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(71) Applicant (for all designated States except US): **PHILIP MORRIS PRODUCTS S.A.** [CH/CH]; Quai Jeanrenaud 3, CH-2000 Neuchâtel (CH).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **CARRARO, Andrea** [IT/CH]; Rebstockweg 51, CH-3232 Ins (CH). **FAULKNER, John** [GB/CH]; Rue de la gare 24, CH-2023 Gorgier (CH). **GRANT, Chris** [NZ/CH]; Rue Des Troncs 16, CH-2000 Neuchâtel (CH). **LUKACS, Attila** [HU/CH]; Chemin du Verger 7, CH-2046 Fontaine (CH).

(74) Agent: **MARLOW, Nicholas, Simon**; Reddie & Grose LLP, 16 Theobalds Road, London WC1X 8PL (GB).

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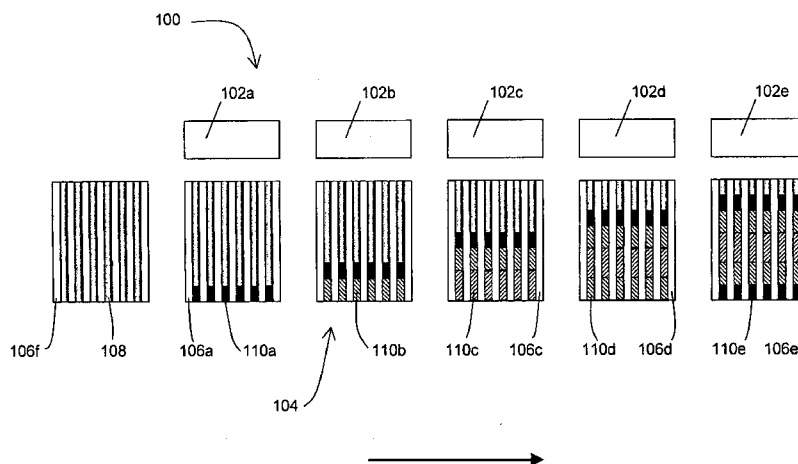


Fig. 1

(57) Abstract: An assembler unit (100) of a combiner for use in the manufacture of rod-shaped articles is disclosed comprising at least one rod-shaped article component supply station (102a-102e), an assembler (106a-106b) including one or more channels (108) and a transfer station at which a complete assembly of components (110a-110e) is transferred for further processing. A controller controls the movement of the assembler between the supply stations and the transfer station enabling the composition of the complete assembly to be varied without the need for time consuming changes to be made to the combiner.



COMBINER FOR ROD-SHAPED ARTICLES

The present invention relates to a combiner for use in the manufacture of rod-shaped articles comprising at least two components.

Rod-shaped articles, for example smoking articles, may comprise a plurality of cylindrical components attached in axial alignment. For example, in conventional cigarettes, these components typically include a wrapped rod of tobacco and a filter. The filter may itself comprise a plurality of cylindrical components. Heated smoking articles in which tobacco or other material is heated rather than burnt may comprise additional cylindrical components, for example a heat source for igniting a heated smoking article.

In the manufacture of smoking articles, one or more of the components may be initially presented as a double or quadruple length component, that is, a component which is two or four times the length of that component in the final smoking article. These multiple lengths are typically cut and separated and other components introduced between the cut portions. This complex combining procedure is carried out on machinery known as a combiner.

A conventional combiner comprises a plurality of drums. The circumferential surfaces of the drums have axially aligned channels, for example grooves or notches, for the reception of the cylindrical components of the smoking article to be manufactured.

The accurate transfer of the cylindrical components of the smoking articles between the plurality of drums and their correct positioning in the channels requires that the width of the channels in the drum surfaces and their spacing from each other, as well as the relative positioning of the drums, be precise and in proper alignment with each other. This means that one combiner, or a particular combination of drums, drum positions and spacings of one combiner, is suitable only for the manufacture of one particular design of smoking article, using cylindrical components of fixed lengths, assembled in a fixed order and having a fixed diameter. If it is desired to change any of these features, one or, usually, several of the drums of the combiner must be changed. This necessitates stopping production in a mass production process for a certain time which is not economically desirable. Flexibility to make smoking articles of significantly different designs is thus restricted, since it is impractical to change several drums frequently or repeatedly.

According to the invention there is provided a method of making an axially aligned assembly of components of rod shaped articles comprising supplying a component from one of a plurality of component supply stations to a channel of an assembler, repeating the step of supplying a component to the channel of the assembler until a desired assembly of components is in the channel of the assembler, transferring the assembly from the assembler and controlling the relative positions of the supply stations and the assembler and controlling the provision of the components to the assembler from the supply stations. Preferably, the assembler moves

from one supply station to another. Preferably, the relative movement of the assembler and the supply stations is controlled. Also preferably, the method also includes controlling the transfer of the assembly from the assembler. The method of the invention is particularly useful in the manufacture of smoking articles.

5 In some embodiments, the assembler includes a plurality of channels.

Transfer of the complete assemblies can be, for example, transfer of the assemblies to successive channels in the circumferential surface of a transfer drum. In other embodiments, transfer can be by a 'pick and place' device. After transfer, the complete assemblies may travel transverse to their axis or longitudinal to their axis. The complete assemblies will typically move
10 to a downstream part of the combiner, such as a rod making unit where they can be wrapped together and if necessary cut or combined with further components. In the case of assemblies which are a multiple of the required final component, the assemblies will generally be transported longitudinally to their axis after wrapping and cut by a cutter positioned to one side of the path of the wrapped assemblies.

15 Preferably the channels on the assembler are of V cross section so that they can accommodate cylindrical components of different diameter.

When a change to the design of smoking article is required, one or more of the following features can be changed:

- the length of component produced at one or more supply stations;
- 20 the diameter of component supplied by the supply stations;
- the type of component supplied at each supply station;
- the order in which the supply stations are visited by the assembler;
- the number of supply stations visited by the assembler;
- the supply of components to the supply stations.

25 These features of the smoking article, the production of components at the component supply stations and the removal of assemblies of components from the assembler can be controlled by software through one or more controllers.

The supply of components to a channel of the assembler preferably takes place immediately after an assembly has been transferred from the channel so that the channel
30 contains components for only a single design of smoking article at one time.

Preferably a component supply station includes a pusher for pushing a rod of the component material partly into a channel of the assembler and a cutter for cutting the rod to leave a component in the channel. The length of rod pushed into the channel is the length of that component required in the complete rod-shaped article. It may be a multiple of the length
35 of the component required in the final product, in which case the component will be cut downstream (this is discussed further with reference to Figures 6A, 6B and 6C). When a

change in the length of a component supplied by a supply station is required, the length of rod pushed into the assembler channel before the rod is cut can be increased or reduced. In preferred embodiments, a supply station provides a plurality of rods of the component material and the pusher pushes each rod the required distance into a respective channel of the assembler before the rods are cut to leave the components in the channels of the assembler.

In some embodiments the assembler comprises one or more trays, preferably 1 to 10 trays, having channels on a principal surface. The trays are moved between the component supply stations and receive components at the supply stations.

In some embodiments, the assembler is a continuous belt running around rollers. Preferably, the belt has channels transverse to its direction of movement. The belt runs past the component supply stations and receives components as it does so. The channels on the belt may be in the surface of the belt or may be carried on the belt. The channels may be defined by pairs of parallel circular section rods extending across the belt. The belt may be a strip of flexible material or it may be one or more chains.

In some embodiments, the channels in the assembler are transverse to the transport direction of the assembler.

In some embodiments the assembler is a rotatable turntable having radial channels. The component supply stations are disposed around the circumference of the turntable. The turntable rotates past the supply stations and receives components as it does so.

In some embodiments, a component assembly station includes a component receiver, each component receiver associated with a respective one of the component supply stations. A plurality of components is delivered to the component receiver. The components are taken from the component receiver, for example by a 'pick and place' device such as a selective compliant assembly robot arm (SCARA) or an industrial robot having a Cartesian anthropomorphic or Delta architecture, and placed in the channels in the assembler to form the assemblies of axially aligned components. The component receivers may be separate from each other or one or more component receivers at adjacent component supply stations may be integral with each other. In these embodiments the component receiver is preferably a tray having a plurality of channels for reception of the components.

The assembler can move from one component supply station to the next in a fixed order or the order can be varied according to the design of smoking article to be made. The assembler can receive one or more components at each component supply station or at only selected supply stations, according to the design of smoking article.

The assembler can move continuously between the component supply stations or it can index between them, stopping adjacent the stations. Depending on the design of the smoking article to be manufactured, the assembler can receive components from every supply station or

from only selected stations. The assembler can stop more than once at one or more of the supply station if the complete assembly of components includes more than one of a particular component. The assembler preferably moves on a continuous path so that after the transfer station, it returns to the first supply station. The path may be of any configuration. One preferred path for the assembler comprises two straight line portions joined by curved portions, one straight line portion of the path taking the assembler past the component supply stations to the transfer station and the other straight line portion returning it to near the first supply station. Another preferred path for the assembler is circular. The assembler can move in the same transport direction throughout, or it can move forwards and backwards, to collect components in the correct order.

In some embodiments the assembler can move transverse to the transport direction to enable components to be correctly positioned in the channels. In some embodiments, the supply stations, or those portions of the supply stations immediately adjacent the assembler, can move transversely to the transport direction of the assembler to enable components to be correctly positioned in the channels.

In some embodiments, the channels of the assembler can be lined with paper or other wrapping material before components are introduced into the channels.

The supply of components to supply stations can be controlled by the controller. As well as controlling the arrangement of components in the complete assembly by controlling whether the assembler receives a component from a supply station, the order in which the supply stations are visited and where on the assembler components are located at a supply station, the controller can change what components are supplied to a supply station. Components can be switched from one supply station to another by changing how supply hoppers of the components distribute components among the supply stations.

Also according to the invention, there is provided a combiner for use in the manufacture of rod-shaped articles, preferably smoking articles, comprising a plurality of article component supply stations for supplying components of a rod-shaped article, an assembler comprising one or more channels for receiving two or more components from the supply stations in axial alignment in the said channels to form assemblies of axially aligned components in the said channels, a transfer device for transferring the said assemblies of axially aligned components from the assembler to a next stage of the manufacturing line for the rod-shaped article. These components are preferably of cylindrical, for example circular or oval cross-sectional shape or even polygonal, but it is emphasized that the particular cross-sectional shape of the components is irrelevant for the present invention. The number of supply stations is preferably between 2 and 10. Preferably, the assembler is arranged to move from one supply station to another. Preferably, the controller controls the relative movement of the assembler and the

supply stations. Also preferably, the controller controls the mentioned transfer of the said assemblies of axially aligned components from the assembler.

Axial alignment of the components is achieved essentially in the longitudinal direction of an underlying rod-shaped article. The different cylindrical components are introduced into the combiner at different locations. They are transferred from drum to drum, if necessary being cut and separated during this process as described above, until an appropriate assembly of axially aligned components has been formed. The assembled components are typically joined together with an overwrap and, if necessary, cut to an appropriate length for the next stage of manufacture. If the complete assemblies are only semi-finished articles but not finished articles, the complete assemblies are combined with other cylindrical components or semi-finished articles, joined by overwrapping and, if necessary, cut to length. The procedure is repeated until a finished article is made.

With the invention, a combiner to be used for the manufacture of rod-shaped articles can easily and rapidly switch from making rod-shaped articles of one design, for example using components of first length, diameter or relative position in the article, to articles of a second design, in which at least one of the length, the diameter or the relative position of the components is different. For example, the invention particularly allows for the manufacture of smoking articles with tobacco rods of various lengths of the above mentioned heated smoking article type, in which tobacco or other material is heated rather than burnt. Different rod lengths may be required because of the heated smoking articles have tobacco rods of different lengths different lengths or because the heaters used for the heating of the tobacco rod are of different lengths. In addition, the filter lengths or lengths of other components of these smoking articles, for example mouth pieces, may differ as well, for example depending on the technology used for the heating of the tobacco and the filtering of the generated aerosol or smoke.

The combiner according to the invention can be used for combining smoking article filter components into final filters, to join filters to rods of smoking material, such as tobacco, and to combine components of heated smoking articles, for example tobacco rods, into final heated smoking articles which may comprise at least one tobacco rod and at least one filter component.

The controller for controlling the relative positions of the supply stations and the assembler can be a software controller or hardware controller like a microchip. The relative positioning can also be controlled using a mechanical device like a micrometric screw or mechanical lever. The screw or lever may movable between a number of discrete positions.

The invention will be further described, by way of example, with reference to the drawings, in which:

Figure 1 is a schematic representation of an apparatus and method of the invention;

Figure 2A is a diagrammatic side elevation of an embodiment of the invention;

Figure 2B is a diagrammatic plan of the belt of the embodiment of Figure 2A, with the supply and transfer stations omitted for clarity;

5 Figure 3 is a diagrammatic elevation, partly in cross section, of a component supply station according to an embodiment of the invention;

Figure 4A is a diagrammatic plan of another embodiment of the invention;

Figure 4B is a diagrammatic side elevation of the embodiment of Figure 4A with the supply stations omitted for clarity;

Figure 5A is a diagrammatic representation of a third embodiment of the invention;

10 Figure 5B is a detail of Figure 5A; and

Figures 6A, 6B and 6C show three different exemplary arrangements of components on assembler trays.

Figure 1 shows schematically an assembler unit 100 of a combiner and a method
15 according to the invention. Five component supply stations 102a-102e are shown in Figure 1. It will be understood that there may be as few as two component supply stations and there is in principal no upper limit to the number of supply stations. However, because of limitations on the processing power of the controller and the complexity of the whole combiner, the number of supply stations may be limited to 5 to 10. An assembler 104 in the form of a tray shown in
20 Figure 1 at five different operating stages 106a-106f as the tray moves past the supply stations 102 in the direction of the arrow in Figure 1. The trays 106 have channels 108 which are arranged crosswise to the moving or transport direction the trays. The channels 108 are of V shaped cross section if viewed transverse to the transport direction of the trays.

Each tray 106 starts upstream of the supply stations, empty. It indexes to the first supply
25 station 102a and stops adjacent that supply station. In this embodiment, each of the channels 108 of the tray receives a first component 110a, for example a filter component. The tray indexes to the second supply station 102b and receives a second component 110b, again for example a filter component. The tray then indexes successively to the third 102c, fourth 102d and fifth 102e supply stations, receiving third 110c, fourth 110d and fifth 110e
30 components, respectively, for example filter components, from the supply stations. At the first supply station 102a the first components 110a are positioned in the channels 108 the end of the channels adjacent the supply station. At successive supply stations, the components are introduced into the channels 108 so that they move the component or components already present in the channels along the channels.

35 After the last supply station 102e, the channels 108 in the trays 106 contain complete assemblies 112 of components. These complete assemblies may correspond to a final filter for

direct attachment to a tobacco rod to form a cigarette or final heated smoking articles. Alternatively, the complete assemblies may be semi-finished or semi-manufactured smoking articles for combination with other filter components to form a final filter or with other components of a heated smoking article to form a finished heated smoking article. In either case, the tray 106e containing the completed assemblies indexes to a transfer station (not shown in Figure 1) at which the complete assemblies are removed from the tray for further processing. The further processing may include one or more of wrapping, cutting and further combining with other components, including other components of heated smoking articles or tobacco rods. After the transfer, the individual assemblies may continue to move transverse to their longitudinal axis, for example on a transfer drum, or they may move longitudinally, preferably aligned into one or more continuous arrays of assemblies.

A controller (not shown) controls how the trays 106 move between the supply stations 102a-102e. The order in which the trays 106 visit the component supply stations 102a-102b can be varied according to the design of smoking article to be made. The trays can bypass one or more selected supply stations if the component supplied is not required or visit a supply station but not receive a component. The trays can visit one or more of the supply stations more than once. The computer also controls the transfer of the complete assemblies 112 from the tray 106e at the transfer station.

Figures 2A and 2B show an embodiment of an assembler unit 200 of a combiner according to the invention for making a filter for a smoking article, a semi-finished filter or a heated smoking article. In this embodiment, channels 208 are carried on the surface of a continuous belt 206 running over rollers 212, 212', one of which is driven. The channels 208 are of arcuate or curved cross section; in other embodiments, the channels are of V cross section. The belt moves in the direction shown by the arrows in Figure 2A. In the embodiment shown in Figures 2A and 2B, the channels are carried on the surface of the belt; they may be formed in the thickness of the belt.

The belt indexes the channels 208 past first 202a, second 202b, third 202c, fourth 202d, fifth 202e and sixth 202f filter component supply stations. The first 202a, second 202b, fourth 202d, fifth 202e and sixth 202f supply stations are provided with component supply chutes 214a, 214b, 214d, 214e, 214f that direct single components 210a, 210b, 210d, 210e, 210f to the channels 208 on the belt 206. At the third supply station 202c, components 210c are supplied to the channels from a hopper 216 by delivery drums 218, 218'. The first 202a and sixth 202f supply stations also have hoppers 220, 222. The fourth supply station 202d also has a hopper (not shown). The hoppers of the first 202a, third 202c, fourth 202d and sixth 202f supply stations are provided with pre-cut filter components 210a, 210c, 210d, 210f.

The second 202b and fifth 202e supply stations each includes a component rod supply tube 224, 224', through which a continuous rod 226, 228 of component material is supplied. A rotary cutter 230, 230' is disposed in the region of the mouth of each supply tube 224, 224' to cut the rod into individual components 210b, 210e of the desired length, which pass into and
5 down the supply chutes 214 toward the channels 208 on the belt 206.

In alternative embodiments, not shown, the supply stations direct the components to the assembler in other ways than does the embodiment of figures 2A and 2B. For example, the components can be directed by a robotic arm such as a SCARA.

Referring again to the embodiment of Figures 2A and 2B, the belt indexes between the
10 supply stations 202a-202f and receives a component from each. As can be seen in Figure 2B, the delivery chutes 214 of the first 202a, second 202b, fourth 202d and sixth 202f supply stations and the delivery drums 218, 218' of the third supply station are disposed across the width of the belt 206 so that each successive component delivered to the channels 208 on the belt abuts the previously delivered component to form a complete assembly 232 at the sixth
15 supply station 202f. In the arrangement shown in Figure 2, the first supply station 202a is disposed to deliver the first component 210a at one end of the channels 208. In other embodiments, the controller can control the introduction of a component into a channel 208 from a supply station 202 to place the component anywhere in the channel, as required for the component assembly being made.

From the sixth supply station 202f, the channels 208 index to a transfer station 234 where
20 the complete assembly 232 is picked up by a transfer channel 236, which holds the assembly by vacuum, moved to a position over a channel section garniture belt 238 where the vacuum is released so that the assembly drops into the channel of the garniture belt 238 and is carried off for further processing, as described earlier. If the complete assembly 232 does not include
25 gaps, provision can be made if necessary for the components of the complete assembly to be pushed together axially to ensure that they abut each other. The transfer channel 236 can transfer a complete assembly 232 to the garniture belt 238 one at a time or it can collect number of complete assemblies, for example three before moving across the garniture belt and depositing the assemblies on the belt. The collection of several assemblies at a time can be
30 made by a 'pick and place' device, for example a selective compliant assembly robot arm (SCARA) or an industrial robot having a Cartesian anthropomorphic or Delta architecture. In other embodiments, the transfer station can comprise a spider robot.

The complete assembly 232 shown in Figures 2A and 2B is a double length smoking article. During subsequent processing the wrapped assembly will be cut in half.

35 In this embodiment, the lengths of the components 210a, 210c, 210d, 210f supplied at the first 202a, third 202c, fourth 202d and sixth 202f component supply stations is determined by

the lengths of the components supplied to the hoppers of these stations. At the second 202b and fifth 202e supply stations, the lengths of the components 210b, 210e supplied are determined by the length of the rods 224, 224' cut off by the cutters 230, 230' to form the components. This length can be varied on demand, and the position of the supply stations
5 across the width of the belt 206 can be changed so that the components introduced into the channels 208 on the belt in the correct position.

The movement of the belt 206 to move the channels 208 between the supply stations 202a-202f, the introduction of components 210a-210f from the supply stations, the lengths of the component rods 226, 228 cut at the second 202b and fifth 202e supply stations to
10 form the components 210b, 210e supplied at those supply stations and the transfer of the complete assemblies 232 to the garniture belt 238 at the transfer station 234 is controlled by a computer (not shown) running appropriate software. The computer can also control the supply of component rods to the supply station, so that the type of component supplied at each supply station, its diameter and other features of the component can be controlled.

Figure 3 shows a preferred component supply station 302 of an assembler unit with an
15 assembler tray 306 adjacent to it. The supply station 302 includes a feeder unit 340, a loading tray 342 below the feeder unit and a pusher 344 adjacent the loading tray. The pusher 344 is of substantially the same width as the loading tray 342. The loading tray 342 has a plurality of V cross section channels (not shown) that align with the channels (not shown) of the assembler tray 306 when the tray is adjacent the station. A holding element 346 is provided generally
20 above the loading tray 342 and a cutter 348 is located generally below the loading tray. The assembler tray 306 is mounted on a base 350. The edge of the assembler tray 306 adjacent the loading tray 342 overhangs the assembler base 350.

The assembler tray 306 indexes along an assembler track 352 from the previous supply
25 station or the transfer station (not shown) and stops adjacent and abutting the loading tray 342 of the supply station. The channels of the assembler tray 306 contain partially completed assemblies 310 of components from previous supply stations. The channels of the assembler tray 306 are aligned with the channels of the loading tray 342. Rods 330 of component material are delivered by the feeder unit 340 to the channels of the loading tray 342. The pusher 344 is
30 actuated to move in the direction of the arrow in Figure 3 to push the rods 330 from the channels in the loading tray 342 partly into the channels in the assembler tray 306, moving the assemblies 310 already in the channels further along the channels. The length of rods 330 pushed into the channels in the assembler tray 306 is the required length of the component. When the pusher 344 has travelled sufficiently to push the required lengths of the rods 330 into
35 the channels of the assembler tray 306, the holding element 346 moves down onto the rods 330 in the loading tray 342. The cutter 348 is then actuated to cut through the rods 330 to leave

components 310 of the required length in the channels of the assembler tray 306. The holding element 346 moves up away from the loading tray 342. The assembler base 350 carrying the assembler tray 306 moves along the track 352 to the next supply station or to a transfer station and another assembler base and tray arrive at this supply station. Once the assembler tray 306 has visited all the supply stations necessary to supply the components required for the complete assembly being made, the complete assembly is transferred from the assembler unit for further processing.

After a number of assembler trays 306 have visited the supply station 302, the rods 330 will be too short to supply components of the required length to the channels 308 in the assembler tray 306. At that stage, the remaining short components are discharged from the supply station 302, for example by means of the pusher 344, the pusher 344 retracts to its start position and new rods 330 are introduced into the loading tray from the feeder unit.

If it is desired to change the length of the component 310 supplied at the supply station 302, the pusher 344 can be controlled so that its length of travel in the direction of the arrow in Figure 3 is greater or less, as required. This will change the length of the rods 330 pushed into the channels on the assembler tray 306 and so the length of the components 310 cut off the rods by the cutter 348. If it is desired to change the diameter of the rods, this can be done by changing the rods supplied by the feeder unit 340. The V cross section channels in the loading tray 342 and the assembler tray 306 can securely accommodate components of a wide range of diameters. If it desired to vary the type of component to be included in the complete assembly, the type of rod supplied by the feeder unit 340 can be changed. All these changes can be accomplished much more easily and quickly than is the case with conventional combiners that would require one or more drums to be changed.

The movement of assembler tray 306 between supply stations, the introduction of components in to the assembler tray at the supply stations, the travel of the pusher 344 to determine the length of component rods 330 cut off into the channels of the assembly tray and the eventual transfer of the complete assemblies for further processing is controlled by a computer (not shown) running appropriate software. The computer can also control the supply of component rods to the supply station, so that the type of component supplied at each supply station, its diameter and other features of the component can be controlled.

The assembler unit 400 of Figures 4A and 4B, is for making a filter for a smoking article, a filter sub unit or a heated smoking article. In this embodiment, the assembler is a circular turntable 406. The upper surface of the turntable has seven radial channels 408 on its upper surface. The channels 408 are of arcuate section; in other embodiments, the channels are of V cross section. Each channel 408 is open at its radially outward end. Component supply stations 402a-402g are disposed in a circle around the turntable. In other embodiments, some

or all of the supply stations are disposed partly or wholly over the turntable. The turntable 406 indexes around in the direction of the arrow in Figure 4 so that the channels 408 stop in turn adjacent the supply stations 402a-402g. At each supply station, one or more filter components 410a-410g is introduced into the channel 408 adjacent the supply station. The components in the channels 408 are in axially alignment with each other. The supply stations 402a-402g can supply pre-cut components or components can be cut off a rod as described with reference to Figure 2A.

At the seventh supply station 402g, the last component of the complete assembly 432 is introduced into the channel 408. The turntable 406 indexes around so that the complete assembly 432 moves to a transfer station 434. At the transfer station the complete assembly 432 is transferred to a continuous garniture belt 438 extending radially away from the turntable 406, driven in the direction of the arrows in Figure 4B. The transfer station 434 comprises a continuous transfer belt 452 driven around rollers 454. In other embodiments, not shown, the transfer station can comprise an industrial robot such as a SCARA. Referring again to the embodiment of Figures 4A and 4B, the transfer belt 452 overlies the garniture belt 438 and the channel on the turntable 406 at the transfer station 434. When a complete assembly 432 is adjacent the transfer station, the transfer belt 452 is driven in the direction shown by the arrows in Figure 4B to move the complete assembly from the channel on the turntable 406 onto the garniture belt 438. The complete assembly 432 is held on the transfer belt 452 during the transfer by a vacuum applied through perforations in or a porous of the transfer belt. When the complete assembly has been moved over the garniture belt 428, the vacuum is released allowing the assembly to be carried away by the garniture belt. The garniture belt 438 is driven at a speed such that the complete assemblies 432 delivered to it at the transfer station 434 form a continuous line on the garniture belt, as seen in Figure 4A. The complete assembly 432 shown in Figures 4A and 4B is a double length smoking article. During subsequent processing the wrapped assembly will be cut in half.

The movement of the turntable 406 to move the channels 408 between the supply stations 402a-402g, the introduction of components 410a-410g from the supply stations and the transfer of the complete assemblies 432 to the garniture belt 438 at the transfer station 434 is controlled by a computer (not shown) running appropriate software. The computer can also control the supply of component rods to the supply station, so that the type of component supplied at each supply station, its diameter and other features of the component can be controlled.

The speed of the garniture belt 434 is set according to the rate of supply of complete assemblies 432, and their length, to ensure that the garniture belt carries a continuous line of complete assemblies. In other embodiments, not shown, groups of channels are disposed on

the turntable 406. Each supply station 402 simultaneously supplies the channels 408 in a group. This allows a number of complete assemblies 432 to be available at the same time at the transfer station 434. The complete assemblies 432 can be transferred to a smaller number of garniture belts 438 than there are complete assemblies at the transfer station, such as to a single garniture belt.

In the assembler unit 500 shown schematically in Figures 5A and 5B, the supply stations 502a, 502b, 502c each comprise a hopper 516a, 516b, 516c for holding components 510a, 510b, 510c and a supply chute 514a, 514b, 514c extending from the hopper. Elongate racks 556a, 556b, 556c having a plurality of transverse V cross section channels 558 are located adjacent the hoppers 516a-516c and chutes 514a-514c. Components 510 are supplied from the hoppers 516 through the chutes 514 to lie in the channels 508 in the elongate racks 556. In figure 5, only exemplary components 510 are shown. The hoppers 516a-516c and thus the racks 556a-556c normally each contain different components 510a-510c.

A robotic arm 560 such as a SCARA includes an elongate pickup head 562 having a longitudinal V cross section channel 508 in its underside (shown in Figure 5B). The channel 508 in the pick up head has vacuum ports 564 opening into it.

A controller (not shown) such as an appropriately programmed computer moves the pick up head 562 between the supply stations 502a-502c. At a supply station, the pick up arm is positioned over a component in a channel 556 on the elongate rack 558 of the supply station. A vacuum is drawn through the appropriate vacuum port or ports 564 in the channel 508 of the pick up head to pick up a component from the rack 558 into the channel 508 of the pick up head. By moving the pick up head from supply station to supply station in the appropriate order, a complete assembly 532 of a desired composition is formed in the channel 508 in the pick up head. Once the complete assembly 532, or a number of complete assemblies, have been formed in the pick up head groove 508, the pick up head moves over a continuous take off belt 566 running around rollers 568 (only one of which is shown in figure 5A). When the pick up head 562 is over the belt 566, the vacuum at the vacuum ports 564 is released and the complete assembly or assemblies 532 deposited on the belt. The belt 556 moves in the direction of the arrows in Figure 5A to take the complete assemblies for further processing.

The pick up head 562 can include a device for pushing the components axially together to ensure that they abut one another. This is provided by a piston moving in a cylinder 570 mounted adjacent and parallel to an end of the channel 508 in the pickup head 562. The piston rod 572 carries a substantially perpendicular arm 574 that extends across the channel 508. A stop 576 is provided in the channel 508 at the end remote from the cylinder 570. In use, when a complete assembly 532 is in the pickup head channel 508, the controller actuates the piston to move the piston rod 572 and the piston arm 574 towards the stop 576, urging the components

of the complete assembly in that direction and thus closing any gaps in the assembly. The travel of the piston rod is set to stop at a distance from the stop corresponding to the correct length of the complete assembly. The piston is then withdrawn into the cylinder, and after the assembly has left the channel 508, the channel is ready to receive the next complete assembly.

5 As the components 510 are removed from the racks 556, they are replaced by components from the hoppers 516. The components 510 can be single components, as shown in Figure 5A, or multiple components supplied to the rack from more than one component source.

10 If it is desired to change the design of the complete assembly made on the assembler unit 500, this can be achieved by one or more of:

- changing the order in which the pick up head 562 visits the supply stations 502a-502c;
- adding additional supply stations;
- omitting supply stations;
- changing the component supplied at a supply station; and

15 changing the position of the pick up head at a supply station so that a gap is introduced in the assembly, for example to make plug-space-plug type filters.

In order to achieve the desired complete assembly, the pick up head 562 can be rotated through 180° between visits to successive supply stations to place the components in the correct position and orientation.

20 If the assembler unit 500 is operated so that components of a different diameter are supplied, the channel 508 in the pick up head 562 and the channels 558 in the supply station racks 556 can accommodate the change because of their V cross section.

In some embodiments of the type shown in Figures 5A and 5B, more than one robotic arm 560 and pick up head 562 is provided to increase the speed at which complete assemblies 532 are formed to ensure a continuous supply of complete assemblies to the further processing.

25 Figures 6A, 6B and 6C show how three different exemplary arrangements of components in complete assemblies can be used to make the same product. Figure 6A shows exemplary a product 600 made using a complete assembly made by an assembler unit 100, 200, 400, 500 of the types described above. The product 600 includes a first, end, component 610a that abuts a second component 610b that abuts a third component 610c that abuts a fourth, end, component 610d over wrapped by a plug wrap 680. Figure 6B shows parts of first 606, second 606' and third 606" assembler trays or belts of the type shown in Figures 1, 2 and 3 having channels 608. In Figure 6B, only two exemplary channels are show on each assembler tray or belt 606; in practice the trays or belts 606 will have many more channels, as shown in Figures 1, 2 and 3.

The channels 608 contain complete assemblies 632, 632', 632" ready for transfer from the assembler unit to make the product 600 of Figure 6B.

Each complete assembly 632 on the first assembler tray or belt 606 includes only those components 610a-610d in the product 600, in the same order as they are present in the product. The final assembly 632 needs only to be wrapped to make the product 600 of Figure 6A.

Each complete assembly 632' in assembler tray or belt 606' includes two of the first, end components 610a of the product 600, one at each end of the final assembly. Each of the first components 610a abuts a second component 610b. Each second component 610b abuts a third component 610c. The two third components 610c in the array are separated by a double length fourth component 610d'. The complete assembly 632' can be wrapped and cut in half through the middle of the double length fourth component 610d' to make two products 600.

Each complete assembly 632" on the third assembler tray or belt 606" includes, in order from left to right as seen in Figure 6, a second component 610b, a third component 610c, a double length fourth component 610d', another third component 610c, another second component 610b and a double length first component 610a'. Each complete assembly 632" includes the components necessary to make two products 600 shown in Figure 6A. In order to make the products 600, the assemblies 632' are transferred for wrapping so that the left hand (as seen in Figure 6) second component 610b of one complete assembly abuts the double length first component 610a' of another, to form a quadruple length assembly 682, shown in Figure 6C. It will be understood that in practice, the quadruple length assembly 682 will abut further complete assemblies 632" at each end in a continuous stream of quadruple length assemblies. The quadruple length assemblies 682 are overwrapped with a plug wrap 680 and cut (shown by the dashed lines in Figure 6C) through the middle of the double length first 610a' and fourth 610d' components to make individual products 600.

It may be required to provide products having a plug-space-plug configuration, that is, a configuration in which at least two of the components in the final product are separated by a gap. This can be achieved by controlling the position in which the components are supplied to the channel or channels in the assembler so that the required gaps are provided. Alternatively or additionally, gaps can be provided by making complete assemblies 632" of the type shown on the third assembler tray or belt 606" controlling the transfer of the complete assemblies to the downstream part of the combiner. The complete assemblies can be transferred to, for example, a garniture belt so that there is a gap between each individual final assembly. The spaced apart final assemblies can be wrapped and cut as described on the preceding paragraph to produce products in which at least two of the components are separated by a gap.

It will be seen that the invention provides combiners and methods which allow a rapid change of smoking article design to be made, without the need for lengthy breaks in production.

CLAIMS:

1. A method of making an axially aligned assembly of components of rod-shaped articles comprising:

supplying a component from one of a plurality of component supply stations to a channel
5 of an assembler;

repeating the step of supplying a component to a channel of the assembler until a desired assembly of components is in the channel of the assembler;

transferring the assembly from the assembler; and

controlling the relative positions of the supply stations and the assembler and controlling
10 the provision of the components to the assembler from the supply stations.

2. A method according to claim 1 in further comprising controlling the length of a component supplied at at least one supply station.

3. A method according to claim 1 or 2 in which, at a component supply station, a rod of the component material is pushed partly into a channel of an assembler and cut to leave a
15 component in the channel.

4. A method according to claim 3 in which at a component supply station a plurality of rods of the component material, the pusher pushes the said plurality of rods partly into respective channels of an assembler and the cutter cuts the plurality of rods to leave components in respective channels of the assembler.

20 5. A method according to any of claims 1 to 4 comprising:
moving an assembler comprising a plurality of channels for receiving components between a plurality of component supply stations in a predetermined order;

supplying a component to a channel of the assembler;

moving the said assembler to another one of the plurality of component supply stations;

25 and

supplying a further component to a channel of the assembler.

6. A method according to any of claims 1 to 5 comprising holding a plurality of components in channels of a component receiver at a component supply station and transferring a component to an assembler at the supply station.

7. A combiner for use in the manufacture of rod-shaped articles composed of at least two components, comprising:

a plurality of component supply stations for supplying components of a rod-shaped article;

an assembler comprising at least one channel for receiving components from the supply stations in axial alignment in the said at least one channel to form assemblies of axially aligned components in the said at least one channel;

a transfer device for transferring the said assemblies of axially aligned components from the assembler; and

a controller for controlling the relative positions of the supply stations and the assembler and provision of components to the assembler from the supply station.

8. A combiner according to claim 7 in which the controller also controls the length of a component supplied at at least one supply station.

9. A combiner according to claim 7 or 8 in which a component supply station includes a pusher for pushing a rod of the component material partly into a channel of the assembler, a cutter for cutting the rod to leave a component in the channel and a holding element to hold the rod during cutting.

10. A combiner according to claim 9 in which the assembler includes a plurality of channels and in which a component supply station provides a plurality of rods of the component material, the pusher is disposed to push the said plurality of rods partly into respective channels of the assembler, the cutter is disposed to cut the plurality of rods and the holding element is disposed to hold the plurality of rods in the said respective channels during cutting to leave components in respective channels of the assembler.

11. A combiner according to any of claims 7 to 10 in which the assembler is arranged to move from one supply station to another.

12. A combiner according to any of claims 7 to 11 in which a component supply station comprises a component receiver having a plurality of channels for holding a plurality of components and transferring a component to an assembler at the supply station.

13. A combiner according to any of claims 7 to 12 in which the said at least one channel on the assembler is of V cross section for holding components of different cross section.

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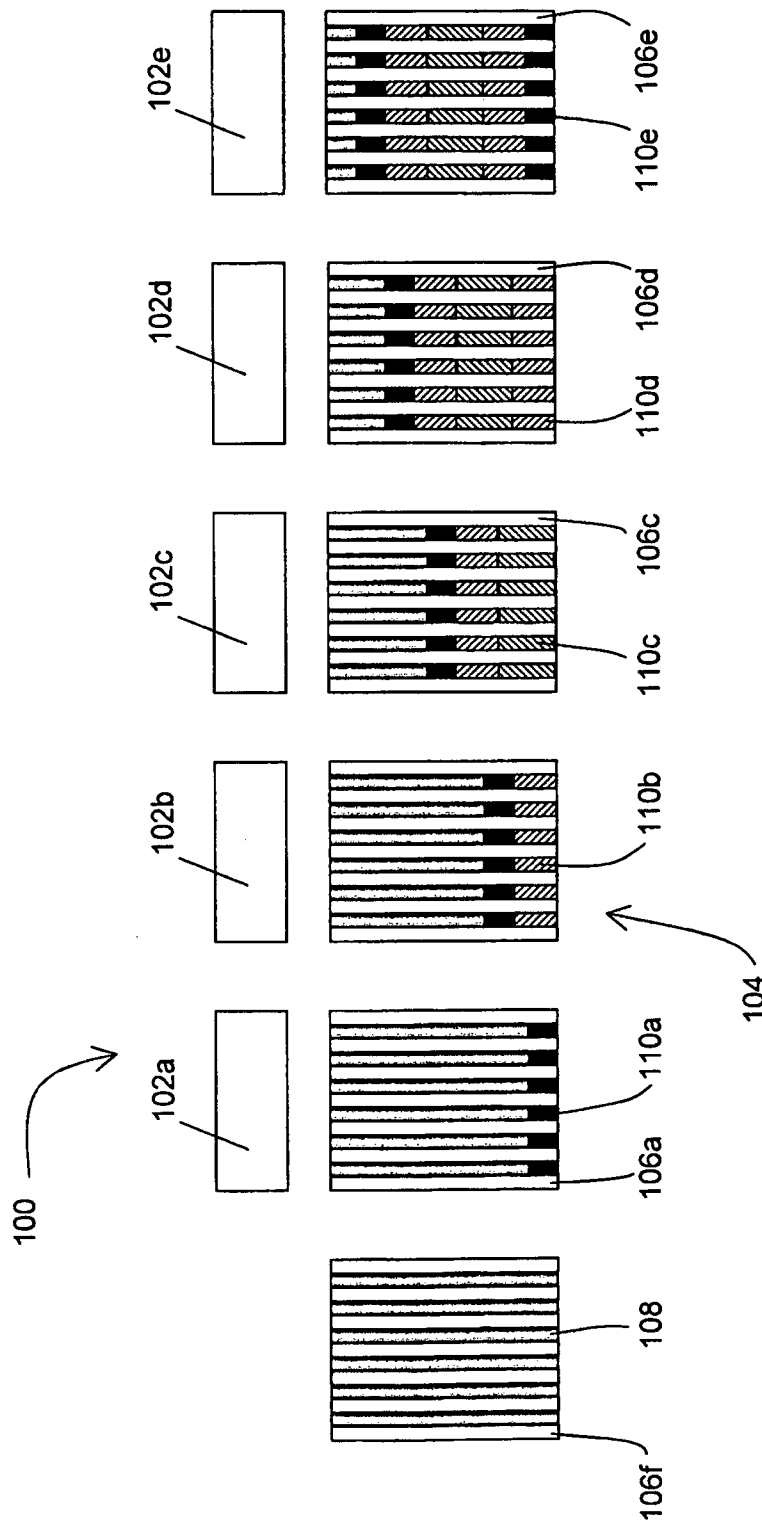
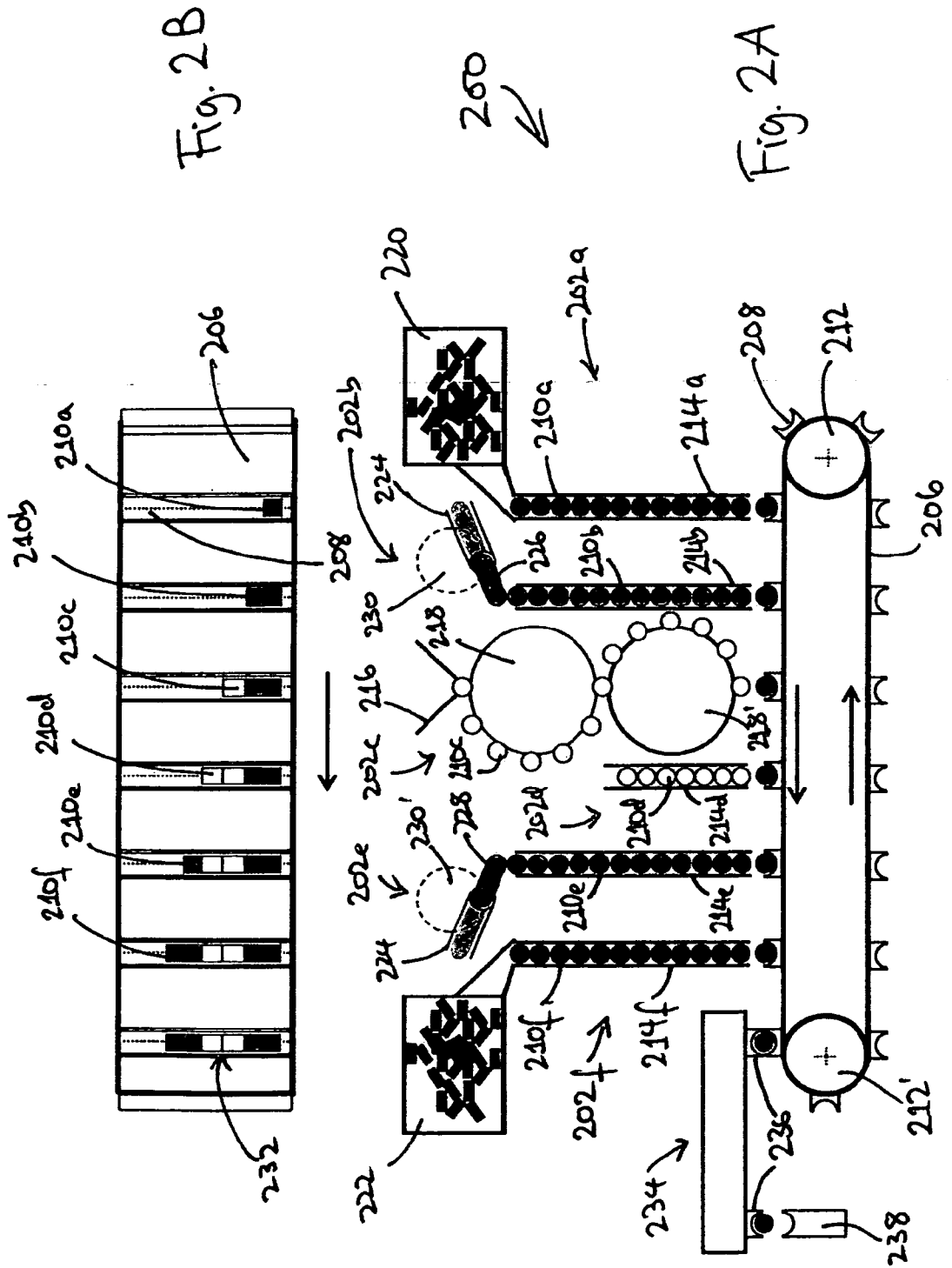


Fig. 1



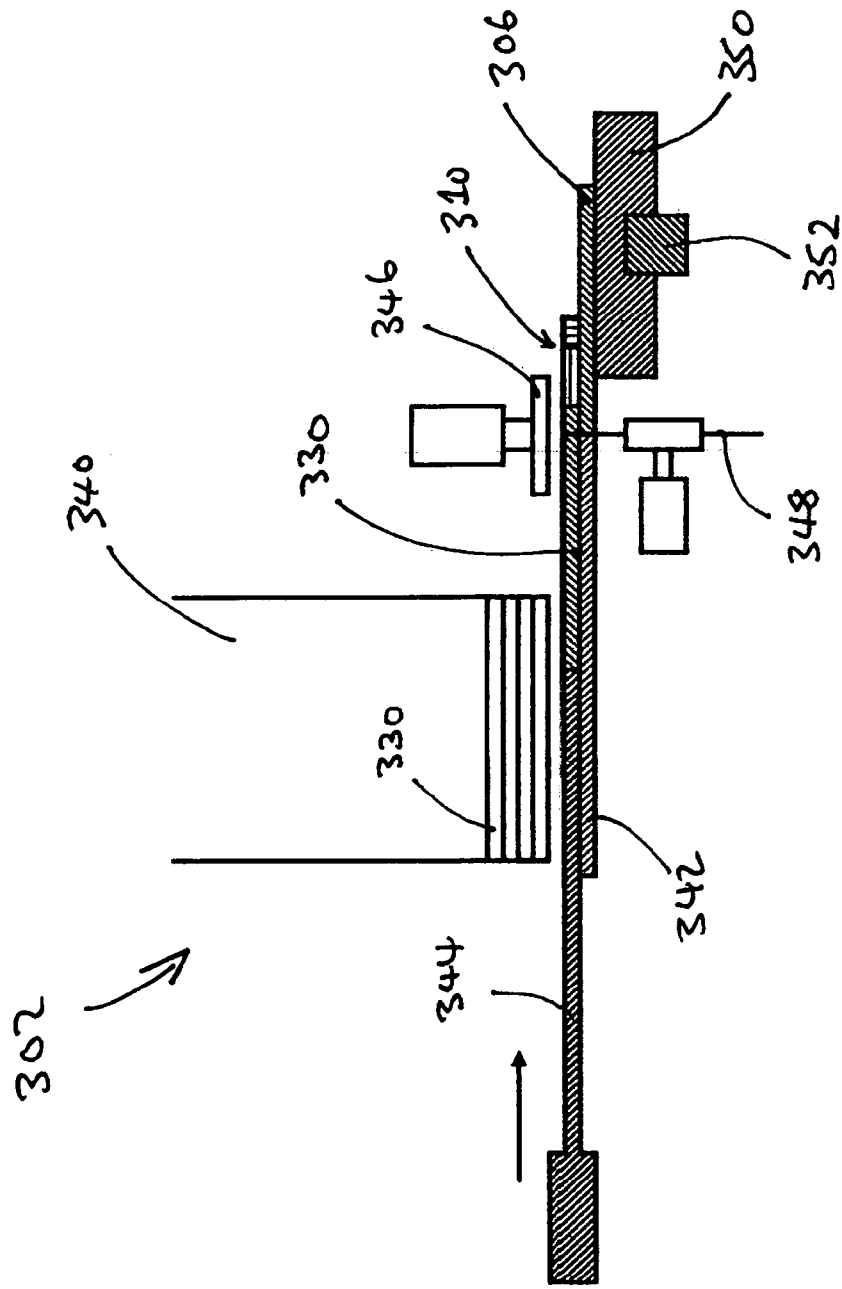
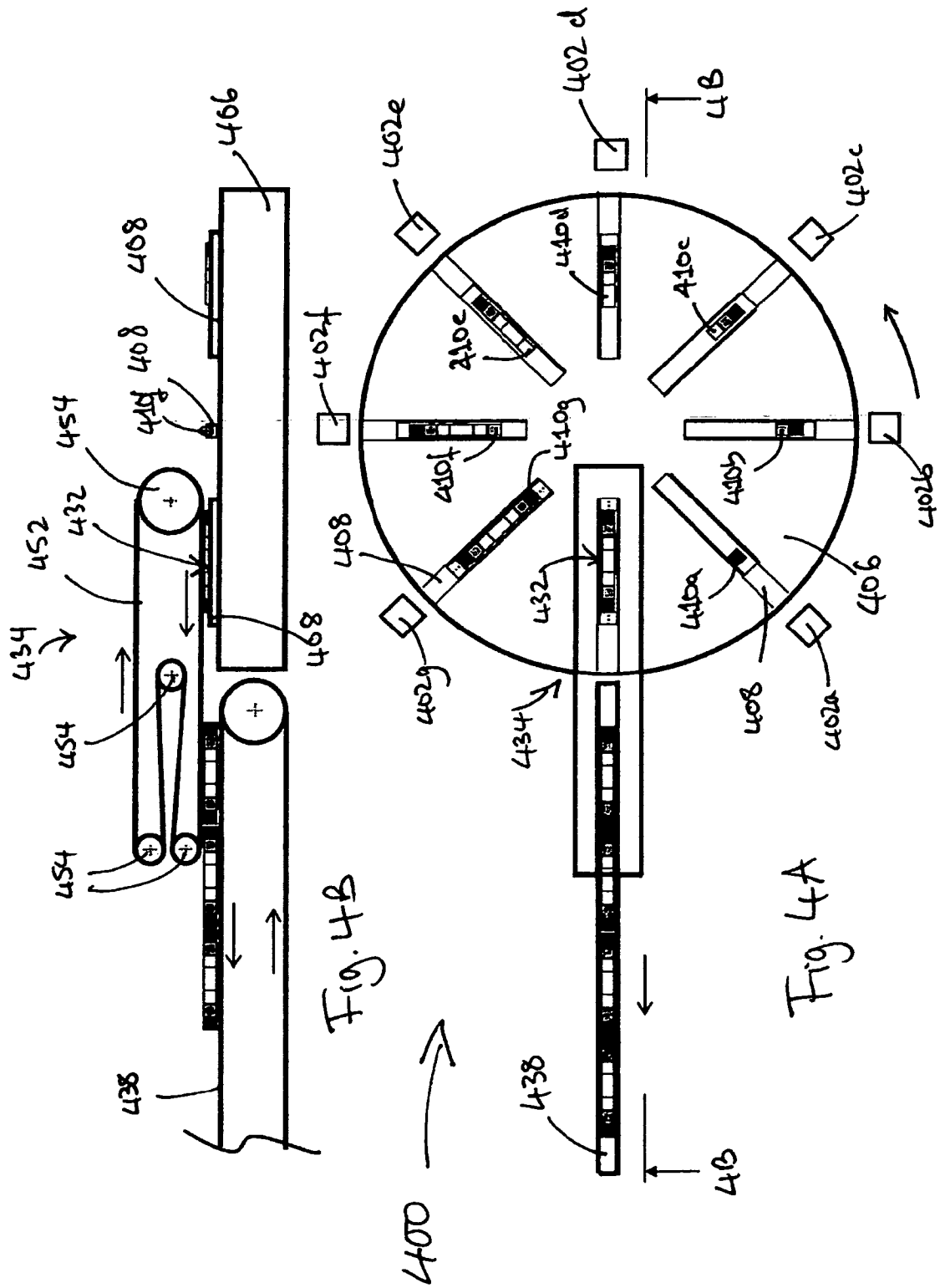
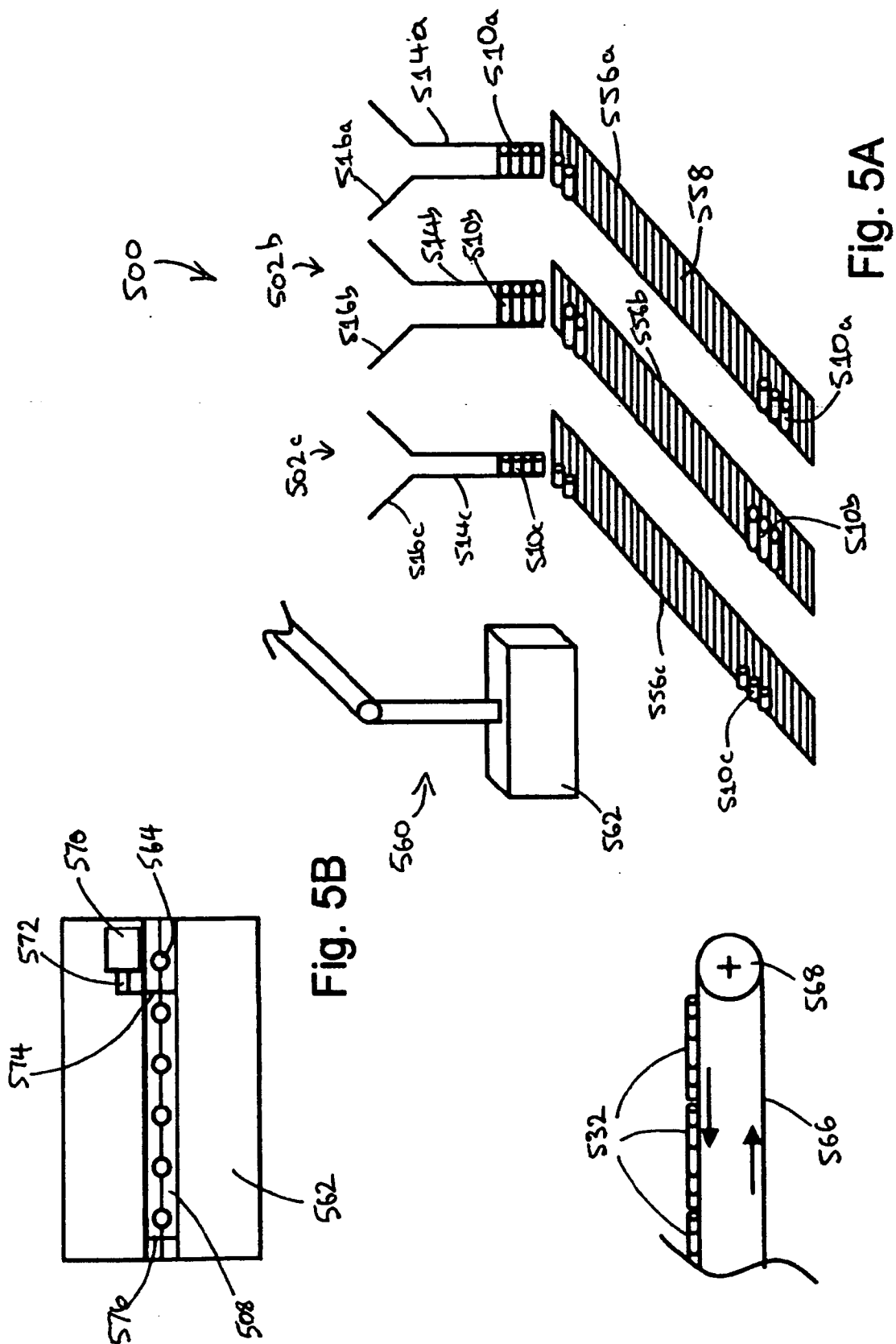
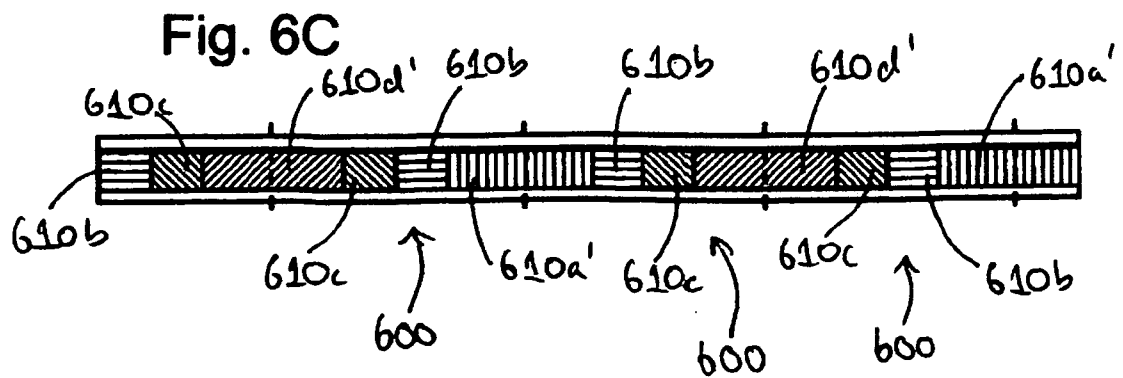
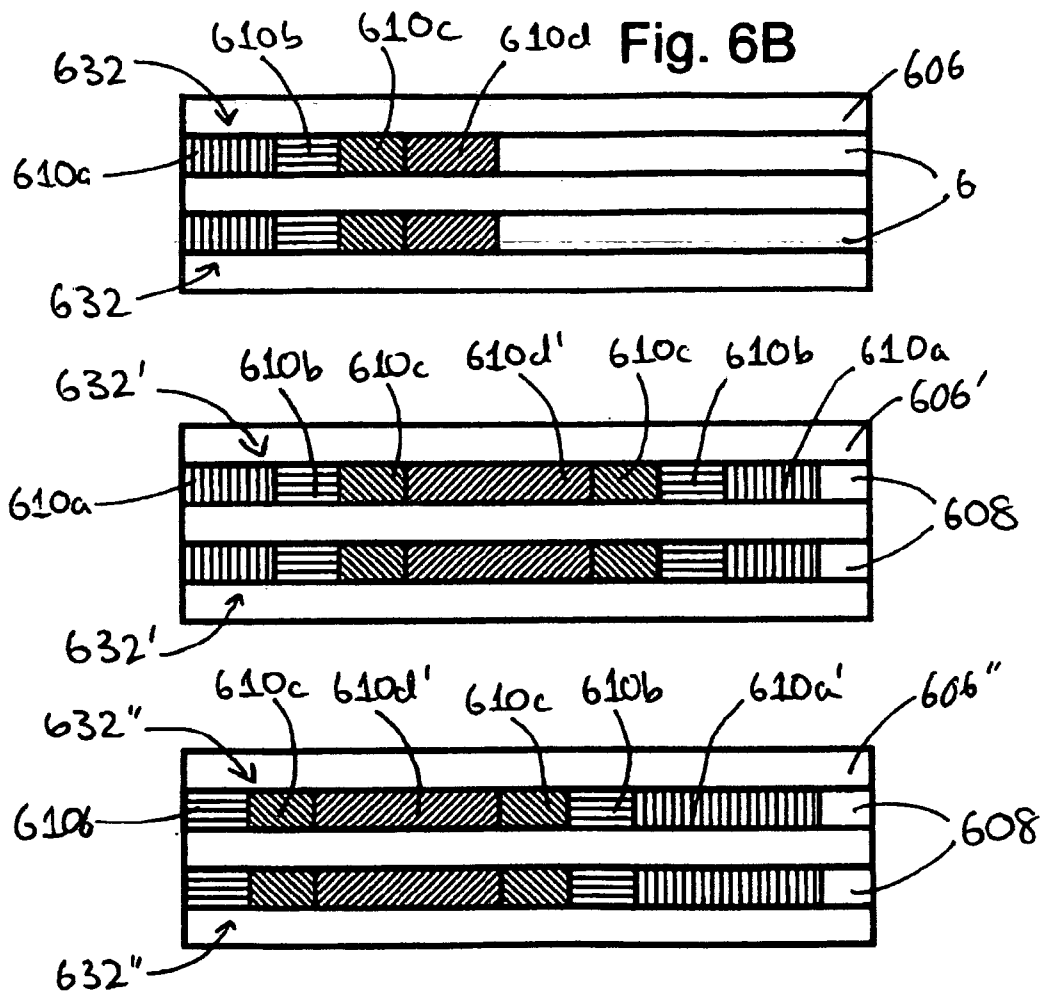
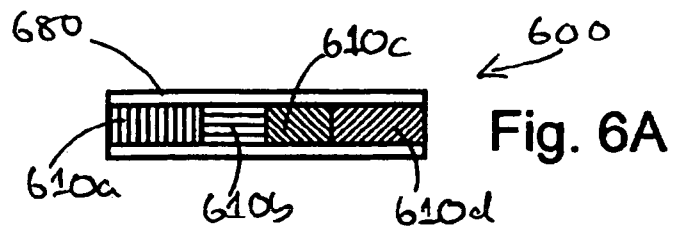


Fig. 3







INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2011/006056

A. CLASSIFICATION OF SUBJECT MATTER

INV. 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)

A24D

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 practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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X	EP 1 767 107 A1 (JAPAN TOBACCO INC [JP]) 28 March 2007 (2007-03-28)	1,7
A	paragraph [0085] - paragraph [0091]; claims; figures	2-6,8-13
A	----- US 2009/145449 A1 (CIESLIKOWSKI BARTOSZ [PL] ET AL) 11 June 2009 (2009-06-11) paragraph [0014] - paragraph [0015] paragraph [0033] - paragraph [0041]; claims; figures	1-13
A	----- WO 2006/082476 A2 (PHILIP MORRIS PROD [CH]) 10 August 2006 (2006-08-10) the whole document	1-13
A	----- US 3 550 750 A (JACKSON NORMAN WALTER) 29 December 1970 (1970-12-29) the whole document	1-13



Further documents are listed in the continuation of Box C.



See patent family annex.

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"&" document member of the same patent family

Date of the actual completion of the international search

8 March 2012

Date of mailing of the international search report

14/03/2012

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

Information on patent family members

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