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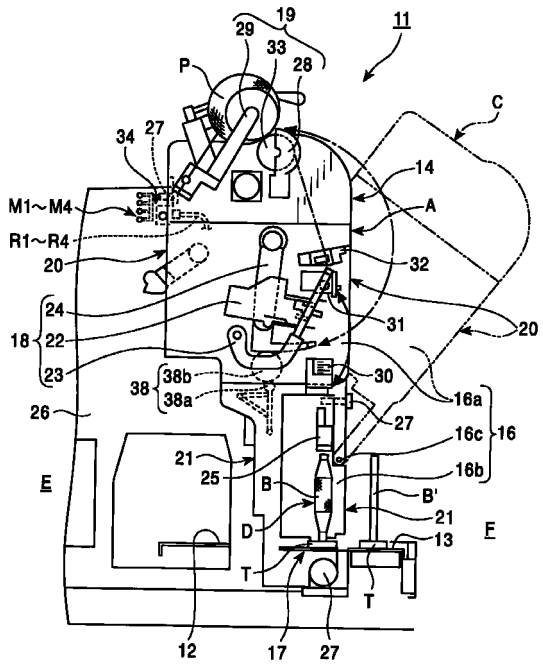
(54) Automatic winder and its winding unit

(57) The present invention provides an automatic winder that eliminates the need to attach and remove a tray guide, as required in the prior art, and that can increase a tilting angle of a standing frame. The automatic winder has winding units 14 each comprising a bobbin supply and ejection device 17, a yarn joining device 18, and a winding device 19. The winding unit 14 is divided into a lower part 21 including the bobbin supply and ejection device 17 and an upper part 20 including the yarn joining device 18 and the winding device 19. The upper part 20 can be tilted from a winding position A where it is stood up to a tilted position C where it is tilted toward an operation passage side F.

FIG. 1



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Description

Field of the Invention

[0001] The present invention relates to improvements of an automatic winder for winding a yarn unwound from a supply bobbin into a package and its winding unit.

Background of the Invention

[0002] A conventional automatic winder comprises a plurality of winding units 4 arranged in a lateral direction corresponding to a conveyor conveying direction, between a supply bobbin conveyor 2 on a rear side E and an empty bobbin conveyor 3 on a front side F (an operation passage side), as shown in the side view in Figure 12. Each winding unit 4 has a standing frame 6 supported tiltably on an underlying support pipe 5 and has a bobbin supply and ejection device 7, a yarn joining device 8, and a winding device 9 attached on the standing frame 6. The standing frame 6 can be tilted between a winding position A where it is stood up and a tilted position C where it is tilted toward an operation passage side for maintenance and inspection. Each winding unit 4 stops a supply bobbin B supplied from the supply bobbin conveyor 2, at an unwinding position D and then uses a winding device 9 to lift a yarn unwound from the supply bobbin B so as to form a package P. The winding unit 4 is also configured so that the yarn joining device 8 joins ends of a yarn cut to remove a yarn defect and so that the bobbin supply and ejection device 7 ejects an empty bobbin B' to the empty bobbin conveyor 3.

[0003] The conventional winding unit 4 is assembled by an operator by attaching, to the single standing frame 6, parts constituting the bobbin supply and ejection device 7, the yarn joining device 8, and the winding device 9. Since, however, the large number of parts cannot substantially be simultaneously attached to the single standing frame 6, the assembly requires the parts to be sequentially attached, thereby increasing an assembly man hour. Furthermore, the winding unit 4 may require different parts depending on different specifications for a yarn or the like, thereby requiring a large amount of time and labor to select parts. Thus, there has been a demand for a reduction in assembly man hour.

[0004] In the automatic winder 1 comprising the plurality of winding units 4 arranged between the supply bobbin conveyor 2 and the empty bobbin conveyor 3, to inspect an arbitrary winding unit 4 for maintenance while maintaining the operation of the other winding units 4, a tray guide (not shown in the drawings) aist be attached instead of the bobbin supply and ejection device 7 tilted with the standing frame 6 for inspection and maintenance. Attachment and removal of the tray guide requires a large amount of time and labor. However, the frequency of maintenance and inspection differs between the bobbin supply and ejection device 7 and the yarn joining device 8 and the winding device 9 and is higher with the yarn joining device 8 and the winding device 9. Thus, there has been a demand for the capability of moving the yarn joining device 8 and/or the winding device 9 to the maintenance and inspection position without the need to move the bobbin supply and ejection device 7.

[0005] It is thus a first object of the present invention to meet the above described demands by providing a winding unit for an automatic winder which enables a yarn joining device and a winding device to be individually assembled to reduce man hour, and a second object to provide a winding unit for an automatic winder which can be easily inspected for maintenance.

Summary of the Invention

[0006] Means employed by the present invention to facilitate inspection of a winding unit for maintenance is an automatic winder having a plurality of winding units, and each winding unit comprising a bobbin supply and ejection device, a yarn joining device, and a winding device, wherein the winding unit is divided into a lower part including the bobbin supply and ejection device and an upper part including the yarn joining device and winding device and can be tilted between a winding position where the upper part is stood up and a tilted position where the upper part is tilted toward an operation passage side. To increase a tilting angle of the upper part to facilitate maintenance and inspection, a tilting center of the upper part may be located above the bobbin supply and ejection device. Furthermore, to facilitate handling of the winding unit, the upper part may be pivoted to the lower part.

[0007] According to the present invention, by tilting the upper part from the winding position to the tilted position without the need to move the lower part having the bobbin supply and ejection device, which is not frequently inspected for maintenance, the yarn joining device and the winding device, which are often inspected for maintenance, can be moved to a position where they can be easily inspected for maintenance. If the tilting center of the upper part is set above the bobbin supply and ejection device, it is higher than that of the conventional automatic winder, so that an angle through which the upper part can be tilted without hindering empty bobbins from being conveyed by the empty bobbin conveyor on the operation passage side can be increased above the tilting angle of the conventional automatic winder. Consequently, a winding unit to be inspected for maintenance can be drawn out further toward the operation passage. If the upper part is pivoted to the lower part, the lower and upper parts can be integrally handled.

[0008] Means employed by the present invention to operate when a pneumatic path provided between a

base on which winding units are mounted and the tilting upper part is separated into two to tilt the upper part, to prevent pneumatic paths in other winding units from being affected by variations in pressure is an automatic winder, wherein one of a plurality of pneumatic paths with closing valves is provided in a base on which winding units are attached, the upper part includes a plurality of pneumatic pipes constituting the other pneumatic path, and a corresponding end of the other pneumatic path can be removably joined to an end of the one pneumatic path. To enable the plurality of closing valves to be easily opened and closed, a valve operating member may be provided for simultaneously opening and closing the plurality of closing valves. In addition, to enable the other pneumatic pipe to be easily attached and removed, the other pneumatic pipe may be flexible.

[0009] According to the present invention, by mutually separating the pneumatic paths with the closing valves closed, the upper part can be tilted with the other pneumatic pipe while preventing pneumatic paths in other winding units from being affected by variations in pressure. With the above described valve operating member, it can be operated to simultaneously open and close the plurality of closing valves.

[0010] Means employed by the present invention to omit a conventional operation for manually removing empty bobbins conveyed by the empty bobbin conveyor disposed on the operation passage side is an automatic winder, wherein the tilted position is a position where the tilted upper part is not hindered empty bobbins from being conveyed by an empty bobbin conveyor disposed on the operation passage side.

[0011] According to this invention, the upper part, when stopped at the tilted position, does not hinder empty bobbins from being conveyed by the empty bobbin conveyor.

[0012] Means employed by the present invention to enable transmission between the lower and upper parts is an automatic winder, wherein one of a driving node and a driven node of a transmission mechanism is located in the lower part while the other is located in the upper part, and the driving and driven nodes are connected together when the upper part is located at the winding position and are mutually separated when the upper part is located at the tilted position. To simplify the transmission mechanism, the driving node is formed of a cam, while the driven node is formed of a cam lever.

[0013] According to this invention, when the upper part is located at the winding position, the nodes of the transmission mechanism are connected together to transmit power between the lower and upper parts. Alternatively, when the upper part is tilted toward the tilted position, the nodes of the transmission mechanism are mutually separated, the tilt of the upper part is affected by the transmission mechanism.

[0014] Means employed by the present invention to enable the yarn joining device and the winding device to be individually assembled is a winding unit for an automatic winder comprising a bobbin supply and ejection device, a yarn joining device, and a winding device all in a frame, wherein the frame can be divided into a frame lower part including the bobbin supply and ejection device, a frame intermediate part including the yarn joining device, and a frame upper part including the winding device.

[0015] According to this invention, the frame can be separated into the frame lower part, the frame intermediate part and the frame upper part, so that the frame lower part, the frame intermediate part and the frame upper part can be individually assembled by, for example, attaching parts together.

[0016] Means employed by the present invention to enable the bobbin supply and ejection device, the yarn joining device, and the winding device to be integrally moved from the winding operation position to the maintenance and inspection position is a winding unit for an automatic winder, wherein the frame lower part, the frame intermediate part and the frame upper part are integrally connected together and the frame lower part is movably connected to a fixed portion so that the integrated frame parts can be moved from a winding operation position to a maintenance and inspection position.

[0017] According to this invention, by moving the frame lower part, a frame comprising the frame lower part, frame intermediate part and frame upper part integrated together can be moved from the winding operation position to the maintenance and inspection position.

[0018] Means employed by the present invention to enable the yarn joining device and the winding device to be integrally moved to the maintenance and inspection position is a winding unit for an automatic winder, wherein the frame intermediate part is movably connected to the frame lower part so that the frame intermediate part and the frame upper part can be moved from the winding operation position to the maintenance and inspection position.

[0019] According to this invention, by moving the frame intermediate position without the need to move the frame lower part, the frame upper part including the winding device can be moved from the winding operation position to the maintenance and inspection position together with the frame intermediate part including the yarn joining device.

[0020] Means employed by the present invention to enable the yarn joining device and the winding device to be integrally moved to the maintenance and inspection position is a winding unit for an automatic winder, wherein the frame lower part is fixed, the frame intermediate part and the frame upper part are integrally connected together, and the frame intermediate part is movably connected to the fixed portion so that the frame intermediate part can be moved from the winding operation position to the maintenance and inspection position.

[0021] According to this invention, by moving the

frame intermediate position, the frame upper part including the winding device can be moved from the winding operation position to the maintenance and inspection position together with the frame intermediate part including the yarn joining device.

[0022] Means employed by the present invention to enable the winding device to be independently moved to the maintenance and inspection position is a winding unit for an automatic winder, wherein the frame upper part is movably connected to the frame intermediate part so that the frame upper part alone can be moved from the winding operation position to the maintenance and inspection position.

[0023] According to this invention, by moving the frame intermediate position, the frame upper part including the winding device can be independently moved from the winding operation position to the maintenance and inspection position.

[0024] To simplify the above described structure for movable connections, the two parts may be connected together using pins so as to enable inclination from the winding operation position to the maintenance and inspection position. In addition, one or all of the frame lower part, frame intermediate part and frame upper part are formed of a synthetic resin material and adjacent frame sections are bolted together, a boss section through which the bolt is inserted may be joined to a side plate of the frame using ribs so that the bolts serve to distribute and reduce stress occurring in the boss section. Furthermore, the assembly man hour can be further reduced by grouping wiring or piping parts and transmission parts into different blocks for incorporation.

Brief Description of the Drawing

[0025]

Figure 1 is a left side view of a first embodiment of an automatic winder according to the present invention, showing an integral part of the automatic winder.

Figure 2 is a front view showing a winding unit constituting the automatic winder according to this embodiment.

Figure 3 is an enlarged perspective view showing a neighborhood of a piping joining member including closing valves according to this embodiment.

Figure 4 is a left side view of a second embodiment of a winding unit according to the present invention, showing an automatic winder incorporating a plurality of present winding units arranged in parallel.

Figure 5 is a front view of the present winding unit according to this embodiment.

Figure 6 is an enlarged sectional view taken along line VI-VI in Figure 4.

Figure 7 is an enlarged sectional view taken along line VII-VII in Figure 4.

Figure 8 is a sectional view showing how a transmission mechanism is mounted on a frame of the present winding unit according to this embodiment.

Figure 9 is a left side view of a third embodiment of the present winding unit, showing an automatic winder incorporating the present winding unit.

Figure 10 is a left side view of a fourth embodiment of the present winding unit, showing an automatic winder incorporating the present winding unit.

Figure 11 is a left side view of a fifth embodiment of the present winding unit, showing an automatic winder incorporating the present winding unit.

Figure 12 is a left side view showing an automatic winder conventional winding unit.

Detailed Description of the Preferred Embodiments

[0026] An automatic winder according to the present invention (hereafter referred to as the "present automatic winder") will be described below based on the embodiments shown in the drawings.

[0027] An automatic winder 11 according to this embodiment comprises a plurality of winding units 4 arranged in a lateral direction corresponding to a conveyor conveying direction between a supply bobbin conveyor 12 on a rear side E and an empty bobbin conveyor 13 on a front side F (an operation passage side) as shown in Figure 1. Improvements of the present automatic winder 11 lie in each of the winding units 4; the winding unit 4 is divided into a lower part 21 having a bobbin supply and ejection device 12, and an upper part 20 having a yarn joining device 18 and a winding device 19, and the upper part 20 can be tilted between a winding position A where it is stood up and a tilted position C where it is tilted toward the operation passage side. The tilted position C is a position where the upper part 20 does not hinder the empty bobbin B' from being conveyed by the empty bobbin conveyor 13.

[0028] A standing frame 16 constituting the winding unit 14 is divided into an upper portion 16a forming the upper part 20 and a lower portion 16b forming the lower part 21, and a lower end of the upper portion 16a is pivoted to a generally intermediate position at a front side of the lower portion 16b, as shown in Figures 1 and 2. The standing frame 16 has the lower portion 16b detachablly fixed and located to a base section 26, and the upper part 20, while standing at the winding position A, is connected to the base section 26 in the neighbor-

hood of a top and a bottom thereof using connection members 27, 27 such as a bolt. To tilt the upper part 20 from the winding position A to the tilted position C, the connection members 27, 27 are released.

[0029] A bobbin supply and ejection device 17 provided in the lower part 21 comprises a guide (not shown in the drawings) including a passage formed between a plurality of plates to allow a tray T supporting a supply bobbin B thereon to pass through the passage, and a feeding mechanism comprising a lever and/or a cam or the like for intermittently moving the tray T. The feeding mechanism stops, at an unwinding position D, the supply bobbin B supplied from the supply bobbin conveyor 12 and ejects the empty bobbin B' onto the empty bobbin conveyor 13. In addition to the bobbin supply and ejection device 17, the lower part 21 comprises a balloon controller 25 that moves upward and downward depending on the amount of yarn on the supply bobbin B so that the balloon controller 25 controls a balloon formed of the yarn unwound from the supply bobbin B, to stabilize yarn tension.

[0030] The yarn joining device 18 provided in the upper part 20 comprises a suction mouth 24, a relay pipe 23, and a yarn joining main body 22, and is configured so that a suction mouth 24 and a relay pipe 23 for respectively sucking ends of a yarn cut by a cutter (not shown in the drawings) are pivoted to place the upper and lower yarns into the yarn joining main body 22 for joining. The winding device 19 provided in the upper part 20 comprises a traverse drum 33 supported on the upper portion 16a of the standing frame 16 in a cantilever manner, a drum cover 28 having a traverse regulating guide or the like, and a package supporting member 29 for supporting a package P into which the yarn is wound. When the traverse drum 33 of the winding device 19 is driven, the yarn unwound from the supply bobbin B is wound into the package P. In addition to the yarn joining device 18 and the winding device 19, the upper part 20 comprises a tension adjusting device 30 in a bottom portion thereof and a wax applying device 31 and a yarn defect detecting device 32 in an intermediate portion thereof. In this manner, the upper part 20 includes devices frequently inspected for maintenance and other devices. The tension adjusting device 30 adjusts the tension of the yarn unwound from the supply bobbin B into the package P, to a set value. The wax applying device 31 applies a wax to the yarn, and the yarn defect detecting device 32 operates when a defect in the yarn wound into the package is detected, to cut the yarn to remove the defect.

[0031] The winding unit 14 can move and stop the yarn joining device 18 and the winding device 19, which are frequently inspected for maintenance, to and at a position where they are easily inspected for maintenance by tilting only the upper part 20 from the winding position A to the tilted position C without the need to move the lower part 21 having the bobbin supply and ejection device 17 and the balloon controller 25, which are not frequently inspected for maintenance.

[0032] In addition, in the winding unit 14, the upper part 20 is pivoted via a shaft 16c above the bobbin supply and ejection device 17, so that the tilting center of the upper part 20 is higher than that of the conventional automatic winder. Consequently, an angle through which the upper part 20 can be tilted without hindering the empty bobbin B' from being conveyed by the empty bobbin conveyor 13 on the operation passage side F can be increased above the tilting angle of the conventional automatic winder, thereby enabling the winding unit 14 to be drawn out further toward the operation passage side further than in the prior art.

[0033] Furthermore, in the winding unit 14, since the upper portion 16a of the standing frame 16 constituting the upper part 20 is pivoted via a shaft 16c to the lower portion 16b of the standing frame 16 constituting the lower part 21, the lower part 21 and the upper part 20 can be integrally handled to enable the entire winding unit 14 to be easily replaced with a new one.

[0034] Moreover, since the balloon controller 25 is fixed, a cylinder of the balloon controller 25 and the bobbin need not be centered after inspection for maintenance.

[0035] As shown in Figures 1 and 3, the present automatic winder 11 comprises a plurality of pneumatic paths for devices provided in each winding unit 14 and requiring compressed air. The plurality of pneumatic paths comprise one composed of a piping joining member 34 provided in the base 26, and the other composed of a plurality of pneumatic pipes R1 to R4 provided in each winding unit 14. In the upper part 20 of each winding unit 14, an unwinding pneumatic pipe R1 and a twisting pneumatic pipe R2 are extended from the yarn joining device 18, a package contacting and pressing pneumatic pipe R3 is extended from the winding device 19, and a yarn tension adjusting pneumatic pipe R4 is extended from the yarn tension adjusting device 30. In the winding unit 14, an end of each of the pneumatic pipes R1 to R4 can be removably joined via a coupling 35 to a corresponding one of connection ports in the piping joining members 34 because the length of each pneumatic pipe R1 to R4 provided in the tilted upper part 20, which is tilted, must be minimized to make the entire winding unit compact. These pneumatic pipes R1 to R4 are each formed of a flexible pipe for easy attachment and removal.

[0036] The single piping joining member 34 is provided for each winding unit 14, and has branch pipes S1 to S4 connected thereto and branching from main pipes M1 to M4 common to each winding unit 14. The piping joining member 34 comprises a closing piece 36 composed of a spindle valve disc or the like and a valve operating member 37 composed of a lever or the like so that the valve operating member 37 is operated to simultaneously open and close the plurality of pneumatic paths. When the pneumatic pipe R1 to R4 is attached or removed, the piping joining member 34 can

close the closing piece 36 to preclude variations in the pressure in the pneumatic pipes R1 to R4 of the other winding units 14.

[0037] Each winding unit 14 has a transmission mechanism 38 for transmitting power between the lower part 21 and the upper part 20. The transmission mechanism 38 has one 38a of a driving node or a driven node (in the drawings, the driven node) disposed in the lower part 21 and the other 38b (in the drawings, the driving node) disposed in the upper part 20. When the upper part 20 is stood up at the winding position A, the nodes 38a, 38b are connected together for transmission. Alternatively, when the upper part 20 is tilted toward the tilted position C, the nodes 38a, 38b are mutually separated. In the drawings, the driving node, that is, the other node 38b of the transmission mechanism 38 is formed of a cam while the driven node, that is, the one node 38a is formed of a cam lever so as to drive the bobbin supply and ejection device 17 provided in the lower part 21.

[0038] Each winding unit 14 of the automatic winder 11 according to this embodiment uses the bobbin supply and ejection device 17 to guide the supply bobbin B loaded by the supply bobbin conveyer 18, to the predetermined unwinding position D, as shown in Figure 1. The yarn unwound from the supply bobbin B stopped at the unwinding position D is passed through the balloon controller 25, the yarn tension adjusting device 30, the wax applying device 31, and the yarn defect detecting device 32 and wound into the package P, which is rotated by the traverse drum 33. For yarn joining, the suction mouth 24 and the relay pipe 23 for sucking ends of a cut yarn are pivoted to place the upper and lower yarns into the yarn joining main body 22. The empty bobbin B' is ejected onto the empty bobbin conveyor 13 by means of the bobbin supply and ejection device 17.

[0039] Figures 4 to 7 show a second embodiment of a winding unit according to the present invention.

[0040] An automatic winder 111 according to this embodiment comprises a plurality of present winding units 114 arranged in a lateral direction corresponding to a conveyor conveying direction between a supply bobbin conveyor 112 on a rear side E and an empty bobbin conveyor 113 on a front side F (an operation passage side) as shown in Figure 4. An improvement of the present winding unit 114 is that a frame 120 constituting a unit can be divided into a frame lower part 121 comprising a bobbin supply and ejection device 117, a frame intermediate portion 122 comprising a yarn joining device 118 and a frame upper part 123 comprising a winding device 119. During a process for manufacturing the winding unit 114 with the frame 120 divided into the three parts, an assembly operation for attaching the bobbin supply and ejection device 117 and the like to the frame lower part 121, an assembly operation for attaching the yarn joining device 118 and the like to the frame intermediate part 122, and an assembly operation for attaching the winding device 119 and the like to the frame upper part 123 are individually performed, and the winding unit 114 is assembled during a comprehensive unit assembly operation by connecting together the assembled frame lower part 121, frame intermediate part 122 and frame upper part 123 so as to be mutually separated.

[0041] During the comprehensive unit assembly operation, the frame intermediate part 122 and the frame upper part 123 are coupled together via a bolt 125, a support leg 122a of the frame intermediate part 122 is pivoted via a shaft 124 to a generally intermediate position at a front side of the frame lower part 121, and a support leg 122a is connected via a connection member 128 such as a bolt to the frame lower part 121 so as to be separated therefrom. The frame intermediate part 122 and frame upper part 123 have their right opening covered with a removable cover 147, while the frame lower part 121 has its right opening covered with a removable cover 148. The assembled winding unit 114 is integrated into the automatic winder 111 by allowing a lower end of the frame lower part 121 to be removably supported by a support pipe 127 so as to be tilted and removably connecting a rear side of each of the frame lower part 121 and the frame upper part 123 via connection members 129, 130 such as a bolt to a fixedly located base section 126.

[0042] To inspect the integrated frame intermediate part 122 and frame upper part 123 for maintenance, the connection members 128, 130 are removed to disconnect the corresponding components and the winding unit 114 integrated into the automatic winder 111 is tilted from the winding operation position A to the tilted position C located frontward. The tilted position C is a position where the tilted winding unit part does not hinder the empty bobbin B' from being conveyed by the empty bobbin conveyor 113. To tilt the entire winding unit 114 from the winding operation position A where the entire winding unit 114 is stood up to the tilted position C located frontward, the connection members 129, 130 are removed to disconnect the corresponding components with the frame lower part 121 and the frame intermediate part 122 connected together via the connection member 128.

[0043] The frame 120 of the winding unit 114 is composed of a metal material such as an iron plate or an aluminum die cast and is generally manufactured by means of machining such as punching or tapping followed by coating finish. All or part of the frame 120, however, may be manufactured by means of injection in order to reduce manufacturing costs by eliminating or reducing the machining and omitting the coating. If the frame 120 is formed of a synthetic resin material, a cylindrical boss section 131 with a bolt through-hole 131a formed therein is directly joined to a side plate 133 and a side edge portion 131b of the boss section 131 extending in a direction in which the bolt is inserted is joined to the side plate 133 using a rib 132, thereby a stress occurring in the boss section 131 due to the connection of the bolt 125 is distributed, as shown in Fig-

ures 6 and 7. In the illustrated frame lower part 122, a connection section 144 is formed of an aluminum die cast, a side plate 145 is formed of an iron plate, and the connection section 144 and the side plate 145 are connected together via a bolt 146. These components, however, may be formed of a synthetic resin meterial. If the frame lower part 122 is formed of a synthetic resin material, the boss section 131 directly joined to the side plate 145 is connected to the side plate 145 via the rib 132 (not shown in the drawings) to reduce a stress occurring in the boss section 131, as in the frame upper part 123 formed of a synthetic resin material.

[0044] The bobbin supply and ejection device 117 provided in the frame lower part 121, shown in Figure 4, comprises a guide (not shown in the drawings in detail) including a passage formed between a plurality of plates to allow a tray T supporting a supply bobbin B thereon to pass through the passage, and a feeding mechanism comprising a lever and/or a cam or the like for intermittently moving the tray T. The feeding mechanism stops, at an unwinding position D, the supply bobbin B supplied from the supply bobbin conveyor 112 and ejects an empty bobbin B' with a yarn already unwound therefrom, onto the empty bobbin conveyor 113. In addition to the bobbin supply and ejection device 117, the lower part 121 comprises a balloon breaker 134 for controlling a balloon formed of the yarn unwound from the supply bobbin B, to stabilize yarn tension.

[0045] The yarn joining device 118 provided in the frame intermediate part 122 comprises a suction mouth 135, a relay pipe 136, and a yarn joining main body 137, and is configured so that a suction mouth 135 and a relay pipe 136 for sucking ends of a yarn cut by a cutter (not shown in the drawings) are pivoted to place the upper and lower yarns into the yarn joining main body 137 for joining, as shown in Figures 4 and 5. In addition to the yarn joining device 118, the frame intermediate part 122 comprises a tension adjusting device 141 in its lower left and a wax applying device 142 and a yarn defect detecting device 143 in its middle. In this manner, the frame intermediate part 122 includes devices frequently inspected for maintenance and other devices. The tension adjusting device 141 adjusts the tension of the yarn unwound from the supply bobbin B into the package P, to a set value. The wax applying device 142 applies a wax to the yarn, and the yarn defect detecting device 143 operates when a defect in the yarn wound into the package is detected, to cut the yarn to remove the defect.

[0046] The frame intermediate part 122 incorporates a group of wiring and piping parts including electric wiring parts (for example, wiring cords, connectors, and a control panel) and compressed air piping parts (for example, pipes, connectors, and solenoid valves), and a group of transmission parts including power transmission parts (for example, cams and cam levers, transmission shafts and bearings, and a couplings), these groups each being formed into a block. A transmission part 149 constituting the group of transmission parts is attached to the side plate 145 via a bolt 150 in a cantilever manner, a free end 149a such as a cantilever-like shaft may be supported by a support member 151 to improve assembly rigidity to suppress vibration, as shown in Figure 8. The support member 151 comprises a connection plate 151a connected to the free end 149a, a plurality of distant pipes 151b, and bolts 151c inserted into the corresponding distant pipes 151b and screwed into the side plate 145.

[0047] The winding device 119 provided in the frame upper part 123 shown in Figures 4 and 5 comprises a traverse drum 138 journaled to the frame upper portion 123 in a cantilever manner, a drum cover 139 having a traverse regulating guide or the like, and a package supporting member 140 for supporting the package P into which the yarn is wound. When the traverse drum 138 is driven, the yarn unwound from the supply bobbin B is wound into the package P.

[0048] While the frame lower part 121 having the bobbin supply and ejection device 117 and the balloon breaker 134, which are not frequently inspected for maintenance, is fixed, only the integrated frame intermediate part 122 and frame upper part 123 can be tilted from the winding operation position A to the tilted position C to move and stop the yarn joining device 118, the winding device 119, and other devices, which are frequently inspected for maintenance, to and at a position where they can be inspected for maintenance.

[0049] In addition, in the winding unit 114, the frame intermediate part 20 is pivoted via a shaft 124 above the bobbin supply and ejection device 117, so that the tilting centers of the frame intermediate part 122 and frame upper part 123 are higher than those in the conventional automatic winder. Consequently, an angle through which the frame intermediate part 122 and the frame upper part 123 can be tilted without hindering the empty bobbin B' from being conveyed by the empty bobbin conveyor 113 on the operation passage side F can be increased above the that in the conventional automatic winder.

[0050] Furthermore, since the frame intermediate part 122 of the winding unit 114 can be pivoted via a shaft 124 to the frame lower part 121 and connected thereto using the connection member 128, the entire frame 120 can be integrally handled to enable the entire winding unit 114 to be easily replaced with a new one.

[0051] As shown in Figure 4, each winding unit 114 has a transmission mechanism 152 for transmitting power between the frame lower part 121 and the frame intermediate part 122. The transmission mechanism 152 has one 152a of a driving node and a driven node (in the drawings, the driven node) disposed in the frame lower part 121 while having the other 152b (in the drawings, the driving node) disposed in the frame intermediate part 122. The nodes 152a, 152b are connected together for transmission when the frame intermediate part 122 is stood up at the winding operation position A,

and are mutually separated when the frame intermediate part 122 is tilted toward the tilted position C. In the illustrated example, the driving node, that is, the other node 152b of the transmission mechanism 152 is formed of a cam while the driven node, that is, the one node 152a is formed of a cam lever, to drive the bobbin supply and ejection device 117 provided in the frame lower part 121.

[0052] Each winding unit 111 for the automatic winder according to this embodiment uses the bobbin supply and ejection device 117 to guide the supply bobbin B loaded by the supply bobbin conveyor 112, to the predetermined unwinding position D, as shown in Figure 4. The yarn unwound from the supply bobbin B stopped at the unwinding position D is passed through the balloon breaker 134, the yarn tension adjusting device 141, the wax applying device 142, and the yarn defect detecting device 143 and wound into the package P, which is rotated by the traverse drum 138. For yarn joining, the suction mouth 135 and the relay pipe 136 for sucking ends of a cut yarn are pivoted to place the upper and lower yarns into the yarn joining main body 137. The empty bobbin B' is ejected onto the empty bobbin conveyor 113 by means of the bobbin supply and ejection device 117.

[0053] Figure 9 is a left side view a third embodiment of the present winding unit, showing an automatic winder incorporating the present winding unit. This embodiment differs from the second embodiment in that a support leg 223a of a frame upper part 223 is pivoted via a shaft 253 to a front side of a frame intermediate part 222 so as to be separated therefrom, a support leg 223a is connected via a connection member 255 such as a bolt to the frame intermediate part 222 so as to be separated therefrom, and the frame intermediate part 222 and the frame upper part 223 is individually removably connected and fixed to a base section 226 via connection members 230, 230 such as bolts, so that the frame upper part 223 can be independently moved from the winding operation position A to the maintenance and inspection position G to allow the winding device 219 and other devices provided in the frame upper part 223 to be independently inspected for maintenance. The Part of the configuration of this embodiment other than the above differences is substantially the same as that of the second embodiment.

[0054] Figure 10 is a left side view a fourth embodiment of the present winding unit, showing an automatic winder incorporating the present winding unit. This embodiment differs from the second embodiment in that a frame lower part 321 and a frame intermediate part 322 are connected together via an appropriate number of bolts 325 so as not to be tilted or mutually separated. To tilt a frame 320 from the winding operation position A to a tilted position (a maintenance and inspection position) H, a support pipe 327 is used as a tilting center. The part of the configuration of this embodiment other than the above differences is substantially the same as that of the second embodiment.

[0055] Figure 11 is a left side view a fifth embodiment of the present winding unit, showing an automatic winder incorporating the present winding unit. This embodiment differs from the second embodiment in that a frame lower part 421 and a frame intermediate part 422 are mutually separated without being connected together, a lower end of the frame lower part 421 is removably supported on a support frame 427 so as to be tilted, the frame lower part 421 is removably connected and fixed to a base section 426 via a connection member 429 such as a bolt, a frame intermediate part 422 is pivoted via a shaft 454 and connected to the base section 426 so as to be tilted, a support leg 423a of a frame upper part 423 is pivoted (453) to a front side of the frame intermediate part 422 so as to be separated therefrom, a support leg 423a is connected to the frame intermediate part 422 via a connection member 455 such as a bolt so as to be separated therefrom, and the frame intermediate section 422 and the frame upper section 423 are individually removably connected and fixed to the base section 426 via connection members 430, 430 such as bolts. According to this embodiment, mutually disconnecting the connection members 430, 430 allows the frame upper part 423 and the frame intermediate part 422 to be moved from the winding operation position A to the maintenance and inspection G, whereas mutually disconnecting the connection member 430 and a connection member 455 of the frame upper part 423 allows only the frame upper part 423 to be moved from the winding operation position A to the maintenance and inspection position G. The Part of the configuration of this embodiment other than the above differences is substantially the same as that of the second embodiment.

[0056] Although not shown in the drawings, the frame upper part 423 and the frame intermediate part 433 are connected and integrated together via a plurality of bolts 425 so as to be mutually separated as in the second embodiment.

[0057] In the second embodiment shown in Figure 4 and in the third embodiment shown in Figure 9, to allow the frame intermediate part 122, 222 to be moved from the winding operation position A to the maintenance and inspection position G, a structure for connecting the frame intermediate part 122, 222 to the frame lower parts 121, 221 may be changed from the above described pivot 124, 224 to a connection structure for slidably guiding the frame intermediate part 122, 222 in a longitudinal direction so that the frame intermediate part 122, 222 can be drawn out forward.

[0058] Furthermore, in the third embodiment shown in Figure 9 and in the fifth embodiment shown in Figure 11, to allow only the frame upper part 223, 423 to be moved from the winding operation position A to the maintenance and inspection position G, a structure for connecting the frame upper part 223, 423 to the frame intermediate parts 222, 422 may be changed from the

above described pivot 253, 453 to a connection structure for slidably guiding the frame upper part 223, 423 in a longitudinal direction so that the frame upper part 223, 423 can be drawn out forward.

[0059] The present automatic winder can move and stop the upper part as well as the yarn joining device and the winding device, which are frequently inspected for maintenance, to and at the position where they are easily inspected for maintenance without the need to move the bobbin supply and ejection device, which is not frequently inspected for maintenance. This configuration eliminates the need to attach and remove a tray guide, as conventionally required for maintenance and inspection, thereby reducing time and labor required for maintenance and inspection.

[0060] The present automatic winder can tilt the upper part and other pneumatic pipes in a manner such that pneumatic paths in other winding units are not affected by variations in pressure, resulting in smooth maintenance and inspection.

[0061] According to the present automatic winder, the upper part, when stopped at the tilted position, does not hinder the empty bobbin from being conveyed by the empty bobbin conveyor, thereby eliminating the necessity of the conventional operation for manually removing the empty bobbin conveyor. Labor and time required for maintenance and inspection can this be removed.

[0062] According to the present automatic winder, when the upper part is located at the winding position, the nodes of the transmission mechanism are connected together to transmit power between the lower part and the upper part. When the upper part is titled toward the tilted position, the nodes of the transmission mechanism are mutually separated to allow the upper part to be smoothly tilted for maintenance and inspection.

[0063] The present winding unit enables the assembly operation such as the attachment of parts to be performed individually for the frame lower part, the frame intermediate part, and the frame upper part, thereby reducing the assembly man hour of the entire unit.

[0064] The present winding unit (the forth embodiment) enables the yarn replacing device, the yarn joining device, and the winding device to be integrally moved from the winding operation position to the maintenance and inspection position.

[0065] The present winding unit enable the yarn joining device and the winding device, which are frequently inspected for maintenance, to be integrally moved from the winding operation position to the maintenance and inspection position, thereby improving the efficiency of maintenance and inspection.

[0066] The present winding unit (the third embodiment) enables the winding device, which is frequently inspected for maintenance, to be independently moved to the maintenance and inspection position.

Claims

1. An automatic winder having a plurality of winding units, and each widing unit comprising a bobbin supply and ejection device, a yarn joining device, and a winding device, the automatic winder being characterized in that said winding unit is divided into a lower part including said bobbin supply and ejection device and an upper part including said yarn joining device and winding device and can be tilted between a winding part where the upper part is stood up and a tilted position where the upper part is tilted toward an operation passage side.

2. An automatic winder according to claim 1, characterized in that one of a plurality of pneumatic paths with closing valves is provided in a base on which winding units are attached, said upper part includes a plurality of pneumatic pipes constituting the other pneumatic path, and a corresponding end of the other pneumatic path can be removably joined to an end of the one pneumatic path.

3. An automatic winder according to claim 1 or claim 2, characterized in that said tilted position is a position where the tilted upper part is not hindered empty bobbins from being conveyed by an empty bobbin conveyor disposed on the said operation passage side.

4. An automatic winder according to any one of claims 1 to 3, characterized in that one of a driving node and a driven node of a transmission mechanism is located in said lower part while the other is located in said upper part, and the driving and driven nodes are connected together when said upper part is located at said winding position and are mutually separated when said upper part is located at said tilted position.

5. A winding unit for an automatic winder comprising a bobbin supply and ejection device, a yarn joining device, and a winding device all in a frame, the winding unit being characterized in that said frame can be divided into a frame lower part including said bobbin supply and ejection device, a frame intermediate part including said yarn joining device, and a frame upper part including said winding device.

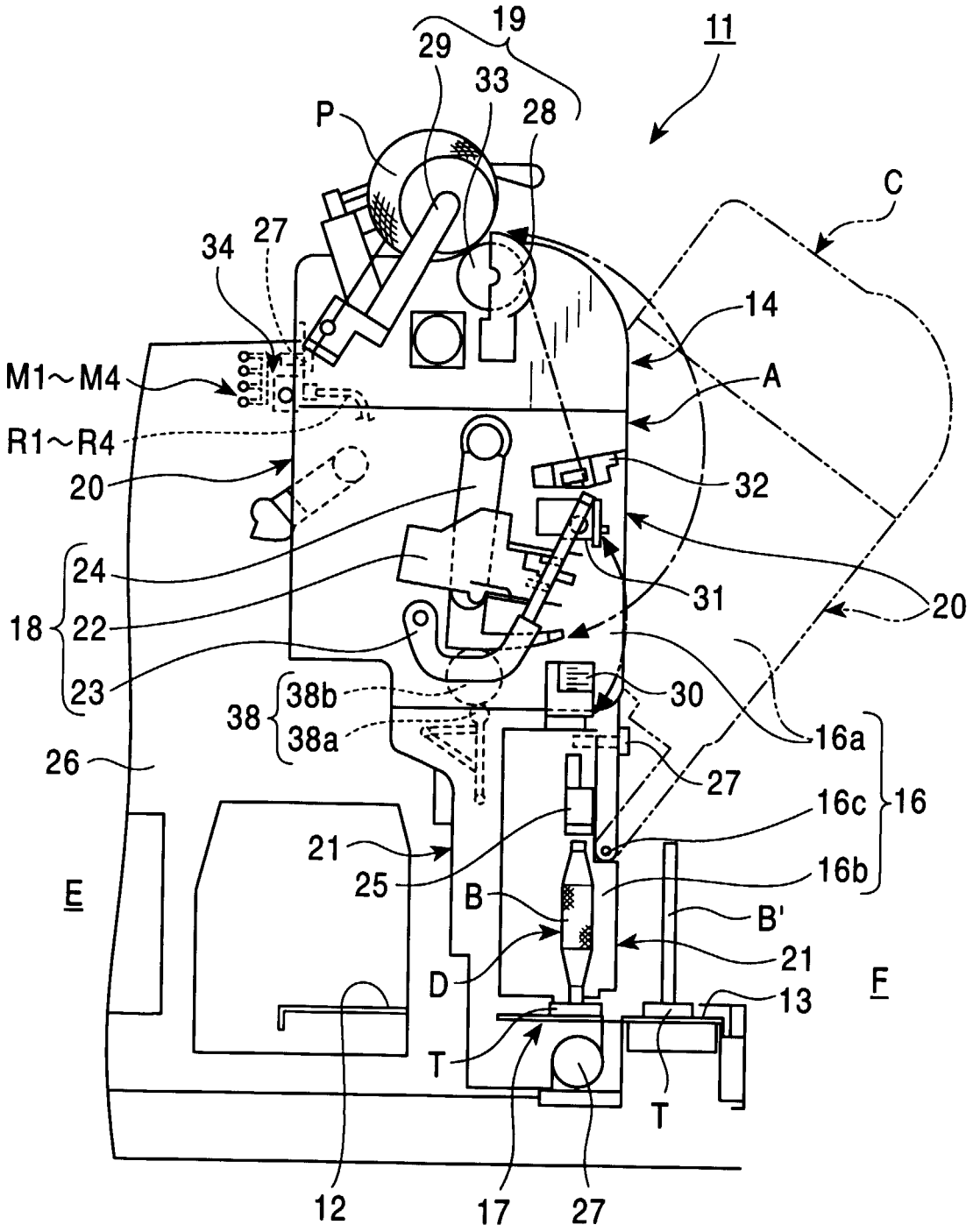
6. A winding unit for an automatic winder according to claim 5, characterized in that said frame lower part, said frame intermediate part and said frame upper part are integrally connected together and said frame lower part is movably connected to a fixed portion so that the integrated body can be moved from a winding operation position to a maintenance and inspection position.

7. A winding unit for an automatic winder according to claim 5, characterized in that said frame intermediate part is movably connected to said frame lower part so that said frame intermediate part and said frame upper part can be moved from the winding operation position to the maintenance and inspection position.

8. A winding unit for an automatic winder according to claim 5, characterized in that said frame lower part is fixed, said frame intermediate part and said frame upper part are integrally connected together, and said frame intermediate part is movably connected to the fixed portion so that said frame intermediate part can be moved from the winding operation position to the maintenance and inspection position.

9. A winding unit for an automatic winder according to any one of claims 6 to 8, characterized in that said frame upper part is movably connected to said frame intermediate part so that said frame upper part alone can be moved from the winding operation position to the maintenance and inspection position.

FIG. 1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23
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38b
38a
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16a
26
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FIG. 2

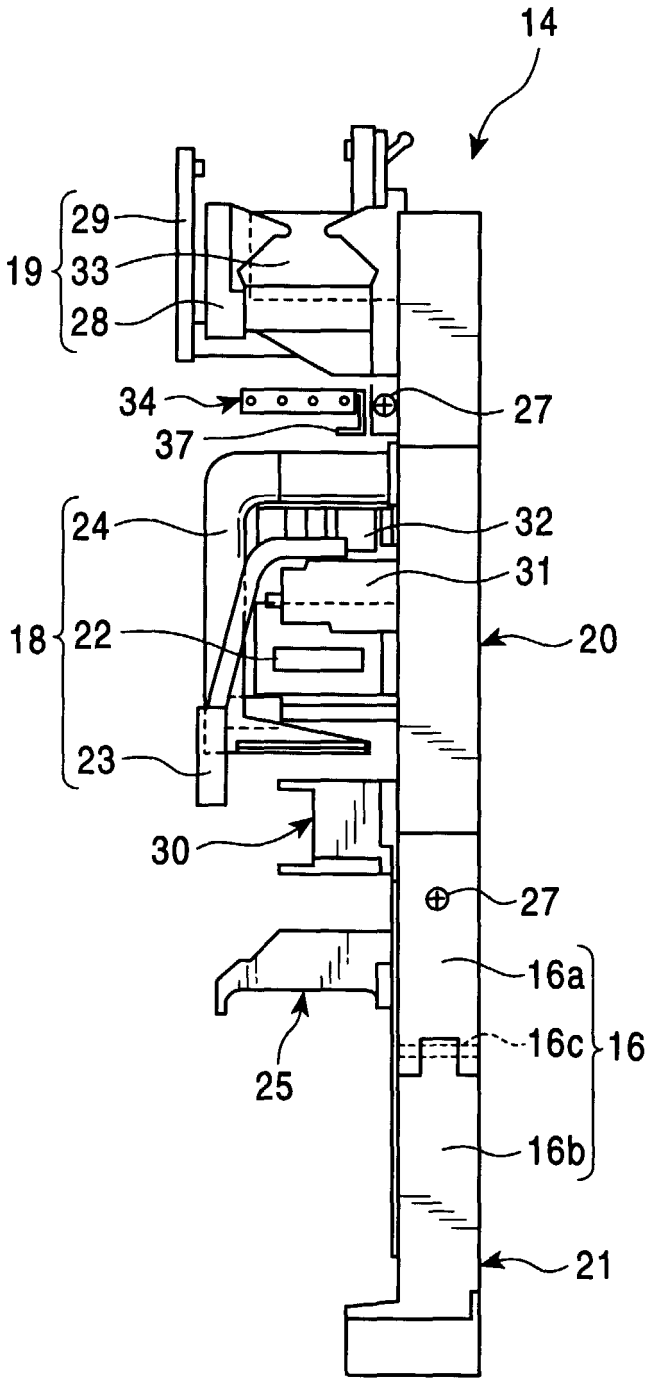


FIG. 3

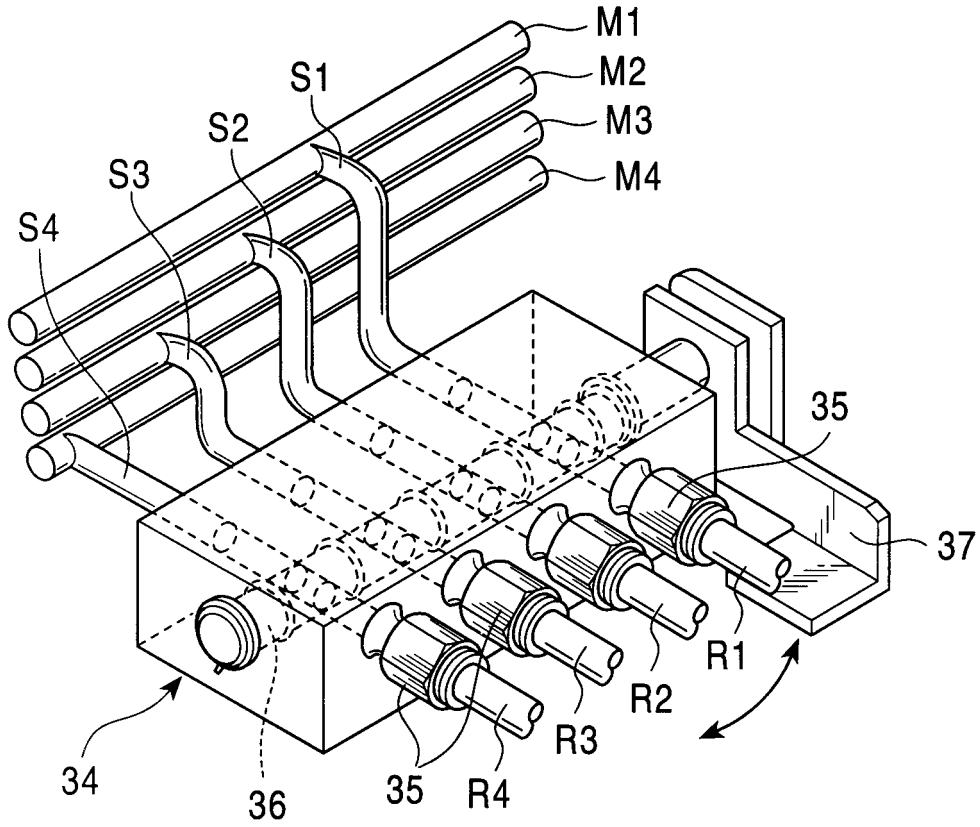
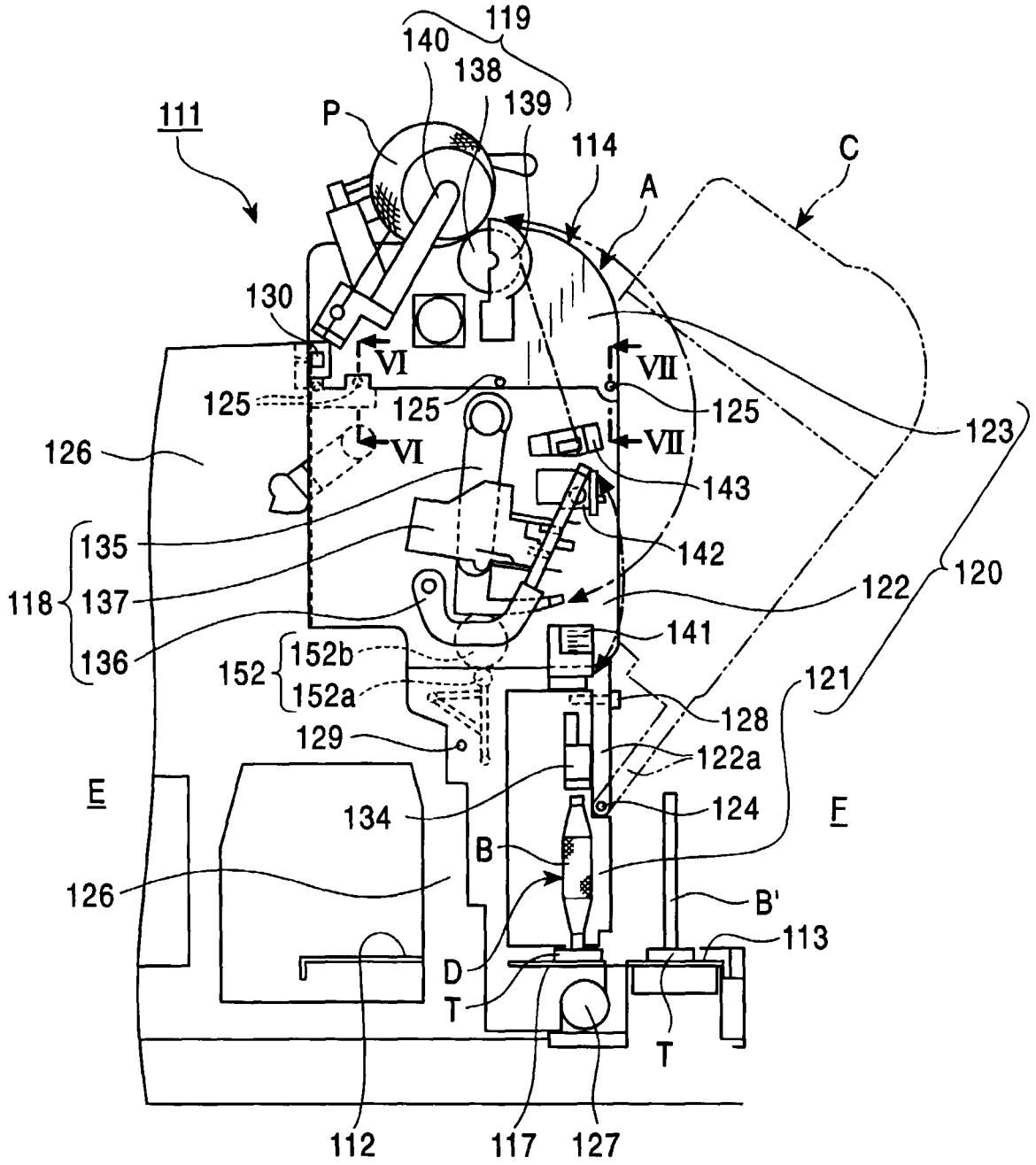


FIG. 4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120
136
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152
152b
152a
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D
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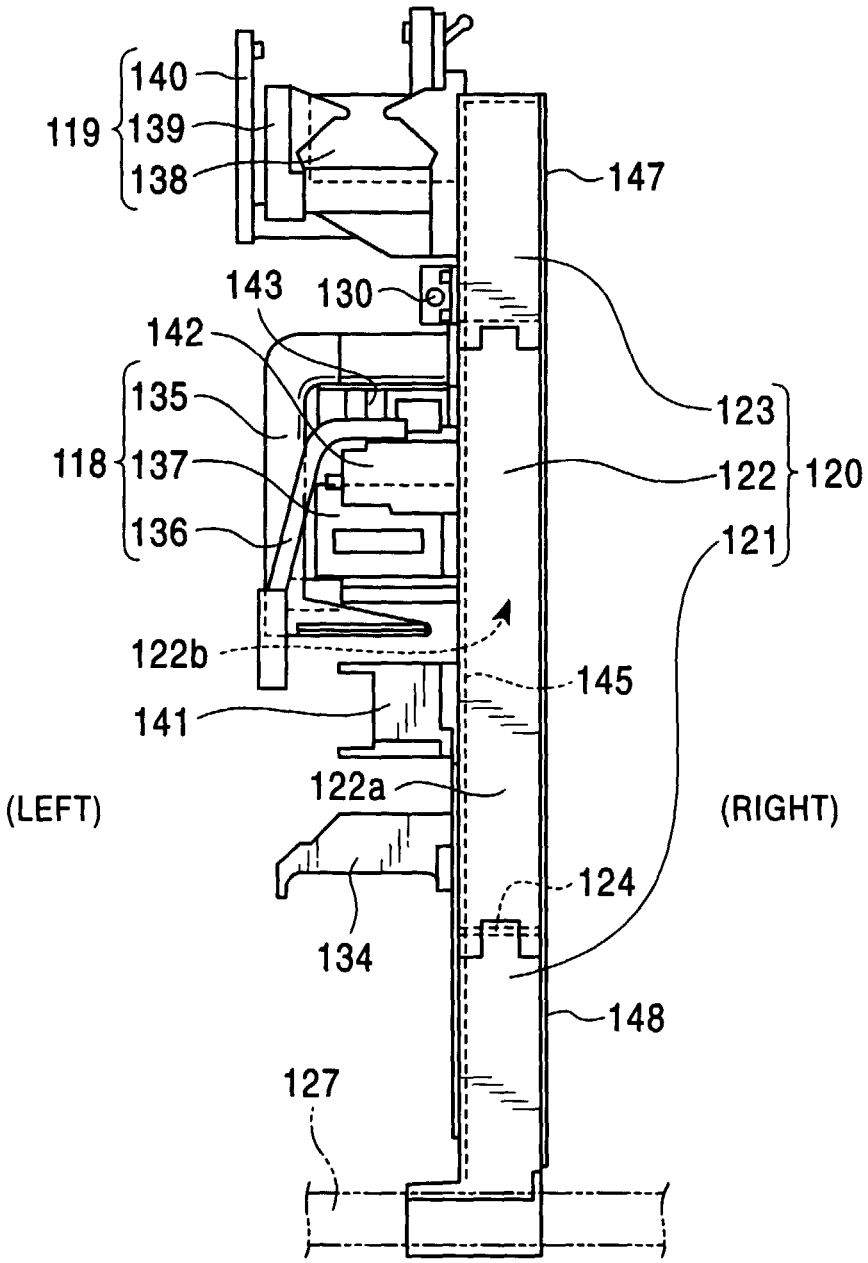
FIG. 5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141
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122a
(RIGHT)
124
134
148
127

FIG. 6

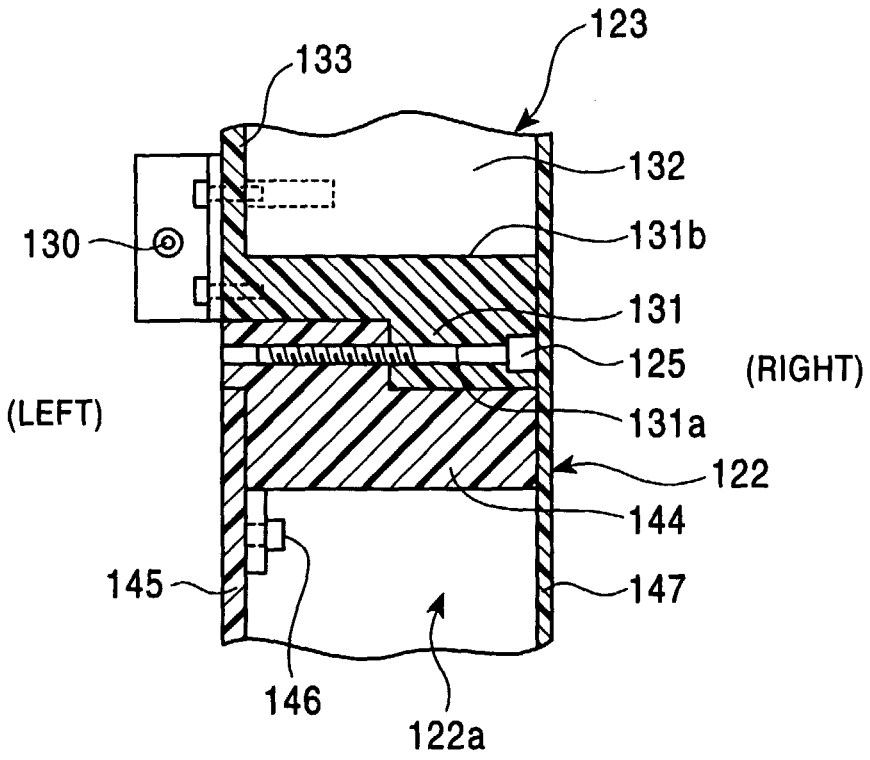
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FIG. 7

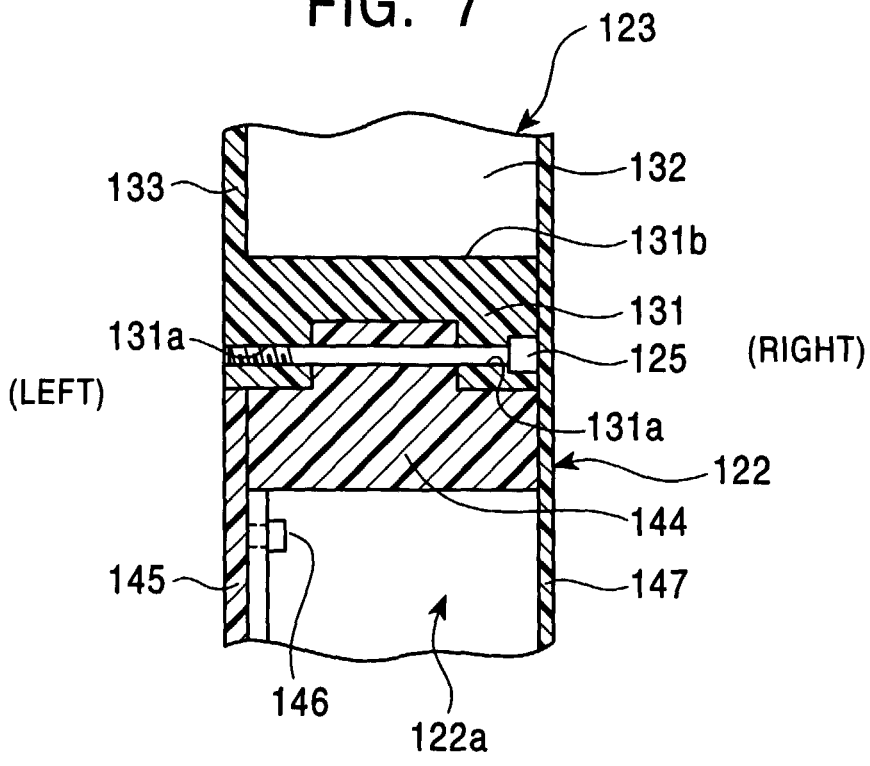
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FIG. 8

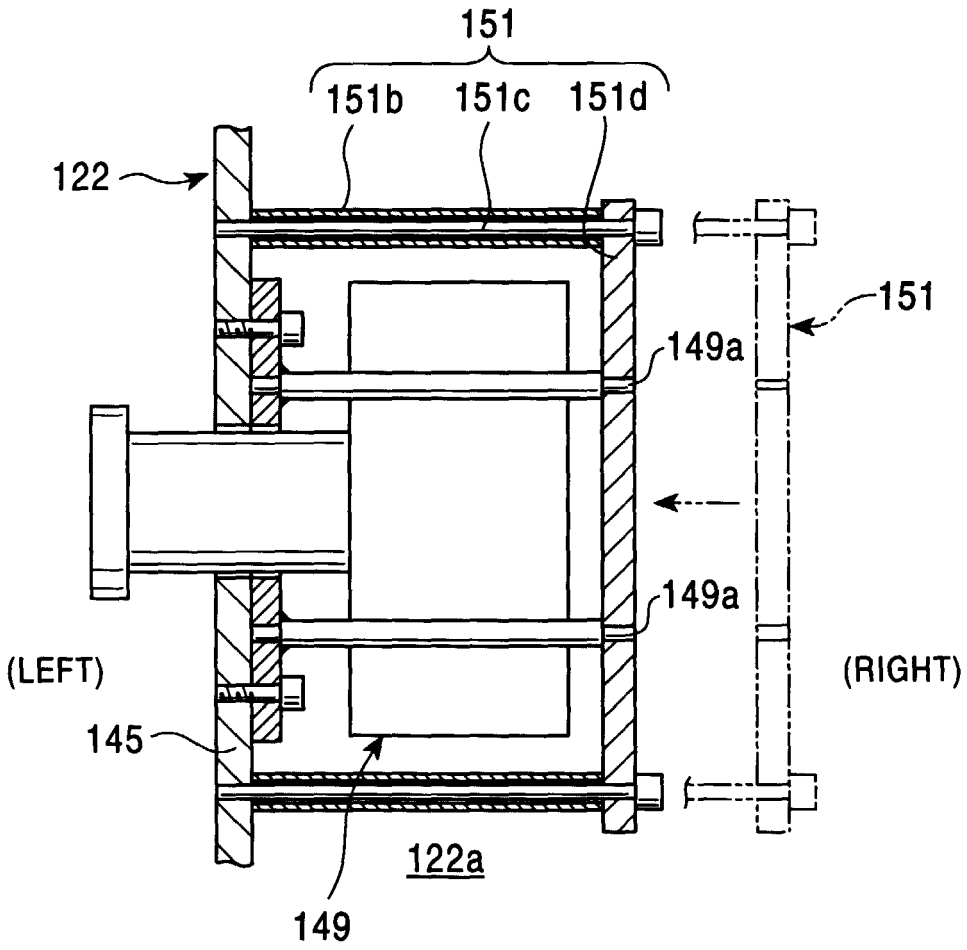

FIG. 9

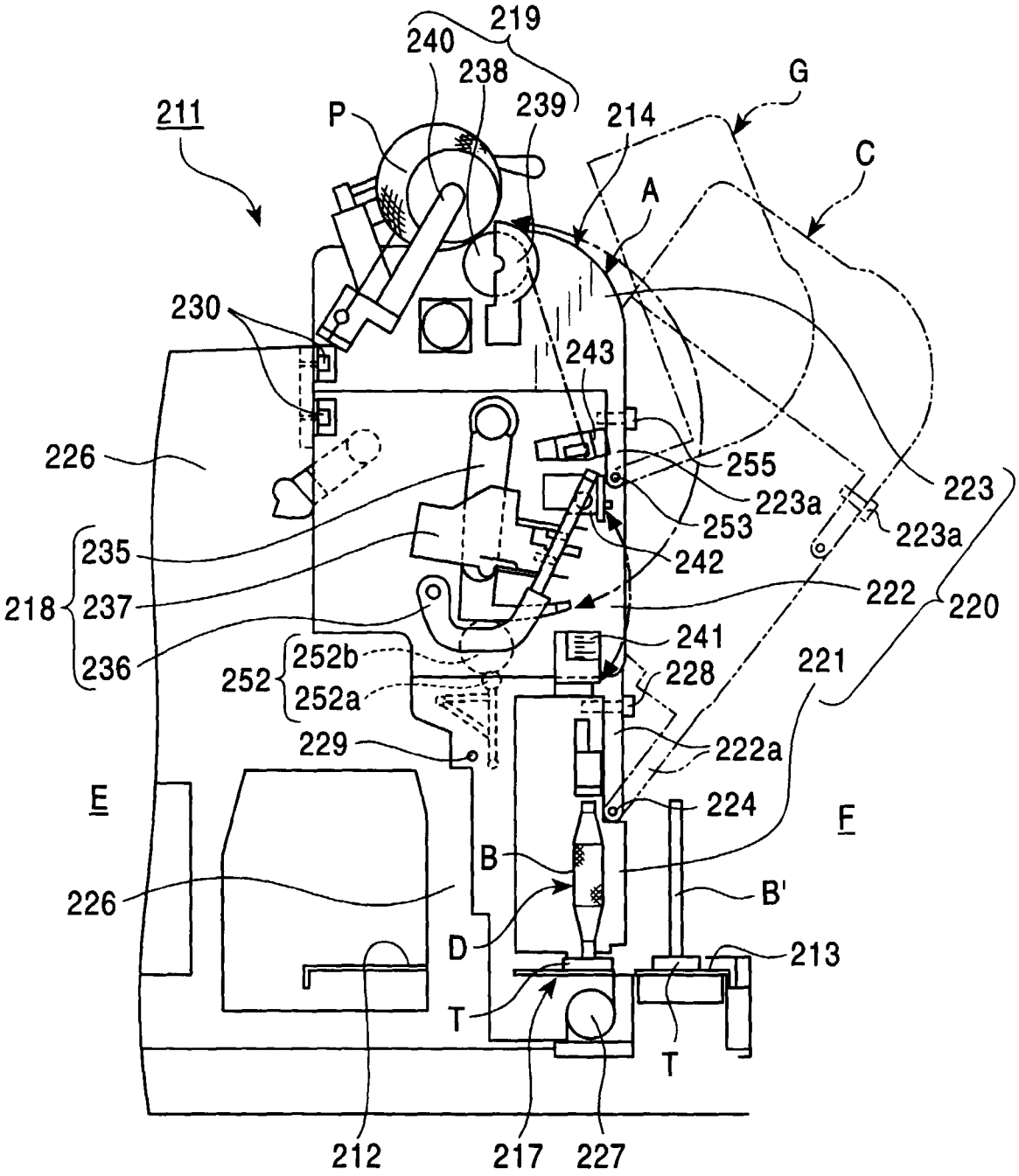
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FIG. 10

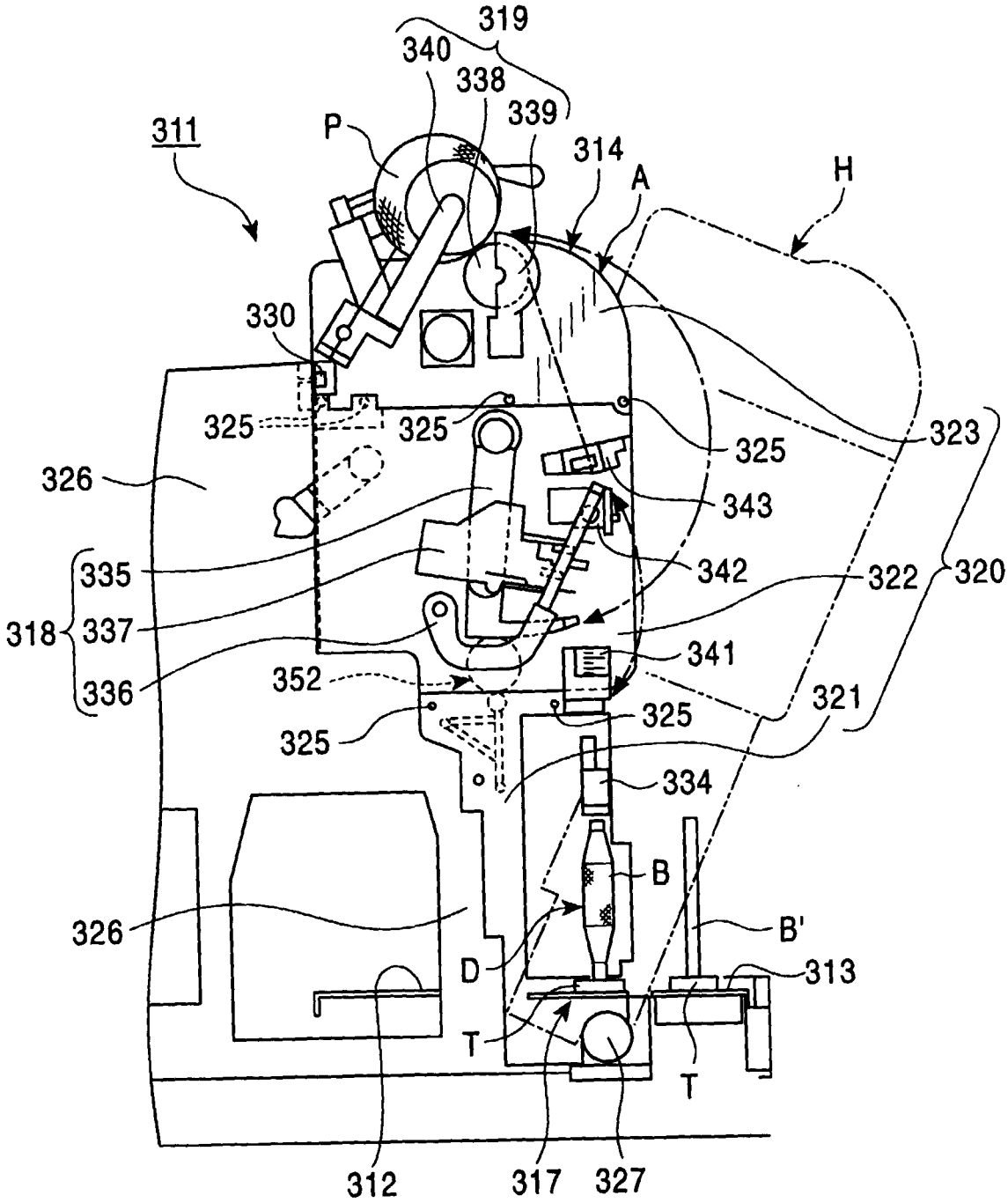
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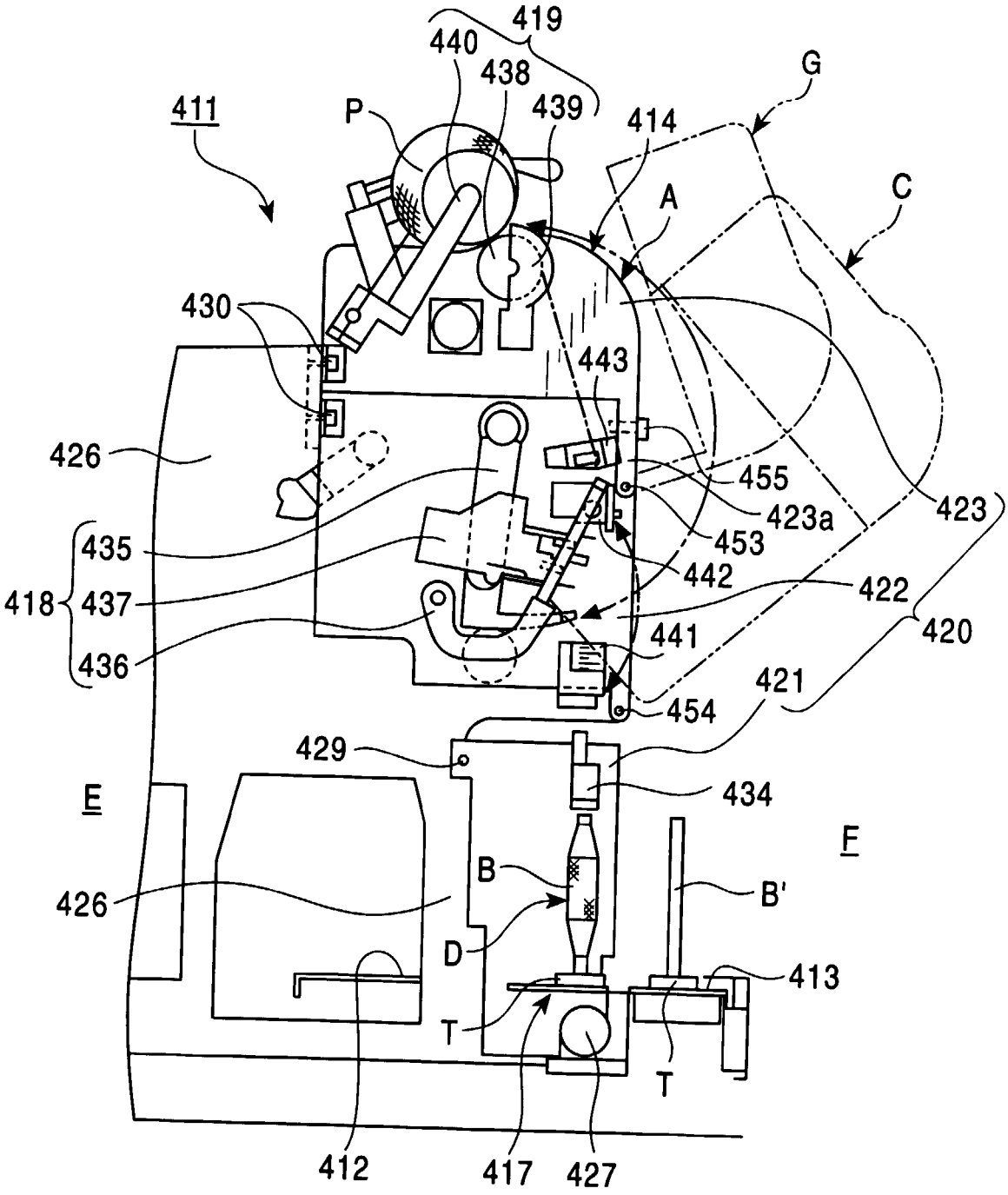
FIG. 11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E
F
B
B'
426
D
413
T
T
412
417
427

FIG. 12
PRIOR ART