(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 2 777 408 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
17.09.2014 Bulletin 2014/38

(21) Application number: **14159398.8**

(22) Date of filing: **13.03.2014**

(51) Int Cl.:
A24C 5/46 *(2006.01)* ***A24F 47/00*** *(2006.01)*
A24D 3/02 *(2006.01)*

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME

(30) Priority: **15.03.2013 US 201361962287 P**
10.03.2014 US 201414202467

(71) Applicant: **HAUNI Maschinenbau AG**
21033 Hamburg (DE)

(72) Inventors:
- **Amiss, Robert**
  Lanexa, VA 23089 (US)
- **Kaminski, Miroslaw**
  Colonial Hights, VA 23834 (US)

(74) Representative: **Seemann & Partner**
Raboisen 6
20095 Hamburg (DE)

(54) Method and apparatus for assembly of multi-segmented cylindrical products, such as tobacco products

(57) An apparatus for assembling a multi-segmented cylindrical product is described. The apparatus can include a feeder adapted to supply segments of a pliable material; and a rotating drum having an outer periphery and a plurality of fixtures distributed around the outer periphery, each fixture adapted to support a substantially cylindrical object, and wrap a segment of the pliable material around the substantially cylindrical object and a portion of the fixture to form a fill tube defining a pocket in the pliable material. Other features and related methods are also described.

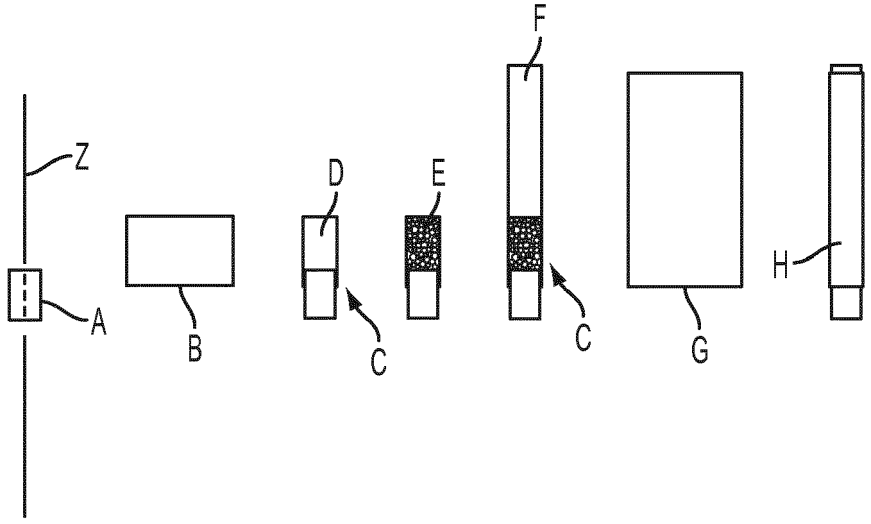

FIG. 2

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Description

[0001] This application claims the priorities of U.S. Provisional Application No. 61/962,287, filed on March 15, 2013, and of U.S. Non-Provisional Application No. 14/202,467, filed on March 10, 2014, the entire contents of which are hereby incorporated by reference.

[0002] This patent application relates generally to apparatuses and methods for manufacturing cylindrical products, such as tobacco products. More specifically, this patent application relates to methods and apparatuses for assembling the components of multi-segmented smoking articles, such as cigarettes.

[0003] Conventional smoking articles, such as cigarettes, typically include a tobacco rod, a filter, and a layer or layers of paper surrounding the tobacco rod and filter. However, the design of cigarettes has evolved to include other components or segments, such as solid heat sources, flavor pellets, flavor capsules, and/or other items. Some of these components may be small in size, difficult to manipulate, and/or difficult to combine. Accordingly, the demands on cigarette manufacturing techniques and related equipment have increased as a result of the evolution in cigarette design.

[0004] Accordingly, it is an object of the present invention to meet these demands.

[0005] According to an embodiment, an apparatus for assembling a multi-segmented cylindrical product is described. The apparatus can comprise: a feeder adapted to supply segments of a pliable material; and a rotating drum having an outer periphery and a plurality of fixtures distributed around the outer periphery, each fixture adapted to support a substantially cylindrical object, and wrap a segment of the pliable material around the substantially cylindrical object and a portion of the fixture to form a fill tube defining a pocket in the pliable material.

[0006] Advantageously, each rolling fixture comprises: a first mandrel; a second mandrel oriented substantially coaxially with respect to the first mandrel, the first and second mandrels adapted to receive the cylindrical object therebetween; and at least one support roller oriented substantially parallel to the first mandrel and the second mandrel, the support roller being adapted to wrap the segment of the pliable material around the substantially cylindrical object.

[0007] The first mandrel and second mandrel are preferably movable with respect to one another along a common axis.

[0008] The apparatus advantageously further comprises vacuum holes located in at least one of the first mandrel or the second mandrel, the vacuum holes being in communication with a vacuum source.

[0009] The at least one support roller preferably comprises a first support roller and a second support roller, the apparatus further comprises vacuum holes located in between the first support roller and the second support roller, the vacuum holes being in communication with a vacuum source.

[0010] The apparatus advantageously further comprises a volumetric metering device adapted to meter granular material into the fill tube.

[0011] Preferably, the cylindrical object comprises a smoking article, the apparatus further comprising: a wrapping station adapted to support the fill tube and a tobacco rod in an end-to-end arrangement, and wrap the fill tube and tobacco rod with paper.

[0012] The apparatus advantageously further comprises a source of tobacco rods that supplies tobacco rods to the wrapping station.

[0013] The apparatus preferably further comprises a tipping machine that adds a filter to the combined fill tube and tobacco rod.

[0014] Each fixture is advantageously adapted to support the substantially cylindrical object in a substantially vertical orientation.

[0015] The feeder is advantageously adapted to feed the segments of pliable material to the rotating drum in a substantially vertical orientation.

[0016] The substantially cylindrical object preferably comprises a heat source, wherein the heat source in particular comprises a carbon plug.

[0017] The segments of pliable material preferably comprise segments of paper, metallic foil, or film.

[0018] The granular material preferably comprises pellets.

[0019] According to another embodiment, a method for assembling a multi-segmented cylindrical product is described. The method comprises wrapping a segment of pliable material around a substantially cylindrical object to form a fill tube with a pocket extending from the substantially cylindrical object.

[0020] The method advantageously comprises wrapping a segment of pliable material around a substantially cylindrical object to form a fill tube with a pocket extending from the substantially cylindrical object.

[0021] The method preferably further comprises metering a predetermined volume of a granular material into the pocket.

[0022] The fill tube is advantageously transferred from a non-vertical orientation to a substantially vertical orientation prior the step of metering. Preferably, the fill tube is transferred to a substantially non-vertical orientation after the step of metering. The step of metering advantageously comprises dispensing the granular material into the pocket from above the pocket.

[0023] Advantageously, the step of wrapping comprises rotating the substantially cylindrical object with respect to the outer periphery of a rotating drum, and wrapping the pliable material around the substantially cylindrical object while it rotates.

[0024] The method according to the invention is advantageously further developed in that the substantially cylindrical object comprises a heat source, wherein in particular the heat source comprises a carbon plug; the segments of pliable material comprise segments of paper, metallic foil, or film; and/or the granular material com-

prises at least one of pellets of compressed tobacco, flavor capsules, and flavor impregnated granulates.

[0025] Further characteristics of the invention will become apparent from the description of the embodiments according to the invention together with the claims and the included drawings. Embodiments according to the invention can fulfill individual characteristics or a combination of several characteristics.

[0026] The foregoing aspects and other features and advantages of the invention will be apparent from the following drawings, wherein like reference numbers generally indicate identical, functionally similar, and/or structurally similar elements.

Figure 1 is a top, elevational view of an embodiment of a system for making multi-segmented cylindrical products, such as cigarettes.

Figure 2 is a flow diagram depicting an embodiment of a process of making a multi-segmented cigarette.

Figure 3 is a perspective view of an embodiment of a fill tube maker including a plurality of fixtures for wrapping a pliable material around a substantially cylindrical object. In Figure 3, portions of the fill tube maker are removed for illustration purposes.

Figure 4 is a perspective view of a portion of an embodiment of the fixture of Figure 3.

Figures 5A, 5B, 5C, and 5D are perspective views of the fixture of Figure 3, shown in various stages of wrapping the pliable material around the substantially cylindrical object.

Figure 6 is a perspective view of a portion of a pliable material inserter of Figure 1.

Figure 7 is another perspective view of a portion of the pliable material inserter of Figure 1.

[0027] Embodiments of the invention are discussed in detail below. In describing embodiments, specific terminology is employed for the sake of clarity. However, the invention is not intended to be limited to the specific terminology so selected. A person skilled in the relevant art will recognize that other equivalent parts can be employed and other methods developed without departing from the spirit and scope of the invention. All references cited herein are incorporated by reference as if each had been individually incorporated.

[0028] This application relates to methods and apparatuses for making multi-segmented cylindrical products. According to embodiments, this application relates to methods and apparatuses for making tobacco products, such as smoking articles (e.g., cigarettes, cigars, or the like), having multiple components or segments. For example, according to an embodiment to be described in more detail herein, a multi-segmented cigarette can include a solid heat source and a predetermined volume of flavor pellets in addition to loose tobacco and a filter. To facilitate insertion of the pellets (which can be difficult to handle), all or a portion of the cigarette can be oriented substantially vertically during one or more phases of the manufacturing process. For example, the cigarette can be held in the substantially vertical position during insertion of the pellets from above. The cigarette, or portion thereof, can be transferred from a non-vertical position (e.g., horizontal) prior to, and/or after, the substantially vertical processes to accommodate horizontal processing in upstream and/or downstream equipment. One of ordinary skill in the art will appreciate that the present invention is not limited to tobacco products, but can be implemented in other manufacturing processes involving hollow tubular objects, such as, for example, pill capsules.

[0029] When referring to a "vertical" or "substantially vertical" orientation herein, it is generally meant that components having a length that is longer than its width or diameter are oriented with the length in a vertical or substantially vertical orientation. For example, and without limitation, in the context of a cylinder, the cylinder is considered to be in a vertical orientation when its axis is oriented vertically. In certain embodiments, the term "substantially vertical" may encompass deviations from exactly vertical, for example, where the axis is closer to a vertical orientation than to a horizontal orientation, e.g., inclined by greater than 45 degrees.

[0030] Figure 1 is a top, elevational view of an embodiment of a system 100 for making multi-segmented smoking articles, such as cigarettes. Figure 2 is a flow diagram depicting an embodiment of a process of making a multi-segmented cigarette. In Figure 2, the axis Z represents, without limitation, the substantially-vertical orientation discussed herein. The circular arrows in Figure 1 represent examples of direction of rotation.

[0031] For ease of discussion, and without limitation, the methods and apparatuses will be described herein with respect to making "cigarettes." However, as mentioned above, the present application is not exclusive to cigarette manufacturing, but could be used with any type of tobacco product or smoking article, or moreover, to other non-tobacco related products such as pill capsules.

[0032] Referring to Figures 1 and 2 in combination, the system 100 can generally include a cylindrical object supply unit 102, which can supply substantially cylindrical objects, e.g., a solid or semi-solid carbon plug heat source for a cigarette (hereinafter, generally, "heat sources"). The cylindrical object supply unit 102 can include a hopper 104 that holds a plurality of the heat sources. The heat sources can be supplied to the hopper 104 by manual or automatic operations, or by a combination of the two. Although the system 100 is described herein in connection with heat sources as the cylindrical object, the application is not limited to the embodiment described. Rather, the invention can alternatively be used with other

cylindrical and substantially cylindrical objects, such as filter rods with or without objects in them, threads or additives. Additionally or alternatively, the substantially cylindrical objects can comprise tubes filled with aromatic substances.

[0033] The cylindrical object supply unit 102 can transport the heat sources from the hopper 104 to a transfer drum 106, such as a 45° transfer drum, which moves the heat sources from a substantially horizontal orientation to a substantially vertical orientation. The transfer drum 106 can then deposit the heat sources on a chain of primary transfer drums 108A, 108B, 108C and secondary transfer drums 110A, 110B, which transport the heat sources downstream in a substantially vertical orientation for later processing. According to an embodiment, the supply unit 102 can subdivide (e.g., cut) bulk heat sources contained in the hopper 104 into smaller heat sources to be used in downstream processing. For example, the unit 102 can subdivide a cylindrical rod of the heat source material into multiple, shorter cylindrical units, however, other embodiments are possible. According to an embodiment, the unit 102 can comprise a hopper and cutting head on the filter feed module of a MAX filter attachment apparatus, available from Hauni Maschinenbau AG of Hamburg, Germany.

[0034] Referring to Figures 1 and 2, the system 100 can also include a fill tube maker 112 that receives the heat sources A and wraps them with segments of a pliable material B (e.g., metallic foil, film, or paper) inserted by a pliable material inserter 114, to make a fill tube C having a hollow tubular portion D, which in the present application is also called a pocket. Further details about the fill tube maker 112 will be provided below. The term pliable material is used herein to describe a metallic foil, film, or paper. However, the term is not limited to the embodiments described. Rather, as used herein, the term pliable material generally refers to a sheet-like material that exhibits some resilience to bending, or which exhibits some degree of plastic deformation, such as a metallic foil or metallic foil laminated with paper. In addition to the examples mentioned above, other embodiments can include, without limitation, thin sheets of plastic, polymers, composites, rubbers, or other materials known in the art. Additionally, while embodiments describe a fill tube as a component of a cigarette, the term is not limited to the embodiments described herein. Rather, as used herein, a fill tube refers generally to any combination of a cylindrical or substantially-cylindrical object with a piece of pliable material to form a tubular component having an open top and a closed bottom formed by the cylindrical or substantially-cylindrical object.

[0035] The pliable material inserter 114 can receive the pliable material from a bobbin and glue pot machine 116, which cuts the pliable material into segments B of the desired size, and applies adhesive to all or a portion of the pliable material B. The adhesive can be applied, for example, to portions of the pliable material that contact the heat sources A, and/or to portions of the pliable material that overlap with one another. According to an embodiment, the pliable material inserter 114 and the bobbin and glue pot machine 116 can comprise the plug wrap guide system from the MAX filter attachment apparatus, as well as a BOB MAX bobbin holder and bobbin changer, all available from Hauni Maschinenbau AG of Hamburg, Germany.

[0036] The pliable material inserter 114 alone or in combination with the bobbin and glue pot machine 116 is also called a feeder which is adapted to supply segments of a pliable material.

[0037] The pliable material inserter 114 can insert segments B of the pliable material to the fill tube maker 112, e.g., at an insertion point where the fill tube maker 112 receives the segments B. According to embodiments, the pliable material inserter 114 can feed the segments B to the fill tube maker 112 in a substantially vertical orientation, however, other embodiments are possible. Likewise, in embodiments, the fill tube maker 112 can make the fill tubes C in a substantially vertical orientation, however other variations are possible.

[0038] A transfer drum 118 can take the fill tubes C from the fill tube maker 112 and transfer them, e.g., while in a substantially vertical orientation, to a granular object filling drum 120. A volumetric metering device 300, shown schematically, can fill the hollow tubular portion D of the fill tubes C with a predetermined volume of a granular material E, such as, for example, tobacco pellets or flavor capsules. Any number of known metering devices can be used, as would be appreciated by one of ordinary skill in the art based on this description. For example, according to an embodiment, the metering device can utilize the principles and structures disclosed in European Patent EP 1 228 709 B1, owned by the assignee of this application, the entire content of which is incorporated herein by reference.

[0039] According to an embodiment, the metering device 300 can dispense the granular material E into the hollow tubular portion D of the fill tube C from above, e.g., while the fill tube C is in a substantially vertical orientation. This can occur while the fill tube C is located on the object filling drum 120.

[0040] While the term granular material is used in embodiments to describe tobacco pellets, flavor capsules, or flavor impregnated granulates, the term is not limited to the described embodiments. Rather, the term granular material refers generally to any material that is made up of small grains, particles, beads, or the like, such as pellets, powders, and capsules, whether regular or irregular in size and/or shape.

[0041] A tobacco rod supply unit 124 can provide a supply of tobacco rods F (e.g., loose tobacco wrapped in paper having a substantially cylindrical shape). The tobacco rod supply unit 124 can include a hopper 126 that holds a plurality of the tobacco rods F. The tobacco rods F can be supplied to the hopper 126 by manual or automatic operations, or by a combination of the two.

[0042] The tobacco rod supply unit 124 can transport

the tobacco rods F from the hopper 126 to a transfer drum 128, such as a 45° transfer drum, which moves the tobacco rods F from a substantially horizontal orientation to a substantially vertical orientation. The transfer drum 128 can then deposit the tobacco rods F on a chain of primary transfer drums 130A, 130B, 130C and secondary transfer drums 132A, 132B, which can transport the tobacco rods F to a combiner drum 134, e.g., in a substantially vertical orientation. According to an embodiment, the supply unit 124 can subdivide bulk tobacco rods contained in the hopper 126 into smaller tobacco rods to be used in downstream processing. For example, the unit 124 can subdivide (e.g., cut) a long tobacco rod into multiple, shorter tobacco rods, however, other embodiments are possible. According to an embodiment, the tobacco rod supply unit 124 can comprise the hopper on the filter feed module of a MAX filter attachment apparatus, available from Hauni Maschinenbau AG of Hamburg, Germany.

[0043] As shown in Figure 2, the combiner drum 134 can receive the fill tubes C (filled with the granular material) from the granular material filling drum 120 and combine them with tobacco rods F received from the secondary transfer drum 132B, for example, in an end-to-end arrangement. For example, referring to Figure 1, the secondary transfer drum 132B can transfer a tobacco rod F to the combiner drum 134 at point X, and the filling drum 120 can subsequently transfer a fill tube C (e.g., with tubular portion D filled with granular material E) to the combiner drum 134 at point Y. According to an embodiment, secondary transfer drum 132B can supply the tobacco rod F to the combiner drum 134 at a first vertical height, and the filling drum 120 can supply the fill tube C to the combiner drum 134 at a second vertical height, such that the fill tube C and the tobacco rod F are combined substantially coaxially on the combiner drum 134, for example, in an end-to-end abutting configuration. According to an embodiment, the open end of the fill tube C can abut the tobacco rod F, as shown in Figure 2, effectively closing off the hollow tubular portion, preventing the granular material E located therein from escaping in downstream operations, however other configurations are possible.

[0044] A wrapping drum 136 can receive the fill tube C and tobacco rods F combined in end-to-end fashion from the combiner drum 134, and wrap them in an outer wrap G, such as cigarette paper. This can form a filterless cigarette rod H. As shown in Figure 1, an outer wrapper inserter 138 can receive cigarette paper from a bobbin and glue pot machine 140, which cuts the cigarette paper into outer wraps G of the desired size, and applies adhesive to all or a portion of the outer wraps G. The adhesive can be applied to all or a portion of the outer wrap G, for example, to portions of the outer wrap G that overlap with one another. According to an embodiment, the inserter 138 can comprise a cutter on the filter feed module of a MAX filter attachment apparatus, available from Hauni Maschinenbau AG of Hamburg, Germany. The bobbin and glue pot machine 140 can comprise a BOB ME, also available from Hauni Maschinenbau AG of Hamburg, Germany.

[0045] The wrapping drum 136 alone or in combination with the inserter 138 is also called a wrapping station.

[0046] According to an embodiment, the inserter 138 feeds the outer wraps G to the combined fill tubes C / tobacco rods F on the wrapping drum 136, where the wrapping drum 136 rolls the outer wraps H around all or a portion of each combined fill tube C / tobacco rod F. According to an embodiment, the outer wraps G are applied to the combined fill tubes C / tobacco rods F while they are in a substantially vertical orientation.

[0047] Referring to Figure 1, a take-off drum 142 and a chain of transfer drums 144A, 144B, 144C can remove the filterless cigarette H from the wrapping drum 136, and transport them to a tipping machine 146, which adds a filter element and/or tipping paper to the filterless cigarette H. According to an embodiment, the tipping machine 146 can transfer the filterless cigarettes H from substantially vertical to substantially horizontal, e.g., using a 45° transfer drum 148. The tipping machine 146 can also invert (e.g., flip by about 180°) every other filterless cigarette H, for example, using a transfer drum 150. The tipping machine 146 can then insert a double-length filter between pairs of end-to-end arranged filterless cigarette rods. The tipping machine 146 can then apply double-length tipping paper around the double-length filter and adjoining cigarette rods, to form a double-ended, filtered cigarette. The tipping machine 146 can subsequently divide the double-ended, filtered cigarette in half, for example by cutting with a rotating blade, to form a pair of filtered cigarettes. One of the filtered cigarettes can be inverted by about 180° to facilitate transporting the finished product in similar orientations, for example, for downstream testing, packaging, etc.

[0048] Referring to Figures 3, 4, and 5A to 5D, an embodiment of the fill tube maker 112 is shown. According to an embodiment, the fill tube maker 112 can include a drum 200 that rotates, e.g., around an axis A1. According to an embodiment, the drum 200 can be supported on a motor-driven shaft (not illustrated) that rotates drum 200 about axis A1 in direction M, however other embodiments are possible as will be apparent to one of ordinary skill in the art based on this disclosure. The drum 200 can define an outer periphery 202, shown for illustration purposes as being substantially circular, however, other shapes are possible. A plurality of fixtures 204 can be distributed around the outer periphery 202 of drum 200, for example, spaced equal distances from one another. In Figure 3, portions of the fixtures 204 are removed for ease of illustration.

[0049] Figure 4 is an enlarged, partial view of an embodiment of one of the fixtures 204. Generally, each fixture 204 can include a first mandrel 206 and a second mandrel 208. The first and second mandrels 206, 208 can be substantially cylindrical in shape (e.g., can have a diameter generally equal to that of a cigarette), however

other shapes and configurations are possible. According to an embodiment, the first and second mandrels 206, 208 can be arranged on a common axis A2, and can rotate in synchronicity about the axis A2, for example, in direction M1. At the same time, the drum 200, and consequently the mandrels 206, 208 located in its outer periphery 202, can rotate about axis A1.

[0050] The first and second mandrels 206, 208 can translate with respect to one another along the axis A2. In the embodiment of Figure 4, the second mandrel 208 translates back-and-forth along axis A2 towards, and away from, first mandrel 206, which does not translate. However, other embodiments are possible, such as both mandrels 206, 208 translating along axis A2, or the first mandrel 206 translating along axis A2 with respect to the second mandrel 208.

[0051] As shown in Figure 4, the first mandrel 206 can include a plurality of vacuum holes 210 located on its periphery, and/or a vacuum hole 212 located at its distal end. The vacuum holes 210 and/or vacuum hole 212 can be connected to a supply of vacuum or pressure using techniques known in the art. Similar vacuum holes can additionally or alternatively be located on the second mandrel 208.

[0052] The first and second mandrels 206, 208 can be supported by bearing blocks 214, 216, respectively, which are coupled to a fixture base 218. The bearing blocks 214, 216 can support the mandrels 206, 208 for rotation and/or translation. The fixture base 218 can, in turn, be mounted to the drum 202, e.g., using fasteners or other techniques known in the art.

[0053] Still referring to Figure 4, each fixture 204 can also include a first support roller 220 and/or a second support roller 222 oriented substantially parallel to the axis A2. The support rollers 220, 222 can be mounted to a roller support 224 located on fixture base 218. As shown in Figure 4, one or more vacuum holes 226 can be located between the support rollers 220, 222, for example, on roller support 224. The vacuum holes 226 can be connected to a supply of vacuum or pressure using techniques known in the art. As shown in Figure 4, the first and second support rollers 220, 222 can rotate about axes substantially parallel to the axis A2, for example, in directions N and O, respectively.

[0054] According to an embodiment, the mandrels 206, 208 and support rollers 220, 222 can each be individually driven for rotation by their own power source, for example, by an electric motor (not shown) coupled thereto using conventional techniques. Alternatively, the mandrels 206, 208 and rollers 220, 222 can be driven for rotation by a transmission system (not shown) such as gears, belts, etc., that translates rotation of the drum into rotation of the mandrels 206, 208 and support rollers 220, 222. Alternatively, various combinations of the foregoing techniques can be used to rotate the mandrels 206, 208 and support rollers 220, 222.

[0055] According to an embodiment, translation of the first and/or second mandrels 206, 208, e.g., along axis A2, can be driven by a linear drive, hydraulic actuator, screw mechanism, or the like that is coupled to each pair of mandrels 206, 208, or to a group of mandrel pairs. Alternatively, a cam mechanism (not shown) can be associated with the drum 202, and can act on a portion of each first mandrel 206 and/or second mandrel 208, such as the proximal ends, to impart motion thereto along axis A2. Alternatively, a combination of the foregoing techniques can be used to translate the mandrels 206, 208. According to embodiments, a programmable logic controller (PLC) can be used to coordinate rotation of the drum 202, movement of the first and second mandrels 206, 208, rotation of the support rollers 220, 222, and application of vacuum or pressure at the vacuum holes. Moreover, according to embodiments, the PLC can be used to control and coordinate the operation of all or some of the components of system 100.

[0056] Referring to Figures 1, 3, and 5A-5D, an example of operation of the one of the fixtures 204 is shown. Figure 5A depicts a fixture 204 in a ready position, e.g., the position it occupies as drum 200 rotates the fixture 204 between transfer drum 110B and transfer drum 118 (see Figure 1). When in the ready position, the first and second mandrels 206, 208 are spaced apart from one another along axis A2 sufficiently to receive a heat source A therebetween.

[0057] Figure 5B depicts fixture 204 when it is located on the periphery 202 of drum 200 in registry with transfer drum 110B. At this point, a heat source A is inserted between the first and second mandrels 206, 208 until it rests against the first and second support rollers 220, 222. At or prior to this point, vacuum may be applied to the vacuum holes 226 to help attract and/or retain heat source A against support rollers 220, 222.

[0058] Figure 5C depicts fixture 204 substantially immediately after the heat source A is inserted between the first and second mandrels 206, 208. At or about this time, the second mandrel 208 can translate along axis A2 until heat source A contacts the first mandrel 206, thereby sandwiching the heat source A between mandrels 206, 208. At or about this time, vacuum may be applied to vacuum holes 210 and/or vacuum hole 212. The mandrels 206, 208 can remain in this position as the fixture 200 is rotated towards the pliable material inserter 114 by drum 200. At or before the time the fixture 200 moves into registry with the insertion point of the pliable material inserter 114, the first and second mandrels 206, 208 and/or the first and second support rollers 220, 222 can begin to rotate, thereby causing the heat source A to rotate about axis A2, for example, in direction M1.

[0059] At or slightly before the time the fixture 200 moves into registry with the insertion point of the pliable material inserter 114, the inserter 114 ejects a segment of the pliable material B, which can be attracted to the first mandrel 206 by the vacuum drawn through holes 210. The vertical alignment of the heat source A and the pliable material inserter 114 can cause the pliable material segment B to attach around all or a portion of the heat

source A, as well as a portion of the first mandrel 206. Rotation of the mandrels 206, 208 can wrap the pliable material around the first mandrel 206 and heat source A, e.g., between the support rollers 220, 222 and the first mandrel 206 / heat source A, until pliable material B is completely wrapped around the heat source A, as shown in Figure 5D, thereby creating the fill tube C. Adhesive applied to the pliable material segment A by the pliable material inserter 114 can adhere the pliable material segment B to the heat source A, and/or to areas where the material B overlaps on itself. The portion of the pliable material segment B surrounding the first mandrel 206 can form the hollow tubular portion D once the first mandrel 206 is removed therefrom. Shortly after the fill tube C is formed, the application of vacuum to vacuum holes 210, vacuum hole 212, and/or vacuum holes 226 can stop. Additionally or alternatively, pressure can be applied to these holes to facilitate later separation of the fill tube C from the fixture 204.

[0060] Still referring to Figure 5D, the mandrels 206, 208 can remain in the position shown as the drum 200 rotates the fill tube C into registry with the transfer drum 118. At a point in time before the fill tube C reaches the transfer drum, the first and second mandrels 206, 208 can move apart from one another along axis A2 (e.g., to the position shown in Figure 5A), thereby removing first mandrel 206 from the hollow tubular portion D of the fill tube C. Vacuum can be applied to a vacuum hole (not shown) located in the distal end of second mandrel 208 to help retain the heat source A on the second mandrel 208 as it pulls away from the first mandrel 206. Additionally or alternatively, a rod can extend through the distal end of first mandrel 206 to push the fill tube C off of the first mandrel 206. The fill tube C can then be transferred from drum 200 to transfer drum 118 for downstream processing. Vacuum associated with the transfer drum 118 can help facilitate removal of the fill tube C from the drum 200 to transfer drum 118. The fixture 200 can remain in the position of Figure 5A until the drum 200 rotates it back into registry with transfer drum 110B, as previously described above in connection with Figure 5A.

[0061] Referring to Figures 6 and 7, the pliable material inserter 114 can be configured to contour, or "curl" the segments B of pliable material prior to, or during, transfer to the fill tube maker 112. By contouring a portion of the segments B to have a curvature that complements the diameter of the heat sources A (e.g., is about the same or larger in diameter), the consistency with which the segments B wrap onto the heat sources A can be improved.

[0062] As shown in Figure 6, the inserter 114 can include a preform drum 400 having a plurality of arcuate recesses 402 distributed about its periphery, e.g., equidistantly. The recesses 402 can define a curvature corresponding to the desired contour of the segments B. According to embodiments, the recesses 402 can define a cross-sectional shape that is a portion of a circle or ellipse, however, other configurations are possible. According to embodiments, the recesses 402 can define an arc that is about equal to or greater than the outer diameter of the heat sources A, e.g., about the same diameter as the mandrels. Still referring to Figure 6, the preform drum 400 can include a plurality of vacuum holes 404 distributed over the arcuate recesses 402 and/or areas of the drum 400 adjacent to the recesses 402. The vacuum holes 404 can be connected to a source of vacuum, and can help secure the segments B on the outer periphery of the preform drum 400, and/or can help pull portions of the segments B into the recesses 402.

[0063] Referring to Figure 7, the preform drum 400 is shown in combination with the fixtures 204. The drum 400 can be synchronized with drum 200, so that the mandrels 206,208 move into registry with the recesses 402 and press the segments B into the recesses 402, thereby helping to contour the segments B to the desired shape. Still referring to Figure 7, the mandrels 206, 208 can have a diameter that complements the shape of the recesses 402. For example, in embodiments, the mandrels 206, 208 can have a diameter that is the same as, or smaller than, the diameter of the recesses 402. However, other configurations are possible.

[0064] The preform drum 400 can serve as the drum that transfers the segments B to the fill tube maker 112. In other words, after contouring the segments B, drum 400 can directly transfer the segments B to the fill tube maker 112. Alternatively, an intervening drum or other device can receive the contoured segments B from the preform drum 400 and in turn transfer them to the fill tube maker 112.

[0065] The embodiments illustrated and discussed in this specification are intended only to teach those skilled in the art the best way known to the inventors to make and use the invention. Nothing in this specification should be considered as limiting the scope of the present invention. All examples presented are representative and non-limiting. The above-described embodiments of the invention may be modified or varied, without departing from the invention, as appreciated by those skilled in the art in light of the above teachings. It is therefore to be understood that, within the scope of the claims and their equivalents, the invention may be practiced otherwise than as specifically described.

[0066] All named characteristics, including those taken from the drawings alone, and individual characteristics, which are disclosed in combination with other characteristics, are considered alone and in combination as important to the invention. Embodiments according to the invention can be fulfilled through individual characteristics or a combination of several characteristics. Features which are combined with the wording "in particular" or "especially" are to be treated as preferred embodiments.

List of References

[0067]

100	system

102	object supply unit
104	hopper
106	transfer drum
108A - 108C	primary transfer drum
110A, 110B	secondary transfer drum
112	fill tube maker
114	pliable material inserter
116	bobbin and glue pot machine
118	transfer drum
120	granular object filling drum
124	tobacco rod supply unit
126	hopper
128	transfer drum
130A - 130C	primary transfer drum
132A, 132B	secondary transfer drum
134	combiner drum
136	wrapping drum
138	outer wrapper inserter
140	bobbin and glue pot machine
142	take-off drum
144A - 144C	transfer drum
146	tipping machine
148	transfer drum
150	transfer drum
200	drum
202	outer periphery
204	fixture
206	first mandrel
208	second mandrel
210, 212	vacuum hole
214, 216	bearing block
218	fixture base
220	first support roller
222	second support roller
224	roller support
226	vacuum hole
300	volumetric metering device
400	preform drum
402	recess
404	vacuum hole
A	heat source
B	segment of a pliable material
C	fill tube
D	hollow tubular portion
E	granular material
F	tobacco rod
G	outer wrap
H	filterless cigarette rod

Claims

1. An apparatus for assembling a multi-segmented cylindrical product, the apparatus comprising:

a feeder (114) adapted to supply segments (B) of a pliable material; and
a rotating drum (200) having an outer periphery (202) and a plurality of fixtures (204) distributed around the outer periphery (202), each fixture (204) adapted to support a substantially cylindrical object, and wrap a segment (B) of the pliable material around the substantially cylindrical object (A) and a portion of the fixture (204) to form a fill tube (C) defining a pocket (D) in the pliable material.

2. The apparatus of claim 1, wherein each rolling fixture (204) comprises:

a first mandrel (206);
a second mandrel (208) oriented substantially coaxially with respect to the first mandrel (206), the first and second mandrels (206, 208) adapted to receive the cylindrical object (A) therebetween, wherein in particular the first mandrel (206) and second mandrel (208) are movable with respect to one another along a common axis; and
at least one support roller (220, 222) oriented substantially parallel to the first mandrel (206) and the second mandrel (208), the support roller (220, 222) adapted to wrap the segment (B) of the pliable material around the substantially cylindrical object (A).

3. The apparatus of claim 2, further comprising vacuum holes (210, 212) located in at least one of the first mandrel (206) or the second mandrel (208), the vacuum holes (210, 212) in communication with a vacuum source.

4. The apparatus of claim 2 or 3, wherein the at least one support roller (220, 222) comprises a first support roller (220) and a second support roller (222), the apparatus further comprising vacuum holes (226) located in between the first support roller (220) and the second support roller (222), the vacuum holes (226) in communication with a vacuum source.

5. The apparatus of one of claims 1 to 4, further comprising a volumetric metering device (300) adapted to meter granular material (E) into the fill tube (C), wherein in particular the granular material (E) comprises pellets.

6. The apparatus of one of claims 1 to 5, wherein the cylindrical object (A) comprises a smoking article, the apparatus further comprising:

a wrapping station (136, 138) adapted to support the fill tube (C) and a tobacco rod (F) in an end-to-end arrangement, and wrap the fill tube (C) and tobacco rod (F) with paper (G),
in particular further comprising a source (124) of tobacco rods (F) that supplies tobacco rods

(F) to the wrapping station (136, 138) and/or further comprising a tipping machine (146) that adds a filter to the combined fill tube (C) and tobacco rod (F).

7. The apparatus of one of claims 1 to 6, wherein each fixture (204) is adapted to support the substantially cylindrical object (A) in a substantially vertical orientation.

8. The apparatus of one of claims 1 to 7, wherein the feeder (114, 116) is adapted to feed the segments (B) of pliable material to the rotating drum (200) in a substantially vertical orientation.

9. The apparatus of claim 1, wherein the substantially cylindrical object (A) comprises a heat source, wherein in particular the heat source (A) comprises a carbon plug.

10. The apparatus of one of claims 1 to 9, wherein the segments (B) of pliable material comprise segments of paper, metallic foil, or film.

11. A method for assembling a multi-segmented cylindrical product, the method comprising wrapping a segment (B) of pliable material around a substantially cylindrical object (A) to form a fill tube (C) with a pocket (D) extending from the substantially cylindrical object (A).

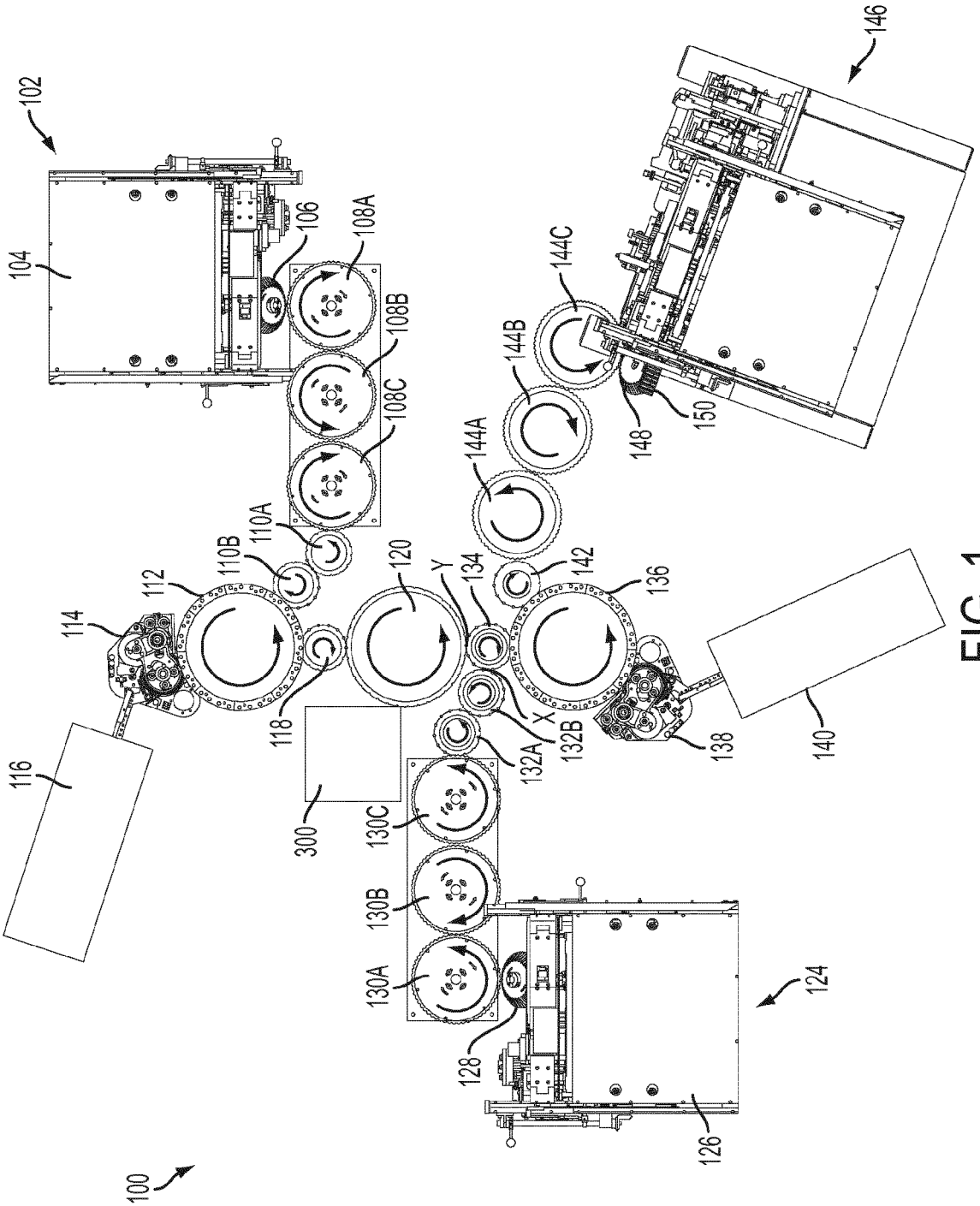
12. The method of claim 11, further comprising:

metering a predetermined volume of a granular material (E) into the pocket (D), in particular dispensing the granular material (E) into the pocket (D) from above the pocket (D);
wherein in particular the granular material (E) comprises at least one of pellets of compressed tobacco, flavor capsules, and flavor impregnated granulates..

13. The method of claim 12, further comprising transferring the fill tube (C) from a non-vertical orientation to a substantially vertical orientation prior the step of metering, in particular further comprising transferring the fill tube (C) to a substantially non-vertical orientation after the step of metering.

14. The method of one of claims 11 to 13, wherein the step of wrapping comprises rotating the substantially cylindrical object (A) with respect to the outer periphery (202) of a rotating drum (200), and wrapping the pliable material around the substantially cylindrical object (A) while it rotates.

15. The method of one of claims 11 to 14, wherein the substantially cylindrical object (A) comprises a heat source, in particular a carbon plug and/or the segments (B) of pliable material comprise segments of paper, metallic foil, or film.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144B
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X
Y

FIG. 1

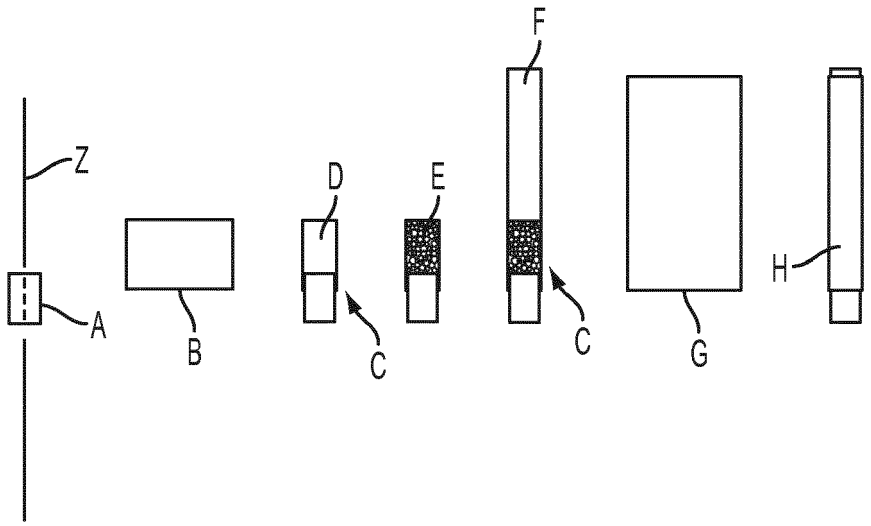

FIG. 2

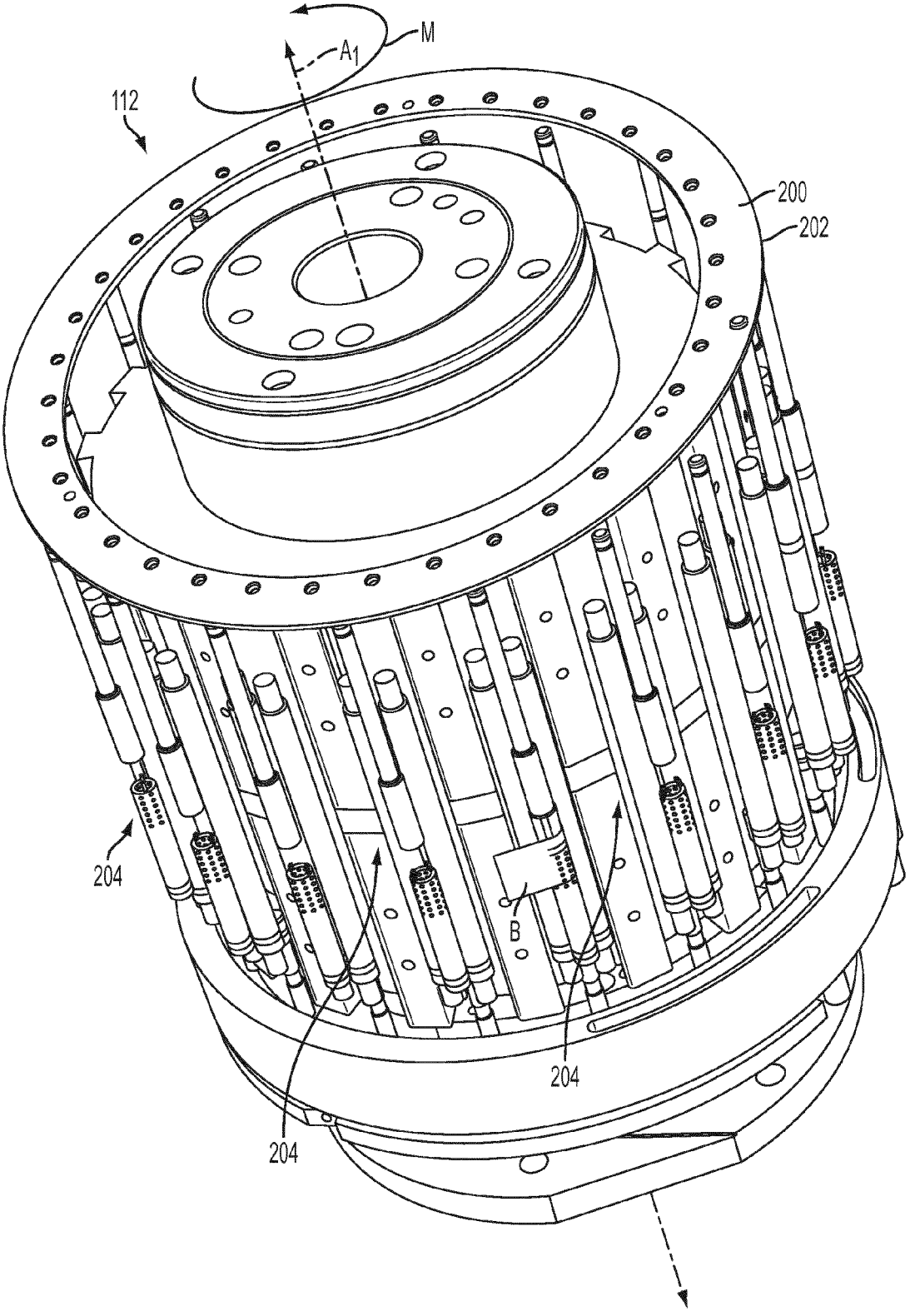

FIG. 3

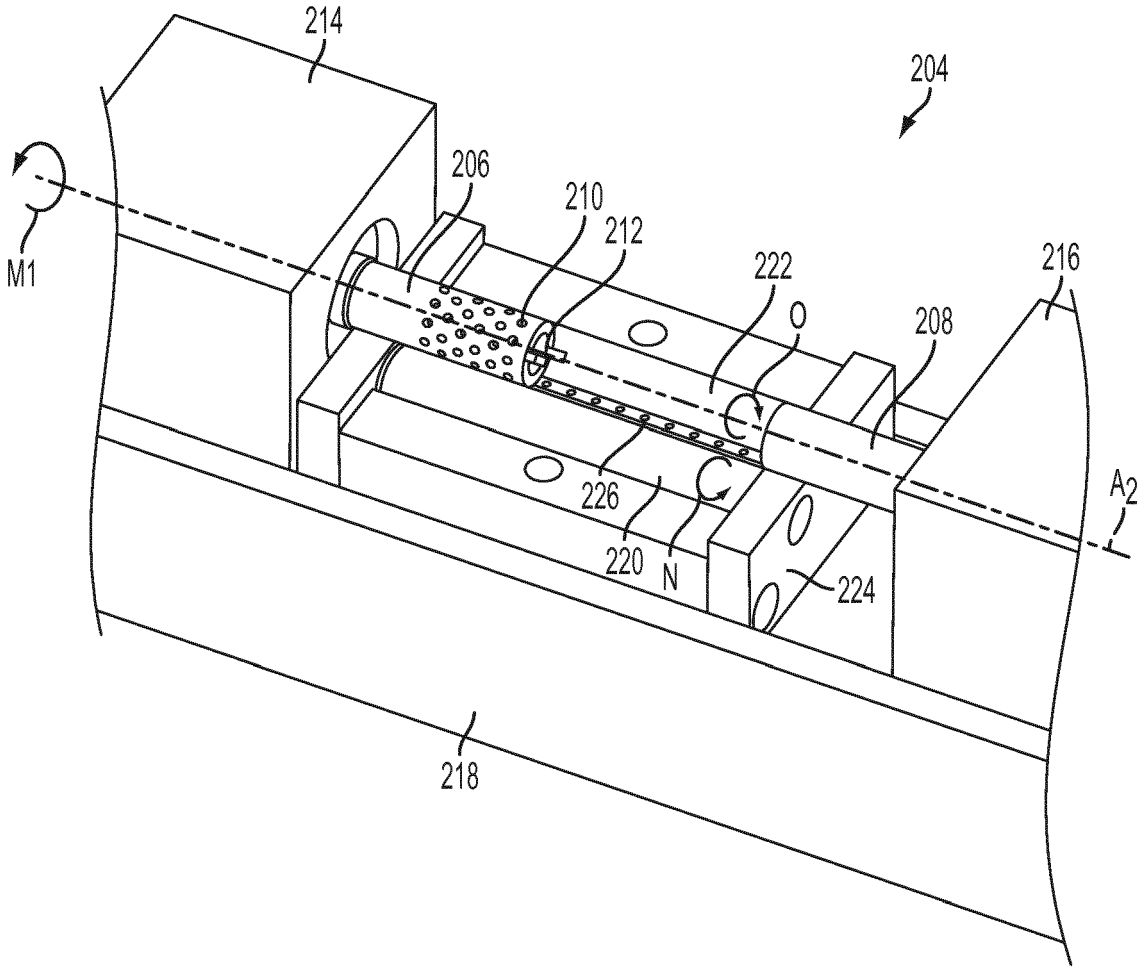

FIG. 4

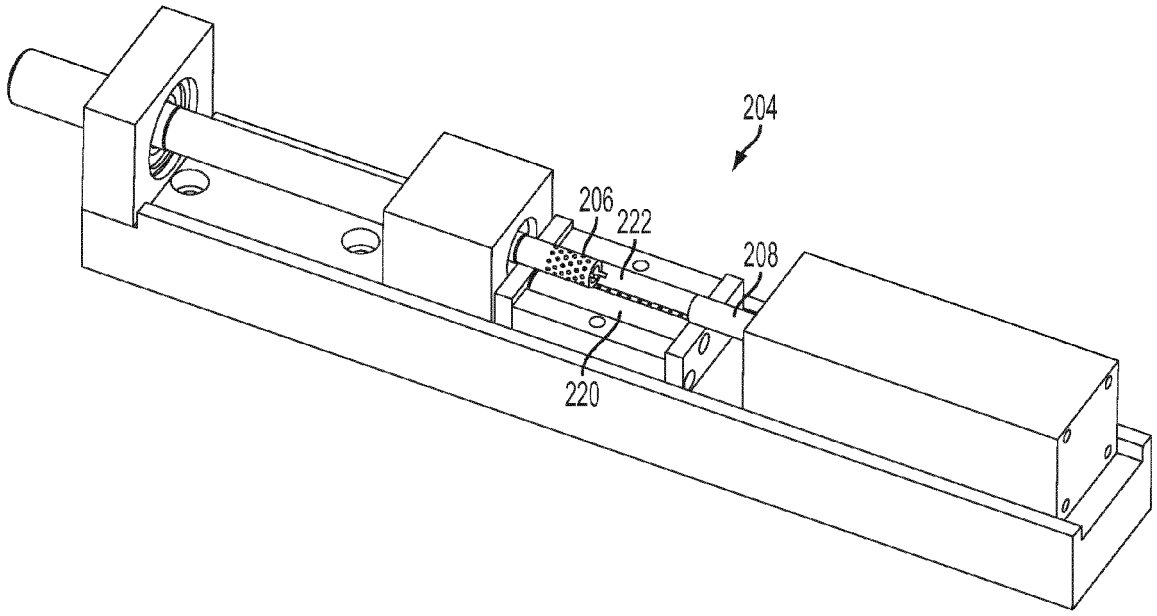

FIG. 5A

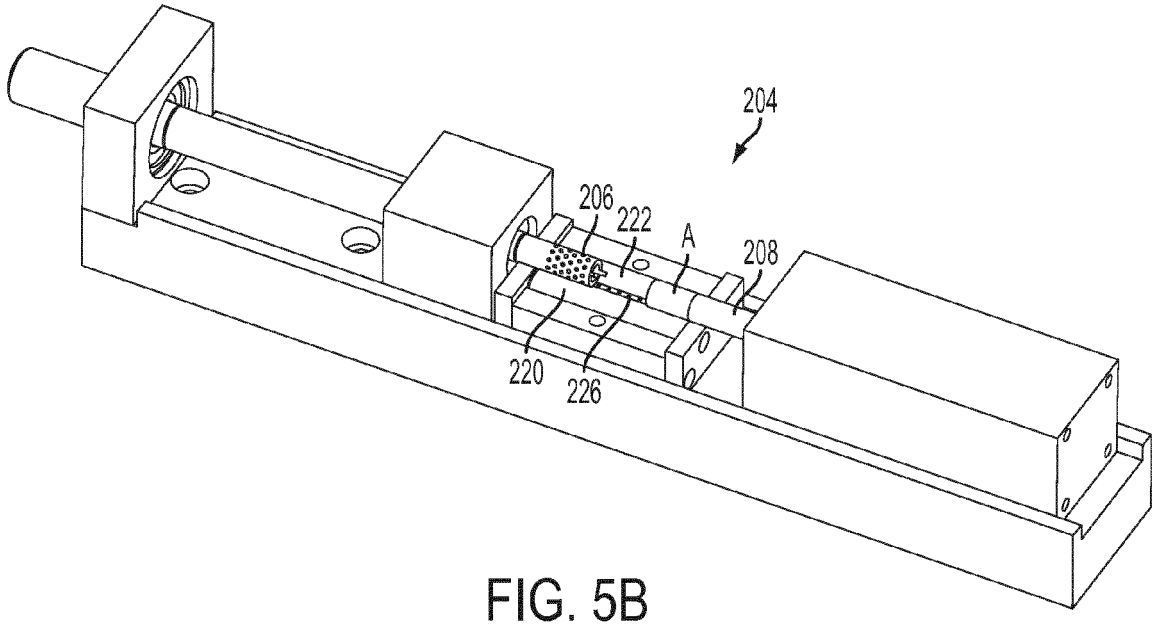

FIG. 5B

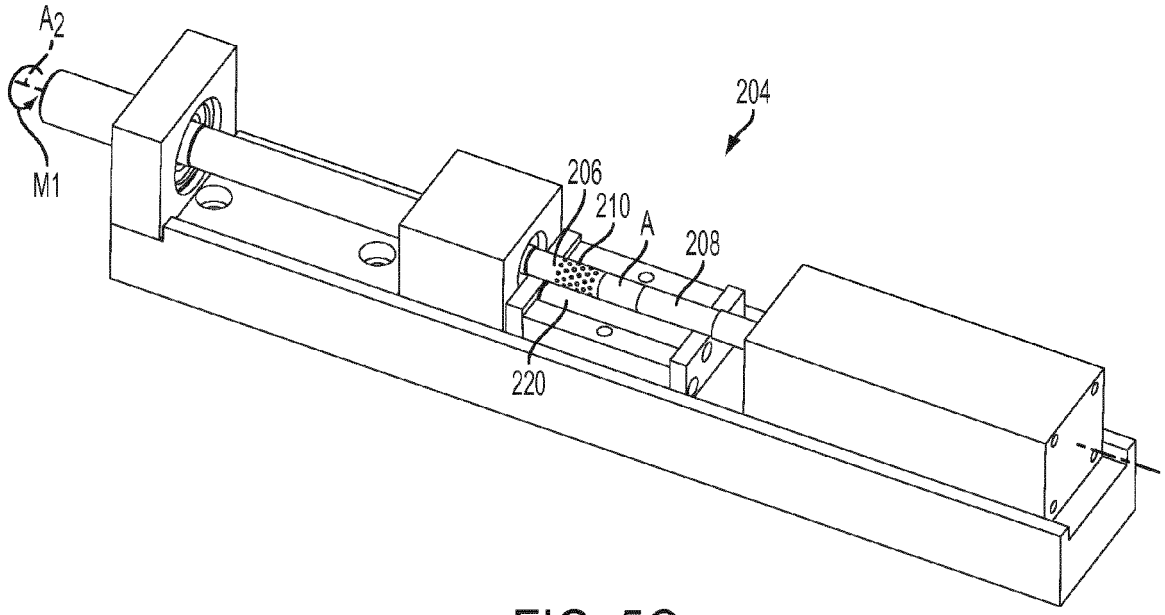

FIG. 5C

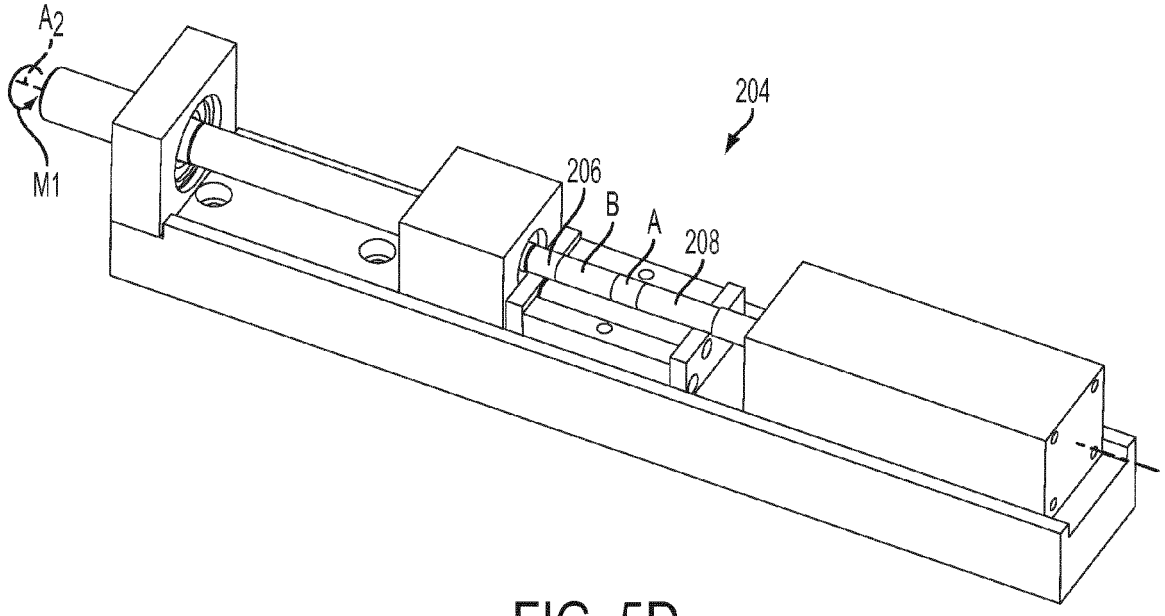

FIG. 5D

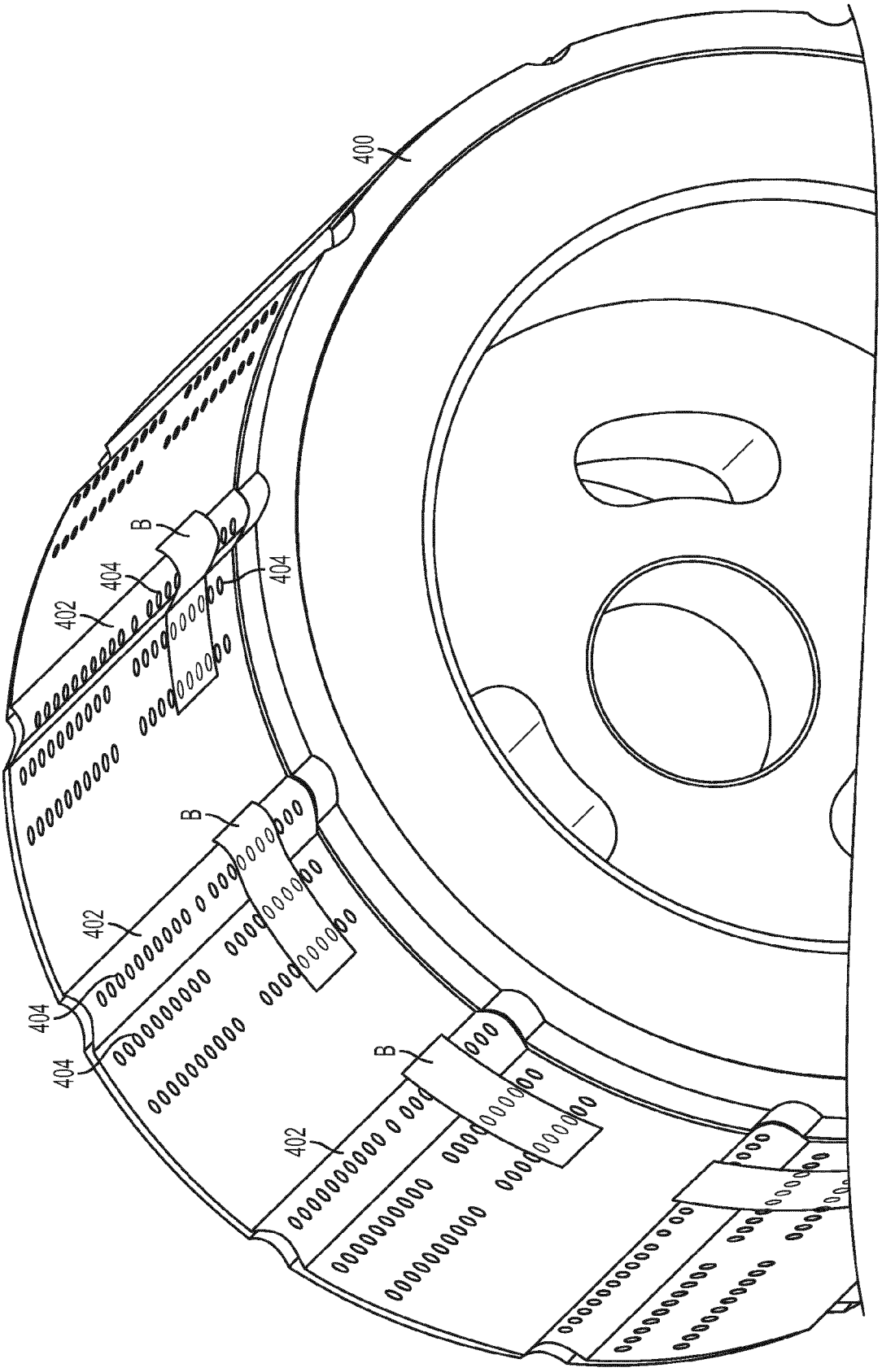

FIG. 6

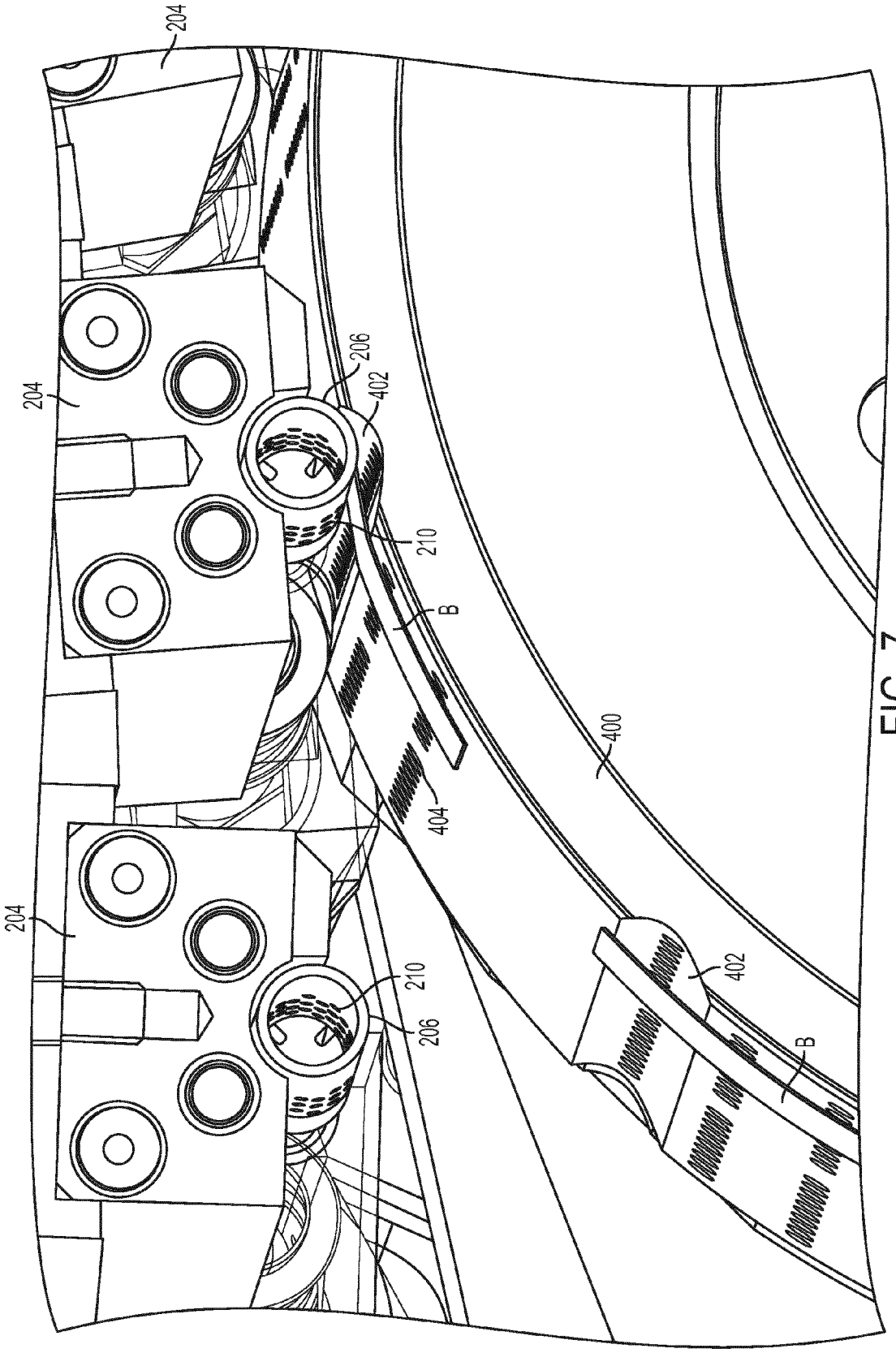

FIG. 7

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EUROPEAN SEARCH REPORT

Application Number
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
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