



Europäisches Patentamt
European Patent Office
Office européen des brevets



(11)

EP 1 557 099 A1

(12)

EUROPEAN PATENT APPLICATION
published in accordance with Art. 158(3) EPC

(43) Date of publication:
27.07.2005 Bulletin 2005/30

(51) Int Cl.7: **A24C 5/18**

(21) Application number: **03717656.7**

(86) International application number:
PCT/JP2003/004993

(22) Date of filing: **18.04.2003**

(87) International publication number:
WO 2003/090570 (06.11.2003 Gazette 2003/45)

(84) Designated Contracting States:
**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR
HU IE IT LI LU MC NL PT RO SE SI SK TR**
Designated Extension States:
AL LT LV MK

(72) Inventor: **Okamoto, Hiroshi,**
JAPAN TOBACCO INC.
Kita-ku, Tokyo 114-0004 (JP)

(30) Priority: **26.04.2002 JP 2002126898**

(74) Representative: **Weise, Reinhard, Dipl.-Ing.**
Reinhard-Skühra-Weise & Partner
Patentanwälte
Postfach 44 01 51
80750 München (DE)

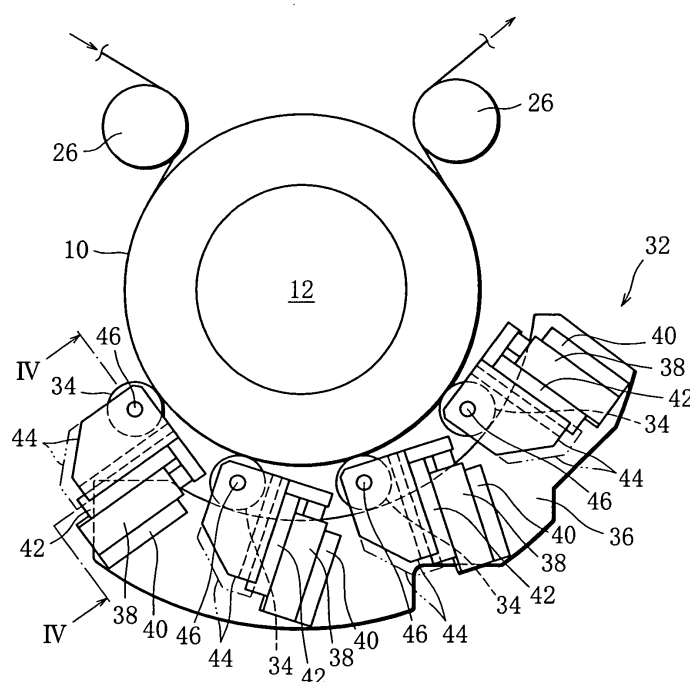
(71) Applicant: **Japan Tobacco Inc.**
Tokyo 105-8422 (JP)

(54) **BAR-LIKE ARTICLE FORMING DEVICE**

(57) A rod-like article forming apparatus comprises an endless garniture tape (10) used for forming a tobacco rod (R) with shredded tobacco and a paper web (P), a driving drum (12) for causing the garniture tape (10) to travel in one direction, and a plurality of presser rollers

(34) for pressing the garniture tape (10) against the outer circumferential surface of the driving drum (12). The presser rollers (34) increase the contacting force of the garniture tape (10) with respect to the outer circumferential surface of the driving drum (12).

FIG. 3



EP 1 557 099 A1

Description

Technical Field

[0001] The present invention relates to a forming apparatus for continually forming a rod-like article obtained by wrapping a filling material in a web.

Background Art

[0002] This kind of forming apparatus is incorporated into a cigarette making machine or a filter making machine. For instance, Unexamined Japanese Patent Publication No. 8-214854 discloses an example of a cigarette making machine. The making machine disclosed in the publication includes a wrapping section as a forming apparatus, and the wrapping section has an endless garniture tape. The garniture tape receives a paper web and shredded tobacco as a filling material, and causes the paper web to travel with the shredded tobacco in one direction. In this process, the shredded tobacco is compression-molded into a rod-like shape and subsequently wrapped in the paper web by using the garniture tape. As a result, a tobacco rod is continually formed.

[0003] The garniture tape is wound around a driving drum and made to travel along the rotation of the driving drum. Moreover, a fixed tension is applied to the garniture tape by a tensioner. The tension of the garniture tape tightens up the garniture tape around the outer circumferential surface of the driving drum, thereby avoiding a slip of the garniture tape in relation to the rotation of the driving drum.

[0004] In recent years, there is a tendency to run the garniture tape at higher and higher speed for the purpose of improving the production capacity of the making machine. In order to increase the running speed of the garniture tape, it is required to greaten a tightening force of the garniture tape with respect to the outer circumferential surface of the driving drum to prevent the garniture tape from slipping on the driving drum.

[0005] Since the tightening force of the garniture tape is produced by the tension thereof as stated, the tension of the garniture tape has to be increased to strengthen the tightening force. An increase in tension, however, is liable to cause tear in the garniture tape and entails frequent suspension of the making machine.

Disclosure of the Invention

[0006] An object of the present invention is to provide a rod-like article forming apparatus capable of allowing a garniture tape to run at high speed and at the same time improving durability of the garniture tape.

[0007] To accomplish the above object, the rod-like article forming apparatus according to the present invention comprises a supplying section for supplying a filling material and a wrapping section for wrapping the filling material supplied from the supplying section in a

paper web to form the filling material into a rod-like article.

[0008] The wrapping section includes an endless garniture tape used for forming the rod-like article and having a forward path portion that extends through the wrapping section and receives the paper web with the filling material and a backward path portion continuing to the forward path portion, a rotatable driving drum that causes the garniture tape to travel in one direction and has a wrapping contact area in which the backward path portion of the garniture tape is wound around an outer circumferential surface thereof, a tensioner for applying tension to the garniture tape, and a presser device for pressing the backward path portion of the garniture tape against the outer circumferential surface of the driving drum in the wrapping contact area of the driving drum.

[0009] With the above-described forming apparatus, when the garniture tape is made to travel along with rotation of the driving drum, the backward path portion of the garniture tape is pressed against the outer circumferential surface of the driving drum by the presser device. Accordingly, the contacting force of the backward path portion of the garniture tape with respect to the outer circumferential surface of the driving drum is increased in the wrapping contact area of the driving drum. Therefore, the garniture tape can travel without slipping against the outer circumferential surface of the driving drum.

[0010] If the contacting force of the garniture tape is increased by the presser device, the tension required in the garniture tape and produced by the tensioner does not have to be large, and tension fluctuation of the garniture tape is suppressed during the travel of the garniture tape. If the tension fluctuation of the garniture tape is suppressed, load applied to the garniture tape, or repeated load, is lessened. As a result, the garniture tape will have more service life and will be less frequently exchanged. Consequently, operation efficiency of the forming apparatus is enhanced, and productivity of the rod-like article is improved.

[0011] The presser device includes a pressing member that sandwiches the backward path portion of the garniture tape between the outer circumferential surface of the driving drum and the pressing member, and drive means that presses the pressing member toward the outer circumferential surface of the driving drum.

[0012] More specifically, the pressing member has a plurality of presser rollers arranged along the outer circumferential surface of the driving drum, the presser rollers being in rotational contact with the backward path portion of the garniture tape. The pressing member may be, instead of having the presser rollers, an endless presser belt wound around the wrapping contact area of the driving drum through the garniture tape. The presser belt travels in conjunction with the backward path portion of the garniture tape.

[0013] In any case, the presser rollers or presser belt tightly presses the garniture tape against the outer cir-

cumferential surface of the driving drum, to thereby increase the contacting force of the garniture tape with respect to the outer circumferential surface of the driving drum. This surely prevents the garniture tape from slipping against the outer circumferential surface of the driving drum during the travel of the garniture tape.

[0014] It is possible to arrange the presser device, namely presser rollers or presser belt, outside the driving drum. This means that the presser device can be easily added to an existing forming apparatus, and that the forming apparatus of the present invention can be obtained without difficulty. Therefore, the presser device has high practicability.

[0015] Furthermore, the presser device may include a suction face formed in the outer circumferential surface of the driving drum, instead of having the presser rollers or presser belt. The suction face sucks the backward path portion of the garniture tape in the wrapping contact area of the driving drum, thereby pressing the garniture tape against the outer circumferential surface of the driving drum.

[0016] The aforementioned presser device of a suction type is suitable for use in a case that there is no space for the presser rollers or presser belt on the periphery of the driving drum.

[0017] The wrapping section is provided with a guide path for guiding the forward path portion of the garniture tape.

[0018] The forming apparatus may further include, in addition to the presser device, a reduction device for reducing friction resistance that generates between the guide path and the forward path portion of the garniture tape.

[0019] When passing through the guide path, the forward path portion of the garniture tape is used to wrap the filling material in the paper web, that is, the forming of a rod-like article. In such a forming process, the guide path produces excessive resistance for the travel of the garniture tape. The reduction device, however, reduces the running resistance of the garniture tape and lessens the tension fluctuation, or repeated load, of the garniture tape. As a consequence, the reduction device is capable of not only further increasing the service life of the garniture tape but also preventing damage to the garniture tape by acting in consort with the presser device.

Brief Description of the Drawings

[0020]

FIG. 1 is a schematic elevation view of a cigarette making machine;

FIG. 2 is an enlarged partial view of the making machine of FIG. 1;

FIG. 3 is a view concretely showing a presser unit of FIG. 2;

FIG. 4 is a cross-sectional view taken along line IV-IV of FIG. 3;

FIG. 5 is a schematic view of a presser belt unit;

FIG. 6 is a view of a modification example of a driving drum;

FIG. 7 is a plan view showing a lower forming guide of a forming bed;

FIG. 8 is a cross-sectional view taken along line VI-II-VIII of FIG. 7;

FIG. 9 is a plan view of tape guides; and

FIG. 10 is a broken-out view of the forming bed.

Best Mode of Carrying out the Invention

[0021] A rod-like article forming apparatus constitutes a part of a cigarette making machine or a filter making machine. As illustrated in FIG. 1, the cigarette making machine comprises a shredded tobacco-supplying device 2 and a forming apparatus 4. The forming apparatus 4 forms cigarette rods.

[0022] More specifically, the supplying device 2 has an endless suction belt, namely a tobacco band 6, which runs in one direction. While the tobacco band 6 travels, a suction face of the tobacco band 6 sucks shredded tobacco in layers to form a shredded tobacco layer. The shredded tobacco layer is transferred toward the forming apparatus 4 along with the travel of the tobacco band 6.

[0023] The forming apparatus 4 includes a wrapping section 8 continuing to the tobacco band 6. The wrapping section 8 receives the shredded tobacco layer and a paper web P at a start end thereof. The shredded tobacco layer and the paper web P pass through the wrapping section 8, and in this process, the shredded tobacco layer is wrapped in the paper web P. Thus, a tobacco rod is continuously formed, and a seam line of the tobacco rod is subjected to a drying process by a dryer 14.

[0024] For causing the paper web P and the shredded tobacco layer to travel through the wrapping section 8, the wrapping section 8 has an endless garniture tape 10. The garniture tape 10 is passed around a large number of guide rollers, and the guide rollers define a running path of the garniture tape 10.

[0025] The garniture tape 10 includes an upper-side forward portion that horizontally passes through the wrapping section 8 and a lower-side backward portion. The backward portion of the garniture tape 10 in the running path is wound around a driving drum 12. The driving drum 12 causes the garniture tape 10 to travel in a direction shown by an arrow of FIG. 1 by rotation thereof.

[0026] FIG. 2 shows the running path of the garniture tape 10 and a forming process of a tobacco rod R more in detail.

[0027] The paper web P is superposed on the garniture tape 10 at the start end of the forward path portion of the garniture tape 10, and the shredded tobacco layer is fed from the tobacco band 6 onto the paper web P. Thereafter, along with the travel of the garniture tape 10, the shredded tobacco layer T passes through a compression-molding die (shoe tongue) 16 of the wrapping

section 8 together with the paper web P. The compression-molding die 16 compression-molds the shredded tobacco layer into a round rod through the garniture tape 10 and the paper web P in cooperation with a forming bed 17.

[0028] More specifically, the forming bed 17 extends along the forward portion of the garniture tape 10 and has a guide groove, not shown, in an upper surface thereof. The guide groove guides the forward portion of the garniture tape 10. A part of the forming bed 17, which is located right under the compression-molding die 16, is called a lower forming guide 18. A part of the guide groove, which extends through the lower forming guide 18, is formed as a forming groove. The forming groove has a flat shape in section at an upstream end of the lower forming guide 18, and a substantially U-like shape in section at a downstream end of the lower forming guide 18. That is, the forming groove emerges from the upstream end of the lower forming guide 18, and the bottom width and curvature radius of the forming groove are gradually reduced toward the downstream end of the lower forming guide 18.

[0029] Therefore, when passing through the forming groove, the garniture tape 10 is gradually curved according to the shape of the forming groove to be eventually formed into a U-like shape. The curving of the garniture tape 10 forms a lower half of the shredded tobacco layer T into a semicircular shape in section through the paper web P.

[0030] When the shredded tobacco layer T passes through the compression-molding die 16, a tongue of the compression-molding die 16 forms an upper half of the shredded tobacco layer T into a semicircular shape in section.

[0031] The wrapping section 8 is provided with an upper forming guide downstream of the compression-molding die 16, the upper forming guide being disposed right above the forming bed 17. The upper forming guide has a short holder 20, a front strip 21 and a long holder 22, which are arranged in the order named from the compression-molding die 16 side.

[0032] The short holder 20 bends one of side edges of the paper web P into an arc-like shape through the garniture tape 10, and the side edge is overlaid on the rod-like shredded tobacco T from above. At this moment, the other side edge of the paper web P passes through the front strip 21 while being guided by the front strip 21. In this process, a glue nozzle, not shown, applies seam glue to the other side edge of the paper web P.

[0033] Subsequently, the long holder 22 bends the other side edge of the paper web P into an arc-like shape through the garniture tape 10 in the same manner, and the other side edge is overlaid on the rod-like shredded tobacco T from above. In other words, both the side edges of the paper web P are put together and adhere to each other by seam glue. At this point, the shredded tobacco T is completely wrapped in the paper web P, to

thereby form the tobacco rod R. The tobacco rod R thus formed is continuously delivered from the long holder 22 with the garniture tape 10, and the garniture tape 10 is recovered into the original U-like shape.

[0034] Downstream of the long holder 22, there is disposed a pair of tape guides 24. The tape guides 24 are located in respective sides of the dryer 14 and extend along the guide groove of the forming bed 17. When the tobacco rod R passes through the dryer 14, the tape guides 24 guide the corresponding side edges of the garniture tape 10.

[0035] The dryer 14 is provided with a rod heater, not shown, which dries the seam glue of the tobacco rod R by heating.

[0036] The tobacco rod R that has passed through the dryer 14, namely the wrapping section 8, then passes through a cutting section 15 (refer to FIG. 1). In this process, the cutting section 15 cuts the tobacco rod R into discrete cigarette rods C. Each cigarette rod C is twice as long as a cigarette part of a filter cigarette.

[0037] The cigarette rods C are supplied from the cigarette making machine to a filter attaching machine, not shown, and the filter attaching machine produces filter cigarettes.

[0038] As illustrated in FIG. 2, the backward portion of the garniture tape 10 is guided by a plurality of guide rollers 27 and a meandering control roller 29. There is further disposed a tension roller 28 in the backward portion of the garniture tape 10. The tension roller 28 is rotatably attached to a distal end of an arm 30, and a base end of the arm 30 is supported to be turnable. Referring to FIG. 2, the arm 30 is urged to turn in a clockwise direction A, to thereby apply prescribed tension to the garniture tape 10 through the tension roller 28. As a result, the garniture tape 10 is tightened to remove slack thereof in the running path and closely contact with an outer circumferential surface of the driving drum 12.

[0039] In the backward portion of the garniture tape 10, a pair of guide rollers 26 is located adjacent to the driving drum 12. The guide rollers 26 define a wrapping contact area of the garniture tape 10 wound around the driving drum 12, in view of a circumferential direction of the driving drum 12.

[0040] In the vicinity of the driving drum 12, a presser unit 32 is located along the wrapping contact area. In the wrapping contact area, the presser unit 32 improves the contact force of the garniture tape 10 with respect to the outer circumferential surface of the driving drum 12. Specifically, the presser unit 32 has a plurality of presser rollers 34 (for example four rollers), which are arranged on a same arc line along the outer circumference of the driving drum 12. The presser rollers 34 are in rotational contact with the garniture tape 10, and the garniture tape 10 is sandwiched between the driving drum 12 and the presser rollers 30.

[0041] As shown in FIGS. 3 and 4, the presser unit 32 has an arc-shaped base plate 36. The base plate 36 extends along the outer circumference of the driving drum

12 and is attached to a frame of the forming apparatus 4. A plurality of air cylinders 38 are fixed to the base plate 36 through brackets 40 and allocated to the respective presser rollers 34, respectively. The air cylinders 38 are arranged at intervals in the circumferential direction of the driving drum 12. Each air cylinder 38 has a piston rod, which protrudes toward the outer circumferential surface of the driving drum 12. Therefore, the piston rod of the air cylinder 38 extends toward the outer circumferential surface of the driving drum 12 or contracts to move away from the outer circumferential surface of the driving drum 12.

[0042] A slide block 42 is assigned to each air cylinder 38, respectively. The slide block 42 is supported to be slidable in an extending/contracting direction of the piston rod of the corresponding air cylinder 38 on the base plate 36 and is jointed to the piston rod. Consequently, when the piston of the air cylinder 38 is extended or contracted, the slide block 42 can slide in the extending/contracting direction of the piston rod.

[0043] Attached to each slide block 42 is a roller holder 44, which rotatably supports the corresponding presser roller 30. More specifically, as illustrated in FIG. 4, the roller holder 44 is formed into a U-like shape in section, and the presser roller 34 is located in the inside of the roller holder 44. The roller holder 44 supports both ends of a roller shaft 46, and moreover the presser roller 34 is rotatably supported on the roller shaft 46 through a pair of bearings 48.

[0044] Each air cylinder 38 is connected to a pneumatic source, not shown, and can receive the supply of working air from the pneumatic source. When the working air is supplied to the air cylinder 38, the air cylinder 38 causes the corresponding slide block 42 to slide toward the outer circumferential surface of the driving drum 12. At this time, the roller holder 44 advances from a rest position shown by a chain double-dashed line of FIG. 3 toward the driving drum 12. As a consequence, the presser roller 34 of the roller holder 44 is pushed out toward the driving drum 12, so that the garniture tape 10 is sandwiched between the driving drum 12 and the presser roller 34. Since the garniture tape 10 is thus sandwiched, the garniture tape 10 is strongly contact with the outer circumferential surface of the driving drum 12.

[0045] During the operation of the forming apparatus 4, the garniture tape 10 travels along the running path at high speed. Traction force of the garniture tape 10 is produced by rotation of the driving drum 12. In order to realize the stable high-speed travel of the garniture tape 10, it is required that the garniture tape 10 be prevented from slipping against the driving drum 12 by strengthening the contacting force of the garniture tape 10 with respect to the outer circumferential surface of the driving drum 12.

[0046] The tension of the garniture tape 10 which is exerted by the tension roller 28 is effective at increasing the contacting force of the garniture tape 10 with respect

to the outer circumferential surface of the driving drum 12. In a case that the operation speed of the forming apparatus 4 is further increased, however, an allowable increase of the tension of the garniture tape 10 is limited.

This makes it difficult to gain the contacting force required in the garniture tape 10 simply by using the tension of garniture tape 10.

[0047] In this view, the presser unit 32 is capable of strengthening the contacting force between the garniture tape 10 and the driving drum 12 without increasing the tension of the garniture tape 10 and then capable of effectively preventing a slip of the garniture tape 10 against the outer circumferential surface of the driving drum 12.

[0048] Since the contacting force of the garniture tape 10 is increased by the presser unit 32, it is possible, in proportion as the increase of the contacting force, to reduce the tension of the garniture tape 10 which is exerted by the tension roller 28.

[0049] According to verification conducted by inventors of the present invention, the tension (running load) applied to the garniture tape 10 is rapidly increased in a zone between the lower forming guide 18 and the wrapping section 8 in the running path of the garniture tape 10. Outside of this zone, the tension of the garniture tape 10 is decreased. If the tension of the garniture tape 10 which is exerted by the tension roller 28 is increased, relative to this increase, the tension of the garniture tape 10 in the above-mentioned zone is also heightened.

[0050] Tension fluctuation of the garniture tape 10 applies great repeated load to a material (aramid fibers or the like) of the garniture tape 10, thereby causing wear and tear of the garniture tape 10 at an early stage. If the repeated load, or tension fluctuation, of the garniture tape 10 is lessened, a fatigue limit of the garniture tape 10, shown by an S-N curving line, is raised, which increases the service life of the garniture tape 10.

[0051] As a result, the presser unit 32 strengthens the contacting force of the garniture tape 10 with respect to the outer circumferential surface of the driving drum 12, and in proportion as the contacting force strengthened, the tension required in the garniture tape 10 is decreased. Therefore, the tension of the garniture tape 10 which is exerted by the tension roller 28 is reduced, so that the tension fluctuation of the garniture tape 10 is suppressed during the travel of the garniture tape 10. This causes elongation of the service life of the garniture tape 10.

[0052] In this regard, the inventors confirmed that when the forming apparatus 4 of the present embodiment comprising the presser unit 32 is compared with a conventional forming apparatus without the presser unit 32 in terms of the service life of the garniture tape 10, the forming apparatus 4 of the present embodiment provides more service life of the garniture tape 10 than the conventional forming apparatus.

[0053] FIG. 5 shows a presser belt unit 50 that can be replaced by the presser unit 32.

[0054] The presser belt unit 50 comprises an endless presser belt 52. The presser belt 52 presses the garniture tape 10 against the outer circumferential surface of the driving drum 12 in the wrapping contact area. More specifically, the presser belt unit 50 includes two guide rollers 54 and 55 for guiding the travel of the presser belt 52, the guide rollers 54 and 55 being rotatably supported by the respective roller shafts. The roller shafts are fixed to the frame of the forming apparatus 4. Referring to FIG. 5, the guide roller 54 is located on the left of the driving drum 12, and the guide roller 55 under the driving drum 12.

[0055] The presser belt unit 50 further includes a tension roller 56 for guiding the travel of the presser belt 52, the tension roller 56 being located on the right of the driving drum 12. A part of the presser belt 52, which is located between the guide roller 54 and the tension roller 56, is wound around the driving drum 12 through the garniture tape 10.

[0056] The tension roller 56 is rotatably supported by a roller shaft, which is connected to an actuator 58. The actuator 58 includes an air cylinder, for example. Once driven, the actuator 58 can push up the roller shaft of the tension roller 56. In result, the tension roller 56 is moved from a rest position shown by a chain double-dashed line of FIG. 5 to a working position located above. In the working position, the tension roller 56 presses the presser belt 52 against the outer circumferential surface of the driving drum 12 through the garniture tape 10, to thereby increase the contacting force of the garniture tape 10 against the outer circumferential surface of the driving drum 12.

[0057] In addition, the air cylinder 58 may be displaced by an actuator using hydraulic pressure or solenoid.

[0058] FIG. 6 shows the driving drum 12 having the function of the presser unit 32 or the presser belt unit 50. In this case, the driving drum 12 is a suction drum and has an outer circumference formed as a suction face 12s. A suction area S of the suction face 12s may extend over the whole wrapping contact area of the garniture tape 10 or may extend over a part of the wrapping contact area, in view of the circumferential direction of the driving drum 12. Furthermore, in the wrapping contact area, the suction area S may be divided in the circumferential direction of the driving drum 12.

[0059] The driving drum 12 shown in FIG. 6 sucks the garniture tape 10 on the suction face thereof, and this results in an increase in the contacting force of the garniture tape 10 with respect to the outer circumferential surface of the driving drum 12.

[0060] Either the presser belt unit 50 or the suction drum 12, instead of the presser unit 32, can decrease the tension of the garniture tape 10 while preventing a slip of the garniture tape 10. Consequently, the tension fluctuation of the garniture tape 10 is suppressed, and the service life of the garniture tape 10 can be elongated.

[0061] In the forming apparatus 4, various modifica-

tions for lessening the running resistance of the garniture tape 10 can be added, and these modifications will be described below.

[0062] FIGS. 7 and 8 concretely show the lower forming guide 18. The lower forming guide 18 includes two half guides 60 and 62, which are located at the respective sides of the running path of the garniture tape 10. The half guides 60 and 62 define a forming groove 63 therebetween. The forming groove 63 has a guide face 64 for guiding a back surface of the garniture tape 10, the guide face 64 being formed of a bottom face and both inner side surfaces of the forming groove 63.

[0063] The half guides 60 and 62 are separated from each other at a prescribed distance, and there is a slit 61 in the bottom of the forming groove 63. The slit 61 extends in the running direction of the garniture tape 10. In the slit 61, there are disposed a large number of spacers 65 so as not to protrude from the bottom of the forming groove 63. The spacers 65 are arranged in a row at intervals in the running direction of the garniture tape 10. The half guides 60 and 62 are connected to each other with bolts, not shown, with the spacers 65 therebetween.

[0064] Furthermore, a plurality of rollers 66 are accommodated in the lower forming guide 18, the rollers 67 being arranged alternately with the spacers 65. A part of an outer circumference of each roller 66 is located in the slit 61 to form a part of the bottom of the forming groove 63.

[0065] More specifically, as illustrated in FIG. 8, the half guides 60 and 62 have recessed portions 70 and 72 in corresponding surfaces thereof faced to each other through the slit 61. The recessed portions 70 and 72 define an accommodation chamber 67 for the corresponding roller 66. Housed in the accommodation chamber 67 is a boss 68 of the roller 66, and the boss 68 protrudes on both sides of the roller 66.

[0066] The boss 68 of the roller 66 is rotatably supported by a roller shaft 74 through a pair of bearings 76, and both ends of the roller shaft 74 project on both sides of the boss 68. In the bottoms of the recessed portions 70 and 72, there are formed respective guide holes 69, in which the corresponding ends of the roller shaft 74 are slidably received.

[0067] Flanges 78 and 80 are formed in the roller shaft 74. The flanges 78 and 80 are located on both sides of the boss 68 to sandwich the boss 68 of the roller 66 therebetween. The flange 78 is in contact with the bottom of the recessed portion 70, and a coned disc spring 82 is located between the flange 80 and the bottom of the recessed portion 72. The coned disc spring 82 surrounds the roller shaft 74 and urges the roller shaft 74 toward the recessed portion 70 through the flange 80. Accordingly, the flange 78 is pressed against the bottom of the recessed portion 70, and the roller 66 is accurately positioned in relation to the slit 61, thereby making rotations without contacting the half guides 60 and 62. Additionally, a coil spring may be utilized in place of the

coned disc spring 82.

[0068] When the garniture tape 10 passes through the lower forming guide 18, the travel of the garniture tape 10 is guided by the forming groove 63, that is, the guide face 64 thereof. At this time, the shredded tobacco layer T is compression-molded as mentioned above, so that the shredded tobacco layer T strongly compresses the garniture tape 10 onto the guide face 64 through the paper web P. Therefore, the running resistance of the garniture tape 10 is notably increased especially in the lower forming guide 18.

[0069] However, since a part of the bottom of the forming groove 63 in the lower forming guide 18 is formed of the rollers 66, the running resistance of the garniture tape 10 is decreased. Consequently, the tension fluctuation of the garniture tape 10 is suppressed.

[0070] FIG. 9 concretely shows the above-mentioned tape guide's 24 serving in pairs.

[0071] The tape guides 24 have respective surfaces faced to each other and given a wavy shape. Crests of waves of the wavy surfaces 24a are directed downstream, in view of the running direction of the garniture tape 10.

[0072] Each tape guide 24 has three guide rollers 86 in a terminal end portion thereof, and the guide rollers 86 are arranged at intervals in the running direction of the garniture tape 10. Specifically, three recessed portions 88 are formed in each tape guide 24, and the guide rollers 86 are received in the recessed portions 88 in a horizontal posture. Each guide roller 86 is rotatably supported by a roller shaft, and the roller shaft of the guide roller 86 is fixed to a bracket 90. The brackets 90 are fitted to the tape guides 24. An outer circumferential surface of the guide roller 86 guides the travel of the garniture tape 10 outside the recessed portion 88 while in rotational contact with the garniture tape 10.

[0073] The wavy surfaces 24a of the tape guides 24 have small contact areas that contact both side edges of the garniture tape 10, and this decreases the friction and running resistance of the garniture tape 10.

[0074] After passing through the tape guides 24, the garniture tape 10 is recovered from the U-like shape to a flat shape while guided by a recovery guide 96. In this process, both side edges of the garniture tape 10 are strongly pressed on the terminal end portions of the tape guides 24. Since the guide rollers 86 are located in the terminal end portions of the tape guides 24, however, the garniture tape 10 can exit smoothly from the tape guides 24. Therefore, the friction of the garniture tape 10 is decreased.

[0075] FIG. 10 shows a part of the forming bed 17.

[0076] The forming bed 17 has a guide groove 92, which is formed into a semicircular shape in section. A great number of dimples 94 are formed in an inner surface of the guide groove 92. The dimples 94 are distributed in the inner surface of the guide groove 92 in the form of a matrix.

[0077] Each dimple 94 has a pore size falling in the

range of from approximately 0.5 mm to 1.0 mm and a depth in the range of from approximately 0.1 mm to 0.5 mm. The dimples 94 have no adverse affect on the travel of the garniture tape 10, namely the forming of the tobacco rod R. The dimples 94 can be formed by means of an electrical discharge machine or the like, for example.

[0078] Since the guide groove 92 of the forming bed 17 has a large number of dimples 94, the friction and running resistance of the garniture tape 10 are decreased. Accordingly, the tension fluctuation of the garniture tape 10 is suppressed, and the service life of the garniture tape 10 is increased.

[0079] The dimples 94 may be irregularly distributed in the inner surface of the guide groove 92. It is also possible that the guide groove 92 have the inner surface subjected to sandblast, in place of the dimples 94.

[0080] As described above, the forming apparatus 4 is capable of reducing the tension required in the garniture tape 10 and the running resistance of the garniture tape 10. Therefore, it is possible not only to elongate the service life of the garniture tape 10 but also to prevent damage to the garniture tape 10, which is attributable to abrasion, or more specifically, tears caused in both side edges of the garniture tape 10.

[0081] The present invention is not limited to the above embodiment and may be modified in various ways. For instance, the presser unit 32, the presser belt 52 and the suction drum 12 may be used in arbitrary combination.

Claims

1. A rod-like article forming apparatus comprising a supplying section for supplying a filling material and a wrapping section for wrapping the filling material supplied from said supplying section in a paper web to form the filling material into a rod-like article; wherein

said wrapping section includes:

an endless garniture tape used for forming the rod-like article and having a forward portion that extends through said wrapping section and receives the paper web with the filling material and a backward portion continuing to said forward portion,

a rotatable driving drum that causes said garniture tape to travel in one direction and has a wrapping contact area in which said backward portion of said garniture tape is wound around an outer circumferential surface of said driving drum,

a tensioner for applying tension to said garniture tape; and

a presser device for pressing said backward portion of said garniture tape against the outer

circumferential surface of said driving drum in said wrapping contact area of said driving drum.

2. The forming apparatus according to claim 1, wherein

said presser device includes:

a pressing member for sandwiching said backward portion of said garniture tape between the outer circumferential surface of said driving drum and said pressing member; and driving means for pressing said pressing member toward the outer circumferential surface of said driving drum.

3. The forming apparatus according to claim 2, wherein

said pressing member has a plurality of presser rollers arranged along the outer circumferential surface of said driving drum; and said presser rollers are in rotational contact with said backward portion of said garniture tape.

4. The forming apparatus according to claim 3, wherein

said wrapping section further includes:

a guide path for guiding said forward portion of said garniture tape; and a reduction device for reducing friction resistance that generates between said guide path and said forward path portion of said garniture tape.

5. The forming apparatus according to claim 2, wherein

said pressing member has an endless presser belt wound around said winding area of said driving drum through said garniture tape; and said presser belt travels in conjunction with said backward path portion of said garniture tape.

6. The forming apparatus according to claim 5, wherein

said wrapping section further includes:

a guide path for guiding said forward path portion of said garniture tape; and a reduction device for reducing friction resistance that generates between said guide path and said forward portion of said garniture tape.

7. The forming apparatus according to claim 1, wherein

said presser device has a suction face formed in the outer circumferential surface of said driving drum; and said suction face sucks said backward

portion of said garniture tape in said wrapping contact area.

8. The forming apparatus according to claim 7, wherein

said wrapping section further includes:

a guide path for guiding said forward portion of said garniture tape; and a reduction device for reducing friction resistance that generates between said guide path and said forward path portion of said garniture tape.

FIG. 1

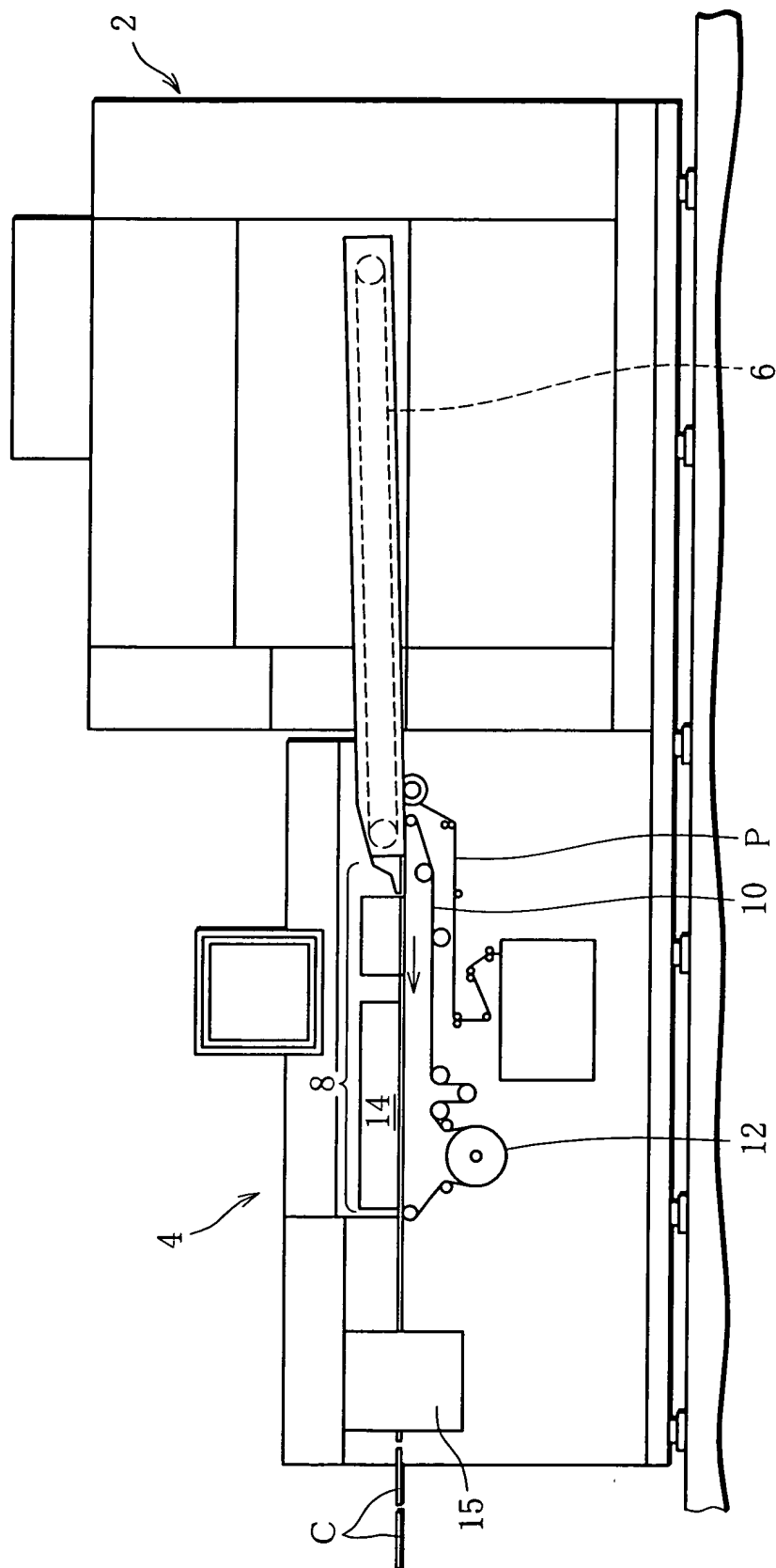


FIG. 2

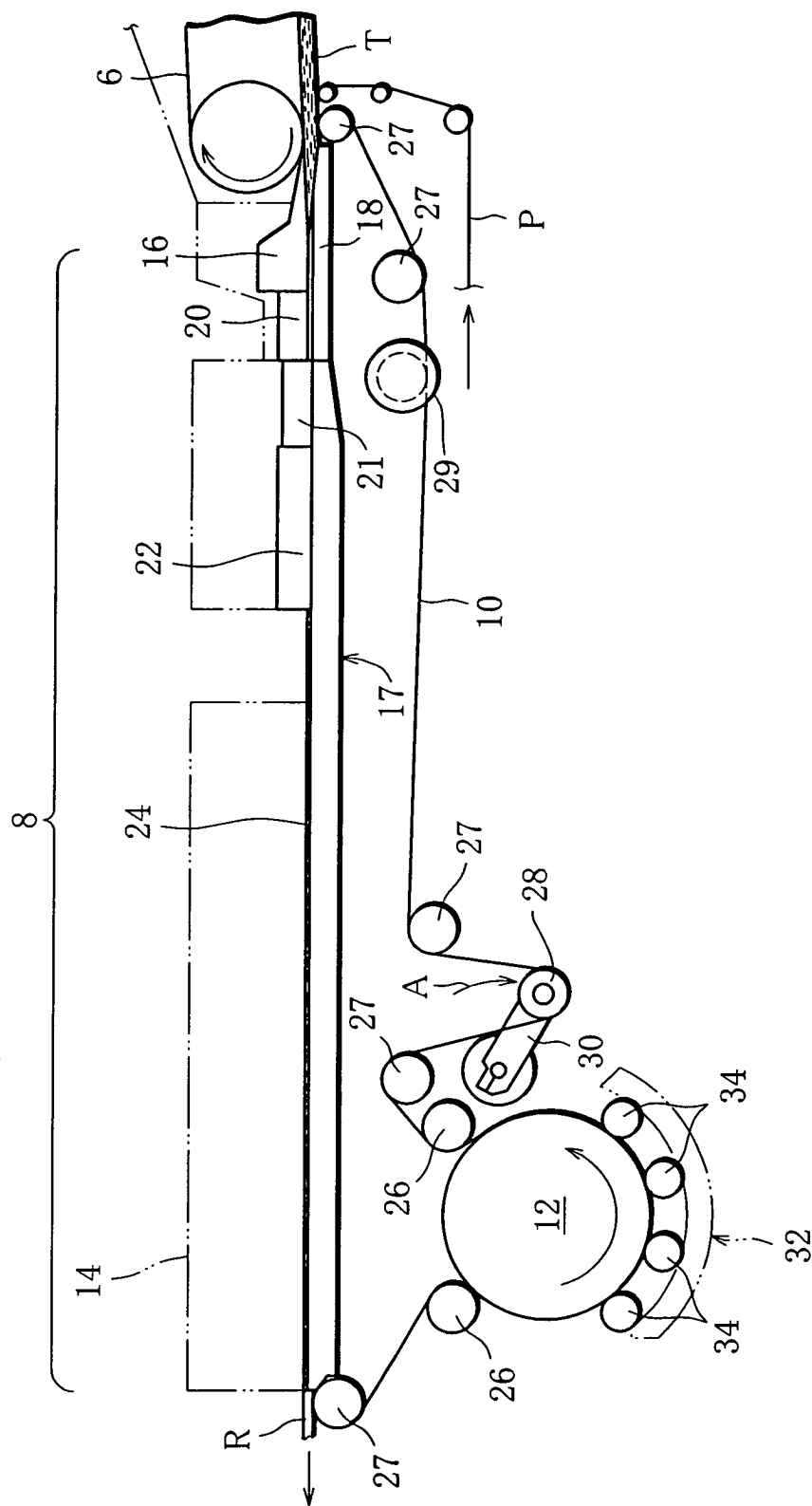


FIG. 3

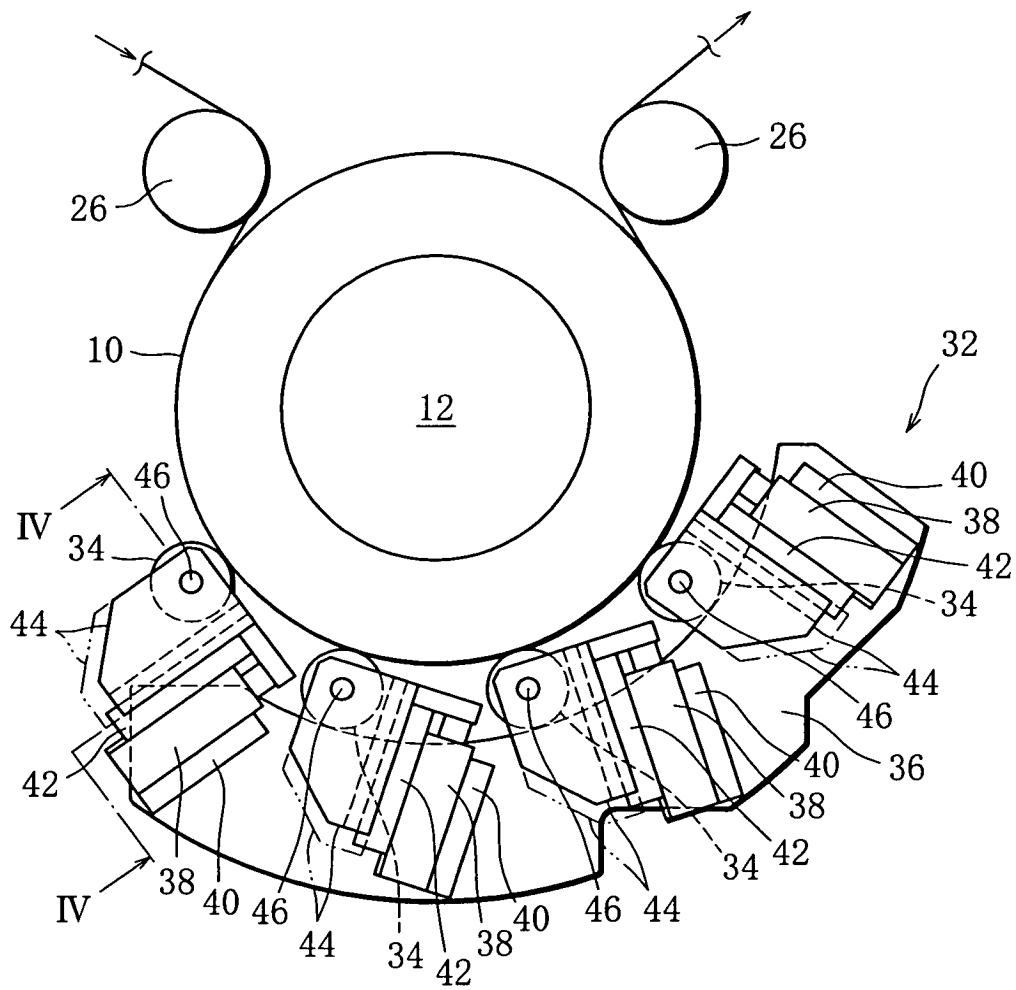


FIG. 4

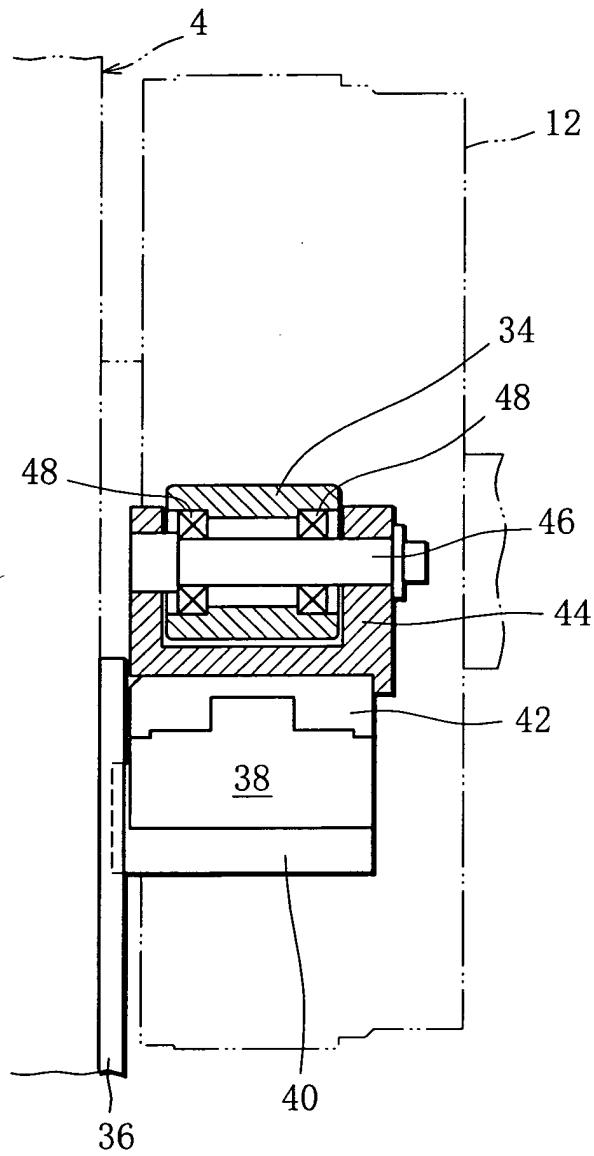


FIG. 5

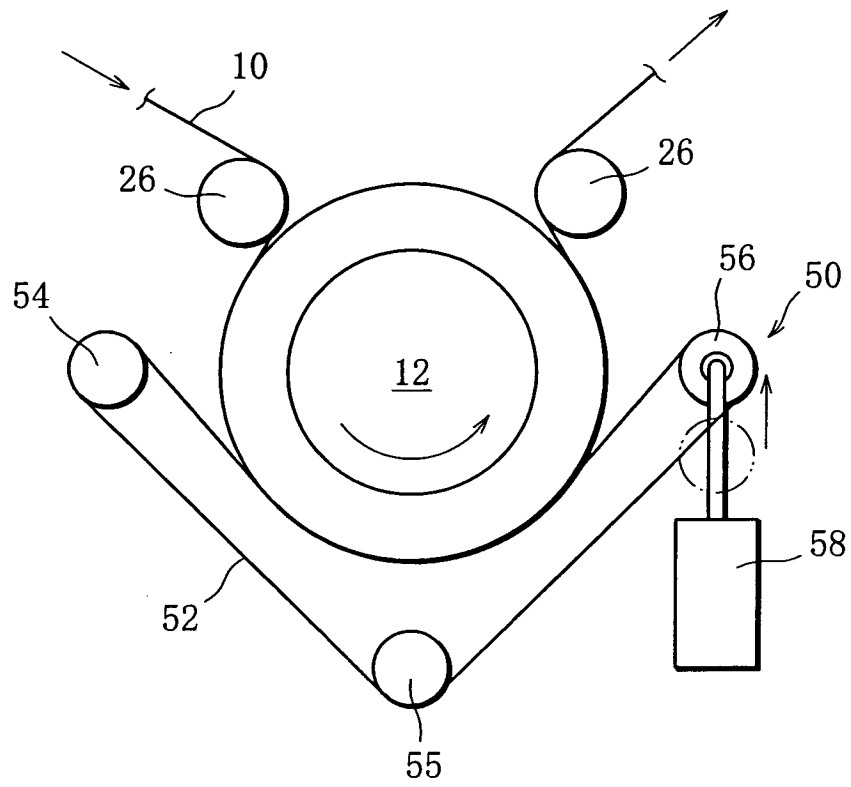


FIG. 6

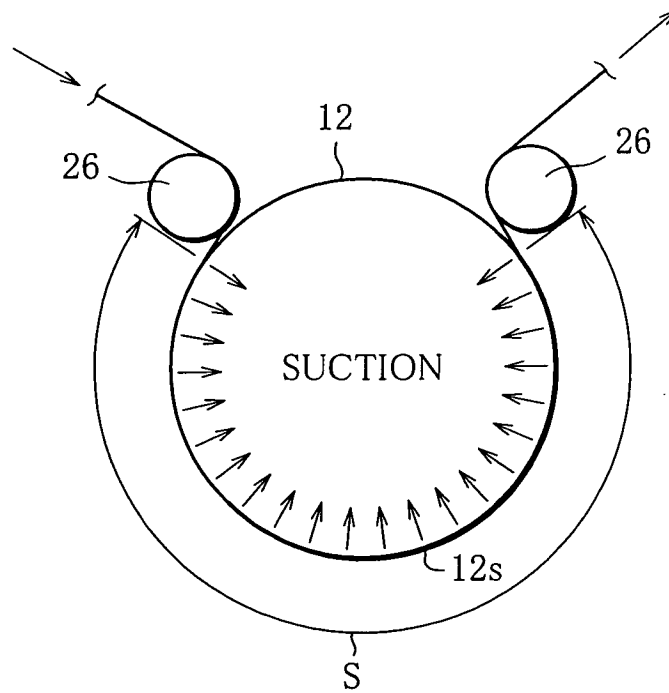


FIG. 7

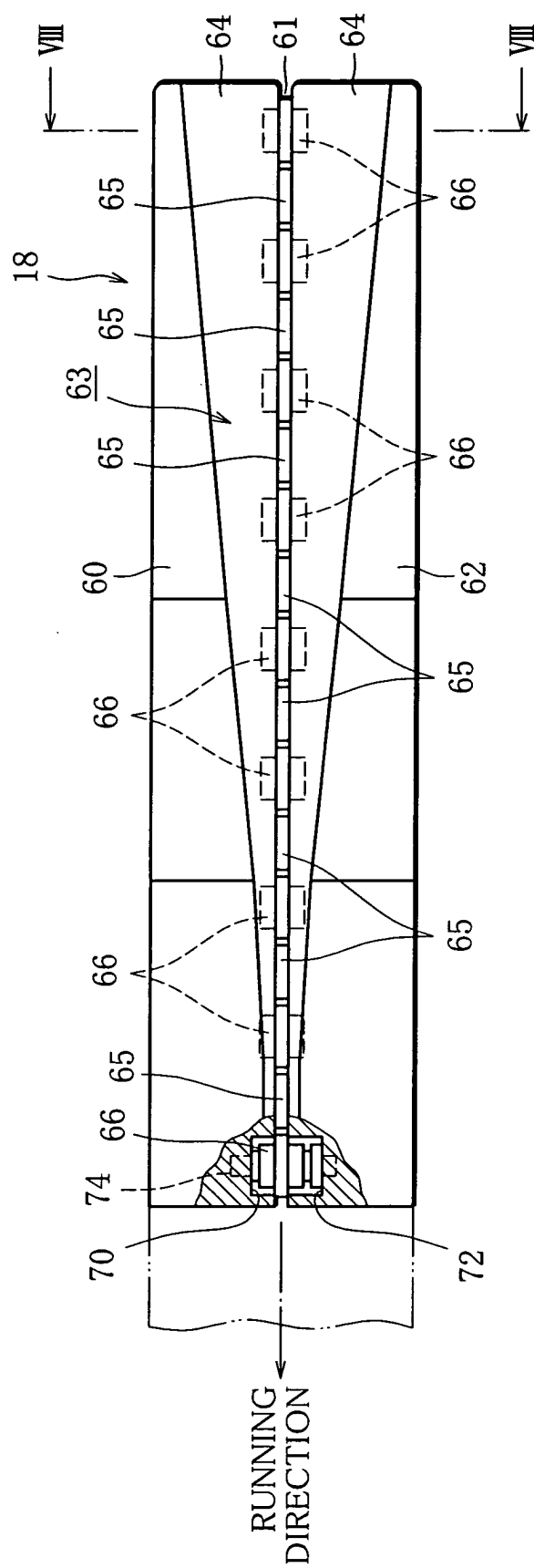


FIG. 8

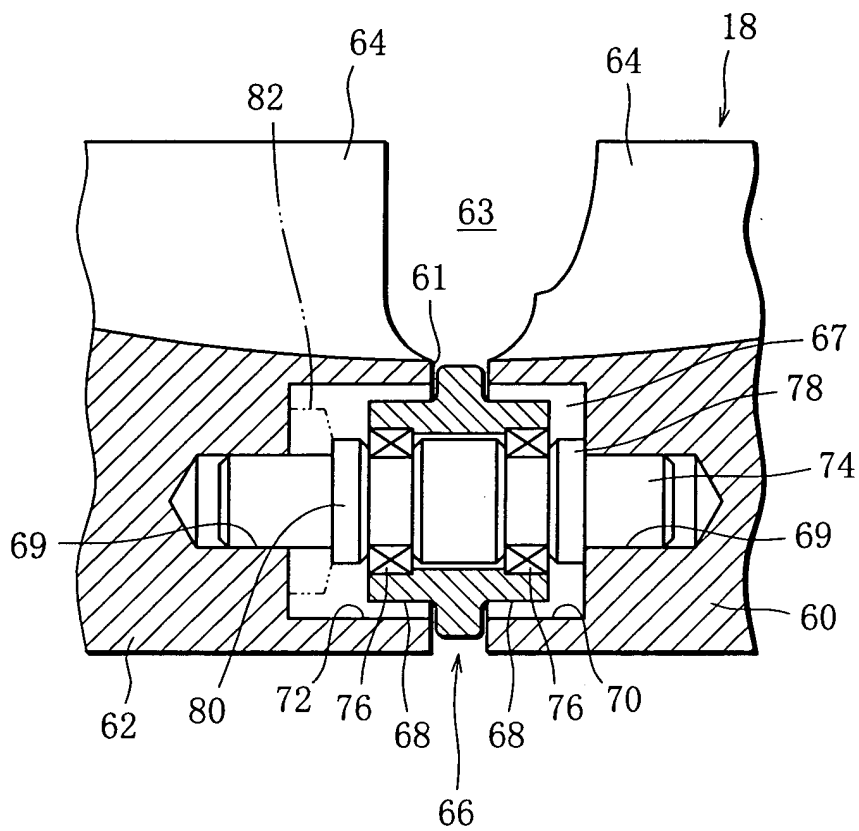


FIG. 9

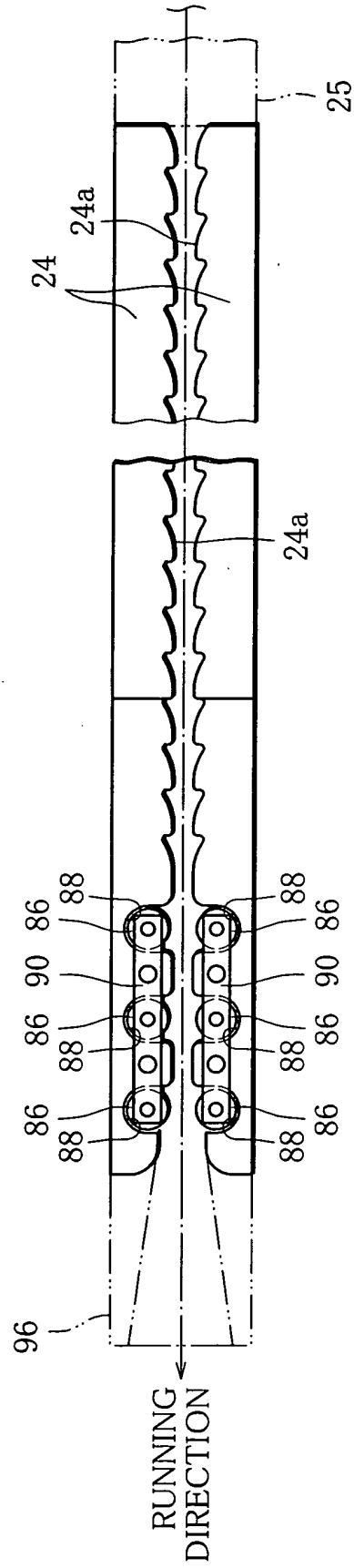
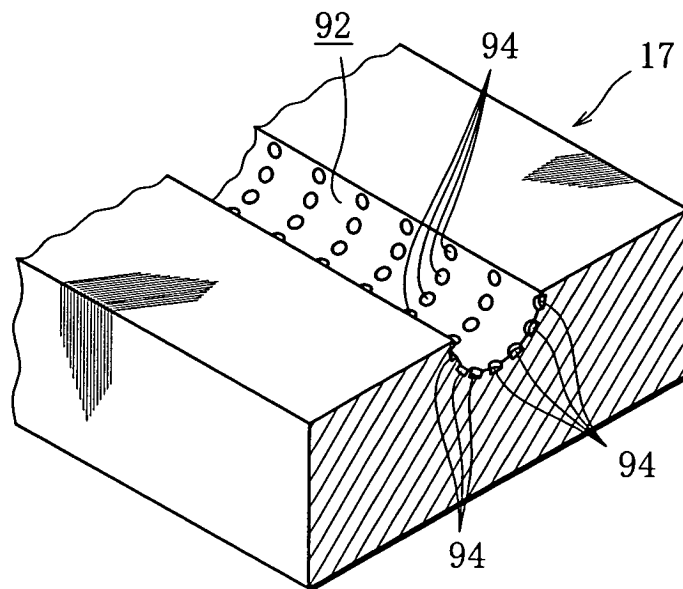


FIG. 10



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP03/04993

A. CLASSIFICATION OF SUBJECT MATTER Int.Cl. ⁷ A24C5/18		
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) Int.Cl. ⁷ A24C5/14, 5/18, F16H7/00-7/24		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Jitsuyo Shinan Koho 1926-1996 Toroku Jitsuyo Shinan Koho 1994-2003 Kokai Jitsuyo Shinan Koho 1971-2003 Jitsuyo Shinan Toroku Koho 1996-2003		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y A	JP 8-214854 A (Japan Tobacco Inc.), 27 August, 1996 (27.08.96), & DE 69612679 D & EP 726031 A1 & US 5615693 A1	1-6 7-8
Y	JP 58-109753 A (Nitta Belting Co., Ltd.), 30 June, 1983 (30.06.83), & FR 2518682 A & DE 3223370 A & GB 2112103 A & US 4571220 A1 & IT 1190883 B & CH 664609 A	1-6
Y	JP 11-69964 A (Focke & Co.), 16 March, 1999 (16.03.99), & DE 59801920 D & EP 879564 A1 & CN 1201627 A & BR 9801667 A & US 6152145 A1	4, 6
☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.		
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search 26 May, 2003 (26.05.03)		Date of mailing of the international search report 10 June, 2003 (10.06.03)
Name and mailing address of the ISA/ Japanese Patent Office		Authorized officer
Facsimile No.		Telephone No.

Form PCT/ISA/210 (second sheet) (July 1998)

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP03/04993

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4033360 A (PHILIP MORRIS INC.), 05 July, 1977 (05.07.77), & DE 2654821 A & CH 612330 A & GB 1568972 A	1-8

Form PCT/ISA/210 (continuation of second sheet) (July 1998)