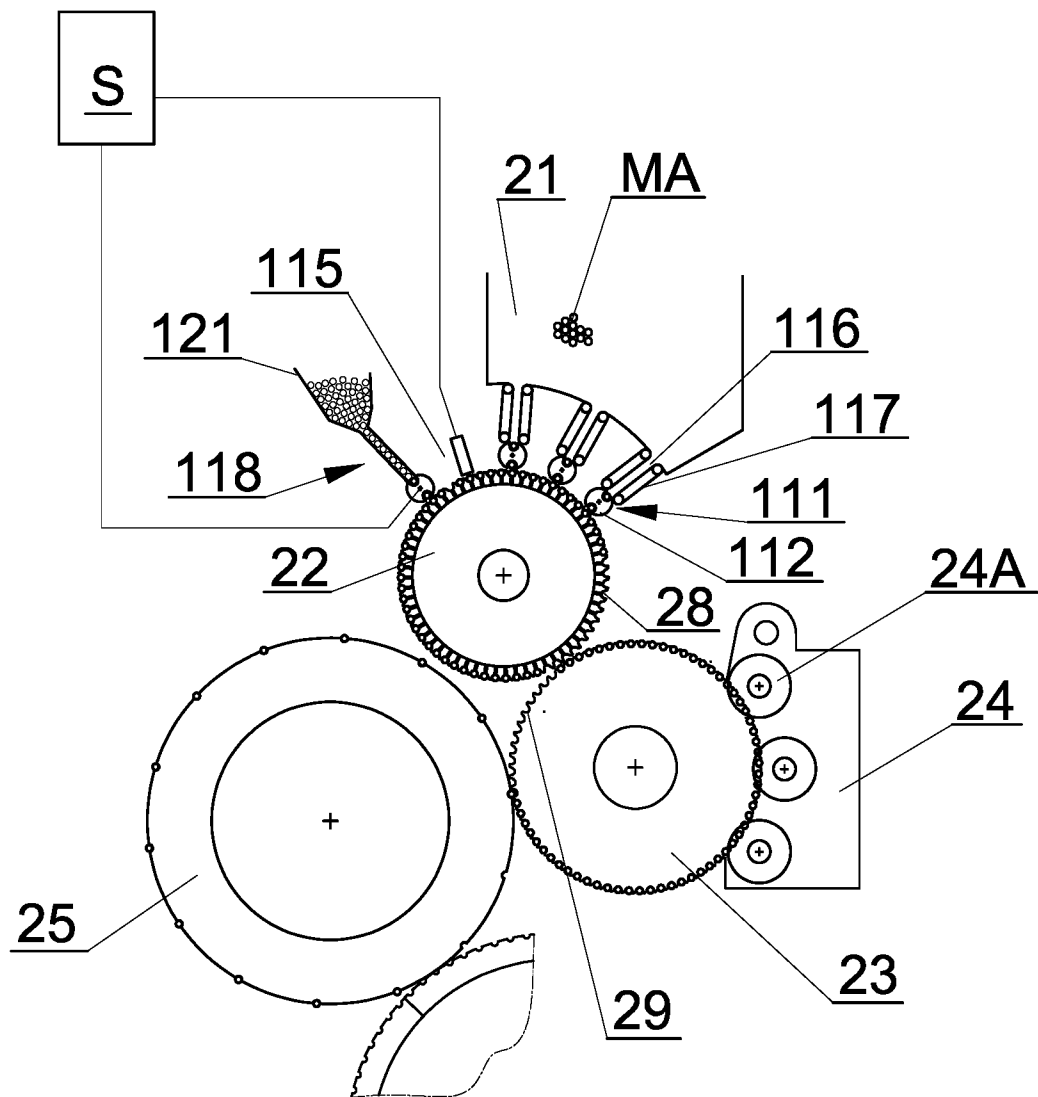


Fig. 6

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2023/061781

A. CLASSIFICATION OF SUBJECT MATTER INV. A24C5/47 A24D3/02 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) A24C		
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		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2014/188306 A1 (GD SPA [IT]) 27 November 2014 (2014-11-27) cited in the application page 5, line 3 - page 7, line 6; claims; figures -----	1-7
A	WO 2019/105813 A1 (INT TOBACCO MACHINERY POLAND SP ZOO [PL]) 6 June 2019 (2019-06-06) page 6, line 11 - page 7, line 4; claims; figure 4 -----	1-7
A	EP 3 632 224 A1 (GD SPA [IT]) 8 April 2020 (2020-04-08) paragraph [0018] - paragraph [0029]; claims; figures -----	1-7
	-/--	
☒ Further documents are listed in the continuation of Box C. ☒ See patent family annex.		
* Special categories of cited documents : "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance;; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance;; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search		Date of mailing of the international search report
19 February 2024		12/03/2024
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016		Authorized officer Marzano Monterosso

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2023/061781

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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Information on patent family members

International application No

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