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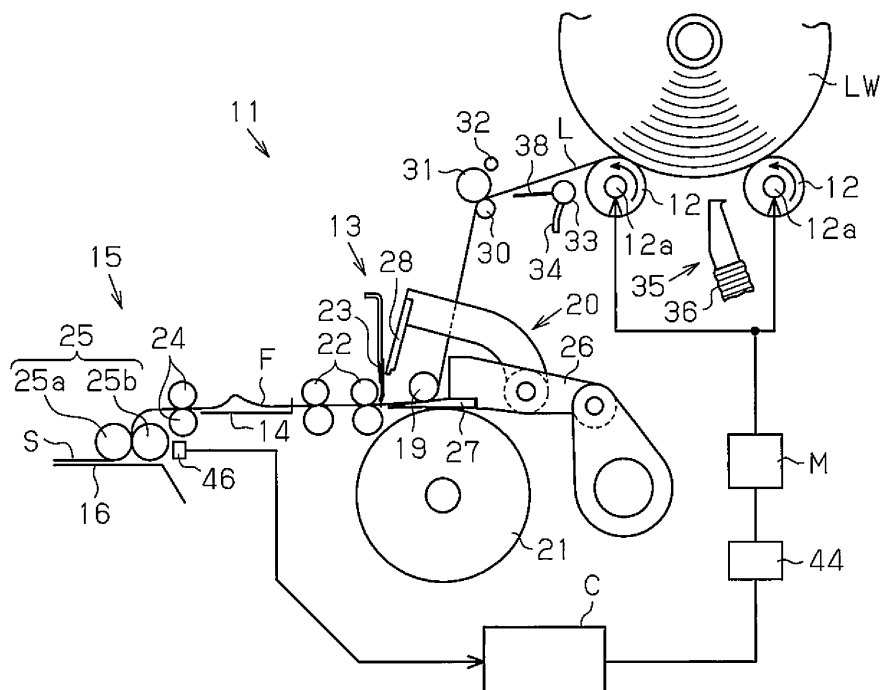
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(54) **AUTOMATIC LAP SPLICING APPARATUS**

(57) An automatic lap splicing apparatus for a ribbon lap machine or a comb is provided. The apparatus performs lap splicing by overlapping and joining an end (E2) of a succeeding lap and an end (E1) of a preceding lap. The apparatus includes a detecting section (46) and a parameter changing section (C). The detecting section

detects an overlap thickness corresponding amount, which corresponds to a thickness of an overlapping portion of the succeeding lap and the preceding lap. The parameter changing section changes a parameter related to lap splicing in accordance with the overlap thickness corresponding amount detected by the detecting section.

Fig.2



Description

BACKGROUND OF THE INVENTION

[0001] The present invention relates to an automatic lap splicing apparatus. More specifically, the present invention pertains to an automatic lap splicing apparatus for a ribbon lap machine or a comber that overlaps an end of a succeeding lap onto an end of a preceding lap thereby splicing the laps.

[0002] A comber or a ribbon lap machine splices laps. That is, when the amount of the lap being used (preceding lap) becomes small, the comber or the ribbon lap machine overlaps an end of a succeeding lap (hereinafter, referred to as a succeeding lap end) onto an end of the preceding lap (hereinafter, referred to as a preceding lap end), thereby splicing the laps. Automatic lap splicing apparatuses, which automatically perform such lap splicing, are disclosed, for example, in Japanese Laid-Open Patent Publications No. 4-222234 and No. 4-257324. These automatic lap splicing apparatuses have a preceding lap end forming device, which forms a preceding lap end, a succeeding lap end forming device, which forms a succeeding lap end, and an overlap length setting device, which sets the length of the succeeding lap end overlapped onto the preceding lap end. The overlap length setting device adjusts the amount of forward rotation of a succeeding lap roll (a lap feeding amount) after a succeeding lap end is formed, thereby setting the overlap length of the succeeding lap end onto the preceding lap end.

[0003] The lap feeding amount is input by the operator prior to the lap splicing. Since the fiber lengths of laps vary depending on the materials, an optimal length is not always input as the overlap length of the preceding lap and the succeeding lap. Even if the same material is used, the fiber distributions and the lengths of the lap ends vary at the cut ends of the preceding lap and the succeeding lap. Therefore, the sizes of slivers at the spliced parts vary in the comber.

SUMMARY OF THE INVENTION

[0004] Accordingly, it is an objective of the present invention to provide an automatic lap splicing apparatus that properly joining an end of a succeeding lap to an end of a preceding lap.

[0005] To achieve the foregoing objective and in accordance with one aspect of the present invention, an automatic lap splicing apparatus for a ribbon lap machine or a comber is provided. The apparatus performs lap splicing by overlapping and joining an end of a succeeding lap and an end of a preceding lap. The apparatus being includes a detecting section, which detects an overlap thickness corresponding amount, which corresponds to a thickness of an overlapping portion of the succeeding lap and the preceding lap, and a parameter changing section, which changes a parameter related to

lap splicing in accordance with the overlap thickness corresponding amount detected by the detecting section.

[0006] Other aspects and advantages of the present invention will become apparent from the following description, taken in conjunction with the accompanying drawings, illustrating by way of example the principles of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] The invention, together with objects and advantages thereof, may best be understood by reference to the following description of the presently preferred embodiments together with the accompanying drawings in which:

Fig. 1 is a partial plan view of a comber according to one embodiment;

Fig. 2 is a side view showing a combing head in Fig. 1; Fig. 3 is a partial side view, with a part cut away, illustrating the structure about the nozzle pipe in Fig. 2;

Fig. 4 is a partial side view, with a part cut away, illustrating the structure about the suction nozzle in Fig. 2;

Figs. 5A and 5B are side views schematically showing a cutting step for cutting an end of a succeeding lap;

Figs. 6A and 6B are side views schematically showing the cutting step;

Figs. 7A and 7B are side views schematically showing a step for guiding the succeeding lap end;

Figs. 8A and 8B are side views schematically showing a step for overlapping the succeeding lap end and the preceding lap end; and

Figs. 9A to 9C are diagrams each showing an overlapped state of the succeeding lap end and the preceding lap end.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0008] A comber 10 having an automatic lap splicing apparatus according to one embodiment will now be described with reference to Figs. 1 to 9C.

[0009] As shown in Figs. 1 and 2, the comber 10 includes combing heads 11, which are arranged parallel with each other. Each combing head 11 includes a pair of lap rollers 12, on which lap rolls LW are placed. Hereinafter, the direction in which a lap L is delivered from each lap roll LW is referred to as a forward direction (leftward direction as viewed in Fig. 2, and a direction opposite to the delivering direction of the lap L is referred to as a rearward direction (rightward direction as viewed in Fig. 2). Each combing head 11 includes a combing section 13, a guiding plate 14, and a roller section 15. The combing section 13 is located downstream of the lap rollers 12. The guiding plate 14 guides fleece F, which is

delivered after being subjected to the combing effect of the combing section 13, and concentrates the fleece F. The roller section 15 draws a sliver S, which is obtained by the concentration at the guiding plate 14, and compresses the sliver S. A guide table 16 is provided on the downstream side of the roller sections 15. The guide table 16 extends in a direction perpendicular to the direction in which the slivers S are drawn, or in the lateral direction as viewed in Fig. 1. The slivers S drawn from the combing heads 11 are engaged with guide rollers 17 on the guide table 16 to change the moving direction and move to a draft section 18 arranged to face one end of the guide table 16. The slivers S are bundled (doubled) and drafted at the draft section 18. The slivers S are then stored in a can by a coiling device (not shown).

[0010] As shown in Fig. 2, each combing head 11 includes, at a position forward of and below the lap rollers 12, a nipper device 20, a combing cylinder 21, two pairs of detaching rollers 22, and a top comb 23. The nipper device 20 has a feed roller 19. The roller section 15 is located frontward of the detaching rollers 22, and the guiding plate 14 is located between the detaching rollers 22 and the roller section 15. The roller section 15 includes a pair of delivery rollers (drawing rollers) 24 and calendar roller set 25, which includes a driver roller 25a and a driven roller 25b. The driver roller 25a is driven by a drive-shaft that is common to all the combing heads 11. The driven roller 25b is urged toward and driven by the driver roller 25a.

[0011] The nipper device 20 includes a nipper frame 26, which is pivotally supported on the combing cylinder 21. The nipper frame 26 has a bottom nipper 27 at the bottom in the front portion. The nipper frame 26 further has a top nipper 28. The top nipper 28 is opened and closed in synchronization with the pivoting motion of the nipper frame 26 to nip the lap L with the bottom nipper 27.

[0012] A carrier roller 30 and a top roller 31 are arranged frontward of the lap rollers 12 and above the nipper device 20. The top roller 31 is movable between an operational position, at which the top roller 31 is pressed against the carrier roller 30 from above, and a retracted position, at which the top roller 31 is moved upward from the operational position. The carrier roller 30 and the top roller 31 configure a preceding lap end forming device (or means), which forms an end of a lap L being used, or a preceding lap end, in lap splicing. Other than the time when forming a preceding lap end, the top roller 31 is held at the retracted position, so that the lap L can be moved freely on the carrier roller 30. A gas discharge pipe 32 is provided above and in the vicinity of the top roller 31. The gas discharge pipe 32 is arranged parallel with the top roller 31 and discharges gas (for example, air) downward from discharge ports (not shown).

[0013] A nozzle pipe 33 is located between the carrier roller 30 and the front lap roller 12. The nozzle pipe 33 extends along the axis of the lap roll LW, which is placed on the lap rollers 12, and over the entire axial length of the lap roll LW. The nozzle pipe 33 is connected to a

compressed air supply source (not shown) via a hose 34. A suction nozzle 35 is located below the lap roll LW such that the distal end of the suction nozzle 35 is located between the lap rollers 12. The suction nozzle 35 has an opening that extends over the entire axial length of the lap roll LW and is connected to a negative pressure source (not shown) via a hose 36.

[0014] As shown in Fig. 3, the nozzle pipe 33 has arms 37 attached to the axial ends and is attached to the front lap roller 12 via these arms 37, which allows the nozzle pipe 33 to pivot about the axis of the front lap roller 12. The nozzle pipe 33 has a slit 33a, which extends parallel with an imaginary plane that includes the center of pivoting motion of the arms 37 (the axis of the front lap roller 12) and the axis of the nozzle pipe 33. The slit 33a is located at a position where the slit 33a is allowed to deliver compressed air supplied by the compressed air supply source in a direction from the proximal ends of the arms 37 toward the distal ends. The nozzle pipe 33 has a guide plate 38, which guides the compressed air delivered by the slit 33a. The guide plate 38 extends parallel with the slit 33a and with the imaginary plane. The nozzle pipe 33 can be arranged at a lap end drawing position, which is represented by long dashed double-short dashed lines in Fig. 3, and an overlap guiding position, which is represented by solid lines. When the nozzle pipe 33 is at the lap end drawing position, the guide plate 38 is substantially parallel with the common tangent of the lap roller 12 and the lap roll LW. When the nozzle pipe 33 is arranged at the overlap guiding position, the distal end of the guide plate 38 is directed to a point above the contact point between the carrier roller 30 and the top roller 31.

[0015] As shown in Fig. 4, the suction nozzle 35 has at its distal end a curved portion 35a, which is curved outward toward the rear lap roller 12, and a holding member 39, which is located on the side opposite from the curved portion 35a. The holding member 39 can be tilted to a holding position, which is represented by long dashed double-short dashed lines in Fig. 4. Specifically, the proximal end of the holding member 39 is formed to be flexible, and a projection 40 is formed on the outer surface in the vicinity of the holding member 39. The suction nozzle 35 includes a bracket 42 on the outer surface close to the proximal end and a cylinder 41, which is rotationally attached to the bracket 42. The cylinder 41 has a piston rod 41a, which is rotationally coupled to the projection 40. The holding member 39 is at the holding position when the piston rod 41a is protruded.

[0016] The pivots 12a of the lap rollers 12 are driven by a motor M for lap rollers that is activated independently from the combing driving section. The lap roller driving motor M is configured to be rotated in forward and reverse directions and is activated via an inverter device 44, which is controlled based on commands from a controller C. The controller C is, for example, a processor. During operation of the comb 10, the controller C controls the lap roller driving motor M to rotate in the forward direction,

while conforming to predetermined driving conditions.

[0017] In lap splicing, the controller C controls the lap rollers 12 to be rotated in the reverse direction with the lap L held by the carrier roller 30 and the top roller 31, so that the lap L is cut to form a preceding lap end. That is, the carrier roller 30, the top roller 31, the lap rollers 12, the lap roller driving motor M, and the controller C configure a preceding lap end forming device (means).

[0018] With suction being created at the suction nozzle 35, the controller C drives the lap rollers 12 to rotate in the forward direction and causes the suction nozzle 35 to suction an end of the lap L of a new lap roll LW. Then, with the suctioned lap end being held by holding member 39, the controller C drives the lap rollers 12 to rotate in the reverse direction to cut the lap L, thereby forming a succeeding lap end. That is, the suction nozzle 35, the holding member 39, the lap rollers 12, the lap roller driving motor M, and the controller C configure a succeeding lap end forming device (means).

[0019] The controller C is connected to detecting sections 46, each of which corresponds to one of the combing heads 11. When lap splicing is performed at the corresponding combing head 11, each detecting section 46 detects an overlap thickness corresponding amount, which corresponds to the thickness of a lap overlapping portion, at which the succeeding lap end and the preceding lap end are overlapped. For each combing head 11, the controller C changes a parameter related to the lap splicing in accordance with the overlap thickness corresponding amount detected by the corresponding detecting section 46. That is, the controller C functions as a parameter changing section, which changes a parameter for each combing head 11 related to lap splicing in accordance with the overlap thickness corresponding amount detected by the corresponding detecting section 46.

[0020] In the present embodiment, the detecting sections 46 detect the sizes of the slivers S before being doubled as the overlap thickness corresponding amounts. Specifically, the driven roller 25b of each calendar roller set 25 can be displaced with respect to the driver roller 25a, so that the interaxial distance of the rollers 25a, 25b is adjusted. Also, the driven roller 25b is urged toward the driver roller 25a by a spring. The driven roller 25b is thus displaced such that the interaxial distance of the rollers 25a, 25b is changed in accordance with the size of the sliver S. As the detecting section 46, a distance sensor that continuously detects the distance between the driven roller 25b and the driver roller 25a is used.

[0021] In the present embodiment, the parameter related to lap splicing is the length of the overlapping portion of a succeeding lap end and a preceding lap end (overlap length). The controller C receives detection signals from the detecting sections 46. For each combing head 11, the controller C calculates the size of the sliver S in a part that corresponds to the spliced lap portion based on the detection signal, the operation time of the comb

from when the lap splicing ended, and the operating condition. When the size of the sliver S at the portion is out of a predetermined range, the controller C changes the overlap length. The overlap length is determined by the amount of forward rotation of the lap rollers 12 after a succeeding lap end is formed and the lap rollers 12 are stopped.

[0022] The controller C changes the overlap length in the following manner. That is, the controller C shortens the overlap length when the size of the sliver S is above the predetermined range and lengthens the overlap length when the size of the sliver S is below the predetermined range. The extent of changes in the overlap length is stored in a memory of the controller C in advance through experimentation.

[0023] Operation of the automatic lap splicing apparatus of the above described configuration will now be described, using one of the combing heads 11 as an example. The other combing heads 11 operates in a manner similar to the following description.

[0024] Lap splicing is performed when the amount of the lap roll LW is decreased to a predetermined amount by operation of the comb 10. The lap splicing is performed after the operation of the comb 10 is stopped.

First, the top roller 31 is moved from the retracted position to the operational position so that the top roller 31 and the carrier roller 30 cooperate to hold the lap L, which has been guided to the nipper device 20 from the lap roll LW via the carrier roller 30. In this state, the lap roller driving motor M is driven to rotate in the reverse direction so that the lap roll LW reels in the lap L. The lap L is then cut between the front lap roller 12 and the position where the carrier roller 30 and the top roller 31 hold the lap L, so that a preceding lap end is formed. After the lap L is cut, the lap roll LW is removed from the lap rollers 12, and a new lap roll LW is placed on the lap rollers 12.

[0025] Then, as shown in Fig. 5A, the nozzle 35 is maintained in a suction state, in which negative pressure is supplied, and the lap rollers 12 are driven to rotate in the forward direction. The suction nozzle 35 suctions an end of the lap L of the new lap roll LW. In this state, the preceding lap end E1 is located rearward of the carrier roller 30 and the top roller 31. Subsequently, as shown in Fig. 5B, the end of the lap L of the new lap roll LW is suctioned by the suction nozzle 35 to a position where the holding member 39 of the suction nozzle 35 can hold the lap end. The lap rollers 12 are then stopped and the holding member 39 is arranged at the holding position, so that the end of the lap L is held by the holding member 39 and the curved portion 35a.

[0026] Next, as shown in Fig. 6A, the lap rollers 12 are driven to rotate in the reverse direction, and the lap L is cut between the rear lap roller 12 and the position where the lap L is held by the holding member 39 and the curved portion 35a, so that a succeeding lap end E2 is formed. Then, the lap rollers 12 are stopped as shown in Fig. 6B. Also, supply of negative pressure to the suction nozzle 35 is stopped, and the holding member 39 is arranged

at the retracted position.

[0027] Next, as shown in Fig. 7A, the nozzle pipe 33 is arranged at the lap end drawing position, and the guide plate 38 is arranged to be substantially parallel with the common tangent of the front lap roller 12 and the lap roll LW. Thereafter, when the lap rollers 12 are driven to rotate in the forward direction, compressed air is discharged from the slit 33a of the nozzle pipe 33. The succeeding lap end E2 is moved toward the front lap roller 12 by the forward rotation of the lap rollers 12, and then contacts and moves over the front lap roller 12. When contacting and moving over the front lap roller 12, the succeeding lap end E2 is pressed against the lap roll LW.

[0028] The compressed air discharged from the slit 33a moves along the guide plate 38, which extends from a position close to the front lap roller 12 and parallel with the common tangent of the lap roller 12 and the lap roll LW. Thus, the compressed air discharged from the slit 33a creates a negative pressure in a zone on the surface of the lap roll LW that is close to the proximal end of the guide plate 38. The negative pressure separates the succeeding lap end E2, which is pressed against the lap roll LW, from the surface of the lap roll LW. This allows the succeeding lap end E2 to move along the surface of the guide plate 38 as the lap roll LW is rotated in the forward direction as shown in Fig. 7B. When a predetermined time has elapsed, the rotation of the lap rollers 12 is stopped. At this time, the tip of the succeeding lap end E2 is located forward of the distal end of the guide plate 38.

[0029] Next, the nozzle pipe 33 is moved from the lap end drawing position to the overlap guiding position as shown in Fig. 8A. The distance from the contact position between the front lap roller 12 and the lap roll LW to the distal end of the guide plate 38 changes between when the nozzle pipe 33 is arranged at the lap end drawing position and when the nozzle pipe 33 is located at the overlap guiding position. Specifically, the distance is longer when the nozzle pipe 33 is arranged at the overlap guiding position. Thus, as the nozzle pipe 33 is moved from the lap end drawing position to the overlap guiding position with the lap rollers 12 in a stopped state, the tip of the succeeding lap end E2 is moved toward the proximal end of the guide plate 38. As a result, when the nozzle pipe 33 is arranged at the overlap guiding position, the length of the part of the succeeding lap end E2 that extends from the distal end of the guide plate 38 is short in comparison with a case in which the nozzle pipe 33 is arranged at the lap end drawing position.

[0030] In this regard, the lap rollers 12 are driven to rotate in the forward direction as the nozzle pipe 33 is moved from the lap end drawing position to the overlap guiding position such that the length of the part of the succeeding lap end E2 that extends from the distal end of the guide plate 38 is equalized between when the nozzle pipe 33 is arranged at the lap end drawing position and when the nozzle pipe 33 is located at the overlap guiding position. The amount of the forward rotation of

the lap rollers 12 is determined such that, when the nozzle pipe 33 is arranged at the overlap guiding position, the length of the part of the succeeding lap end E2 that extends from the distal end of the guide plate 38 corresponds to an desired overlap length of the preceding lap end E1 and the succeeding lap end E2. The discharge of the compressed air from the slit 33a is stopped when the nozzle pipe 33 is being moved from the lap end drawing position to the overlap guiding position, so that the compressed air discharged from the slit 33a does not adversely affect the preceding lap end E1 in a state in which the guide plate 38 is arranged to face the preceding lap end E1 as the nozzle pipe 33 is moved. As a result, as illustrated in Fig. 8A, when the nozzle pipe 33 is arranged at the overlap guiding position, the succeeding lap end E2, which protrudes from the distal end of the guide plate 38, is overlapped onto the preceding lap end E1.

[0031] Then, as shown in Fig. 8B, the lap rollers 12 are driven to rotate in the forward direction, and the carrier roller 30 is rotated in a direction for feeding the preceding lap end E1. The gas discharge pipe 32 discharges compressed air to the overlapping portion of the preceding lap end E1 and the succeeding lap end E2. The compressed air discharged from the gas discharge pipe 32 intertwines the fibers in the overlapping portion of the preceding lap end E1 and the succeeding lap end E2. Thereafter, the overlapping portion passes between the carrier roller 30 and the top roller 31 while being pressed by the rollers 30, 31. The lap splicing is thus completed. In Figs. 5A to 8B, components such as the arms 37 and the cylinder 41 are omitted.

[0032] After completion of the lap splicing, the comb 10 is started. The spliced lap portion passes through the combing section 13 to form a sliver S. When the sliver S is delivered to the guide table 16 via the calender roller set 25, the detecting section 46 detects the size of the sliver S, which is an overlap thickness corresponding amount, which corresponds to the thickness of the lap overlapping portion. The controller C receives a detection signal from the detecting section 46 and determines whether the detected size of the sliver S is within a range that corresponds to a predetermined proper thickness of the spliced lap portion. If the size of the sliver S is displaced from the predetermined range, the controller C changes a parameter related to the lap splicing to reduce the amount of displacement and performs the next lap splicing operation based on the changed parameter.

[0033] After the lap splicing is performed, if the size of the sliver S detected by the detecting section 46 is displaced from the predetermined range, the controller C changes a parameter related to the next lap splicing, that is, the overlap length, such that the amount of displacement will be reduced. If the size of the sliver S detected by the detecting section 46 is within the predetermined range, the next lap splicing operation will be performed under the same conditions. Therefore, if the thickness of the lap overlapping portion is displaced from the prede-

terminated range, the lap splicing is repeated while changing the value of a parameter, so that the lap ends E1, E2 are joined in a proper manner.

[0034] In the lap splicing, the lap L is not cut with a cutting tool. Instead, with a part held, the lap L is cut by being pulled at a position separated from the held part. That is, the lap L is cut when the fibers forming the lap L are pulled and separated between the held side and the pulled side. Therefore, the fiber density of the cut ends of the lap L is smaller than that in the other parts as schematically illustrated in Figs. 9A to 9C. If the cut section of the preceding lap end E1 and the cut section of the succeeding lap end E2 are properly overlapped at the overlapping portion of the preceding lap end E1 and the succeeding lap end E2 as shown in Fig. 9A, the fibers in the lap L are uniformized at the joint, so that the fibers in the sliver S made of the lap L is uniformized.

[0035] However, if the overlap length of the cut section of the preceding lap end E1 and the cut section of the succeeding lap end E2 is shorter than the proper overlap length by a length L_s as illustrated in Fig. 9B, the lap L will be thin at the joint, and the size of the sliver S made of the lap L will be small at the part corresponding to the joint. Also, if the overlap length of the cut section of the preceding lap end E1 and the cut section of the succeeding lap end E2 is longer than the proper overlap length by a length L_f as illustrated in Fig. 9C, the lap L will be thick at the joint, and the size of the sliver S made of the lap L will be great at the part corresponding to the joint. In this regard, if the size of the sliver S, which is detected by the detecting section 46, is out of the predetermined range, the controller C changes a parameter related to the lap splicing such that the amount of displacement decreases, and performs the next lap splicing operation. Therefore, even if the initially set overlap length is not proper, the overlap length will be properly controlled in repetitive executions of the lap splicing.

[0036] The present embodiment achieves the following advantages.

(1) The comber 10 of the present embodiment includes the automatic lap splicing apparatus, which overlaps and joins a succeeding lap end and a preceding lap end. The automatic lap splicing apparatus includes the detecting sections 46 and the parameter changing section (the controller C). The detecting sections 46 each detect an overlap thickness corresponding amount, which corresponds to the overlap thickness of a lap overlapping portion. For each combing head 11, the parameter changing section changes a parameter related to the lap splicing in accordance with the overlap thickness corresponding amount detected by the detecting section 46. Therefore, if the thickness of the lap overlapping portion in each combing head 11 is out of the predetermined range, the lap splicing is repeated while changing the value of the parameter, so that the preceding lap end E1 and the succeeding lap end E2

are joined in a proper manner.

(2) The detecting sections 46 detect the sizes of the slivers S before doubling. In the case of the comber 10, the thickness of the lap overlapping portion is not detected in each combing head 11. Instead, the size of the sliver S, which has been combed by the combing head 11 to become the fleece F and concentrated by the guiding plate 14, is detected as the lap overlap thickness corresponding amount. Compared to a case in which the thickness of a lap overlapping portion is detected, variation of the detection accuracy is small. In the comber 10, other than the slivers S formed by the combing heads 11, there is a sliver S that is formed by doubling and drafting the slivers S formed by the combing heads 11. The detecting accuracy is higher when the sizes of the slivers S before doubling are detected than when the size of the doubled sliver S is detected.

(3) The parameter related to the lap splicing is the overlap length of the preceding lap end E1 and the succeeding lap end E2. Parameters that affect the thickness of the lap overlapping portion include the overlap length and the extent of intertwining of the fibers at the lap overlapping portion. The overlap length affects the lap overlap thickness by a greater extent than the extent of the intertwining. Thus, using the overlap length as the parameter related to the lap splicing ensures high detection accuracy.

[0037] The present embodiment is not limited to the above configuration, but may be modified as follows.

[0038] In the above illustrated embodiment, the size of the sliver S is detected at the calender roller set 25 as the overlap thickness corresponding amount, which correspond to the thickness of the lap overlapping portion. Instead, the thickness of a lap passing through between the carrier roller 30 and the top roller 31 may be detected. For example, the top roller 31 may be configured to be movable at the operational position in accordance with the thickness of the lap L, and the movement amount may be detected.

[0039] The detecting section 46, which detects the size of the sliver S, is not limited to a distance sensor that detects the distance between the driver roller 25a and the driven roller 25b, which form the calender roller set 25. For example, a trumpet may be arranged between the guiding plate 14 and the delivery roller 24, and the trumpet may be provided with a detecting section that detects the size of the sliver passing through the trumpet. The detecting section may include a detecting member that is contactable with the sliver passing through the trumpet and may be configured to detect changes in the position of the detecting member. The detecting member is urged by an urging member such as a spring so that the position of the detecting member is changed in accordance with the size of the sliver passing through the trumpet.

[0040] The detecting section 46, which detects the size

of the sliver S, is not limited to a mechanical sensor. That is, the detecting section 46 does not necessarily need to be moved in accordance with the size of the sliver S to detect the amount of the movement. Instead, the detecting section 46 may be a capacitance sensor.

[0041] Instead of the size of the sliver S prior to doubling, the size of the sliver S after doubling and drafting at the draft section 18 may be detected. However, in the doubled sliver, it is difficult to localize a part that corresponds to the spliced lap portion of the slivers before doubling. Thus, the detection accuracy is higher if the size of the sliver S before doubling is detected.

[0042] The slit 33a of the nozzle pipe 33 may be replaced by a number of holes, so that compressed air is discharged through the holes.

[0043] The parameters related to the lap splicing may include, in addition to the overlap length, the flow rate or the time duration of discharge of air onto the overlapping portion of the succeeding lap end E2 and the preceding lap end E1. The intertwined state of the fibers of the succeeding lap end E2 and the fibers of the preceding lap end E1 varies depending on the flow rate or time duration of discharge of air onto the overlapping portion, and the size of the sliver is changed in accordance with the intertwined state of the fibers. If the amount of intertwined fibers of the succeeding lap end E2 and the preceding lap end E1 is small, the sliver is formed to have a relatively small size because the sliver is pulled in the middle of lap splicing. The air discharge flow rate or discharge time duration is thus decreased when the size of the sliver S is above the predetermined range, and is increased when the size of the sliver S is below the predetermined range. The extent of changes in the overlap length and the extent of changes in the air discharge flow rate or the air discharge time duration are stored in a memory of the controller C in advance through experimentation. If the parameters include, in addition to the overlap length, the flow rate or the time duration of discharge of air discharged onto the overlapping portion, the preceding lap end E1 and the succeeding lap end E2 can be more properly joined compared to a case in which only the overlap length is used as a parameter.

[0044] In the illustrated embodiment, the parameter is changed each time the detecting section 46 detects the overlap thickness corresponding amount after lap splicing is executed in each combing head 11. The present invention is not limited to this. Specifically, the parameter may be changed based on the average value of the overlap thickness corresponding amounts that have been detected over several operations in the past by the detecting section 46 or based on another functional calculus such as the least squares method.

[0045] The center of pivoting motion of the arms 37 does not necessarily need to be located at the same position as the axis of the front lap roller 12. For example, the center of pivoting motion of the arms 37 may be arranged such that the distance from the contact position between the front lap roller 12 and the lap roll LW to the

distal end of the guide plate 38 remains the same between when the nozzle pipe 33 is arranged at the lap end drawing position and when the nozzle pipe 33 is located at the overlap guiding position. In this case, the lap rollers 12 do not need to be driven when the nozzle pipe 33 is moved to the overlap guiding position after the nozzle pipe 33 is arranged at the lap end drawing position, the succeeding lap end E2 is drawn from a new lap roll LW, and rotation of the lap rollers 12 is stopped.

[0046] The nozzle pipe 33 does not necessarily need to be moved between the lap end drawing position and the overlap guiding position by the pivotal arms 37. For example, the nozzle pipe 33 may be moved between the lap end drawing position and the overlap guiding position by a robotic arm.

[0047] The guide plate 38 of the nozzle pipe 33 does not necessarily need to be formed to extend radially outward from the center of the nozzle pipe 33. For example, the guide plate 38 may be formed to extend substantially along a tangent of the nozzle pipe 33, and the slit 33a may be formed to discharge air substantially along the tangent.

[0048] The present invention is not limited to an automatic lap splicing apparatus of a comber, but may be applied to an automatic lap splicing apparatus of a ribbon lap machine.

[0049] Adjustment of the parameter in the automatic lap splicing apparatus does not necessarily need to be performed at replacement of lap rolls LW, but may be performed during initial setting of a comber or a ribbon lap machine by repeating lap splicing several times with a new lap roll LW to adjust the parameter to a proper value. In the comber 10, the lap roll LW is replaced after approximately two hour continuous operation. At replacement of the lap roll LW, it takes a long time to obtain the optimal conditions if the parameter is adjusted based on the detection results of the detecting sections 46. However, if the operation is started after repeating lap splicing to adjust the parameter to obtain the optimal operational state at the initial setting, the comber or the ribbon lap machine is permitted to operate to obtain the optimal spliced lap portion.

[0050] Therefore, the present examples and embodiments are to be considered as illustrative and not restrictive and the invention is not to be limited to the details given herein, but may be modified within the scope and equivalence of the appended claims.

[0051] An automatic lap splicing apparatus for a ribbon lap machine or a comber is provided. The apparatus performs lap splicing by overlapping and joining an end of a succeeding lap and an end of a preceding lap. The apparatus includes a detecting section and a parameter changing section. The detecting section detects an overlap thickness corresponding amount, which corresponds to a thickness of an overlapping portion of the succeeding lap and the preceding lap. The parameter changing section changes a parameter related to lap splicing in accordance with the overlap thickness corre-

sponding amount detected by the detecting section.

Claims

1. An automatic lap splicing apparatus for a ribbon lap machine or a comb, wherein the apparatus performs lap splicing by overlapping and joining an end (E2) of a succeeding lap and an end (E1) of a preceding lap, the apparatus being **characterized by**:

a detecting section (46), which detects an overlap thickness corresponding amount, which corresponds to a thickness of an overlapping portion of the succeeding lap and the preceding lap; and

a parameter changing section (C), which changes a parameter related to lap splicing in accordance with the overlap thickness corresponding amount detected by the detecting section (46).

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2. The automatic lap splicing apparatus according to claim 1, characterize in that the detecting section (46) detects as, the overlapping thickness corresponding amount, a size of a sliver before being doubled.

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3. The automatic lap splicing apparatus according to claim 1 or 2, **characterized in that** the parameter includes an overlap length of the succeeding lap and the preceding lap.

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4. The automatic lap splicing apparatus according to claim 3, **characterized in that** the parameter includes a flow rate or a time duration of discharge of air onto the overlapping portion.

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5. The automatic lap splicing apparatus according to any one of claims 1 to 4, **characterized in that** the parameter changing section (C) changes the parameter based on overlap thickness corresponding amounts that have been detected over several operations in the past by the detecting section (46).

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Fig. 1

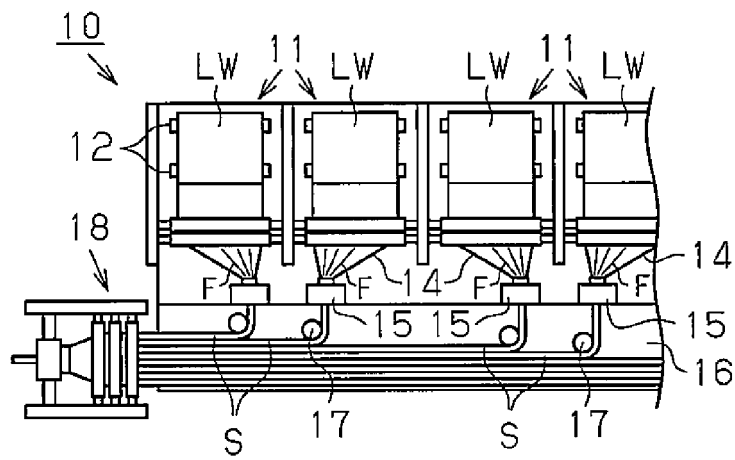


Fig.2

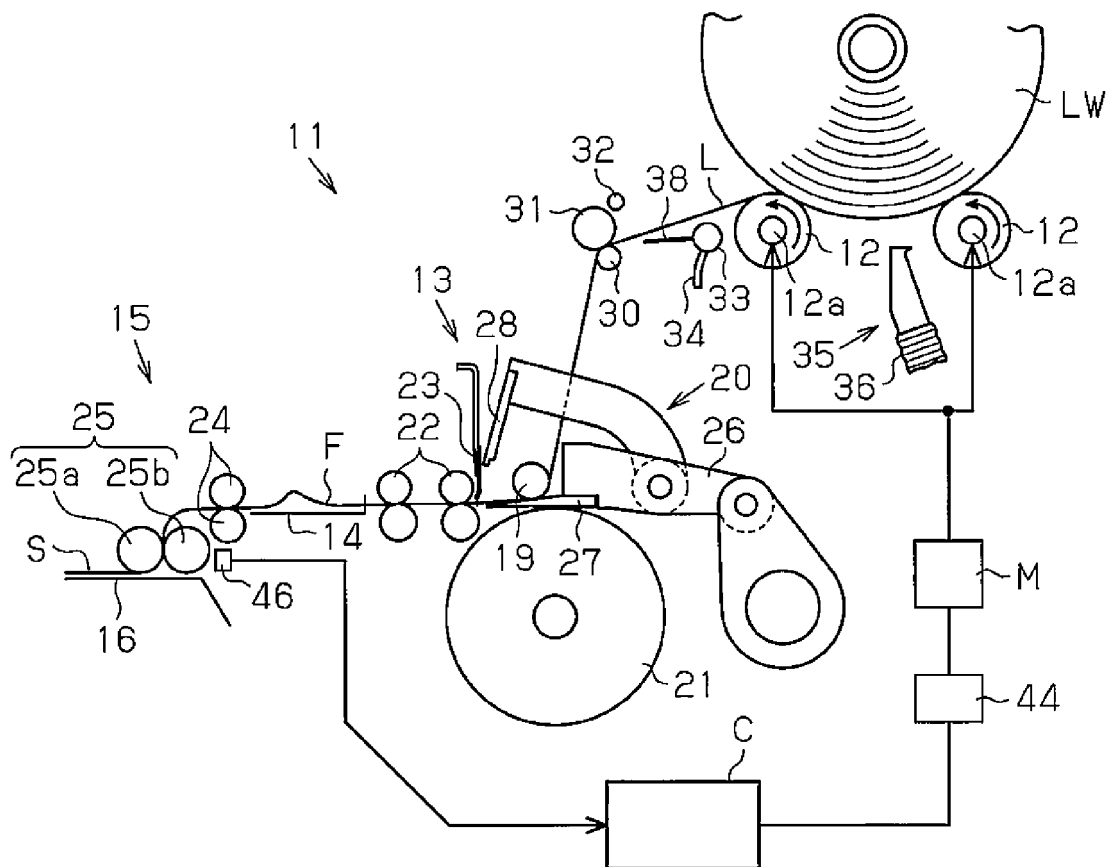


Fig.3

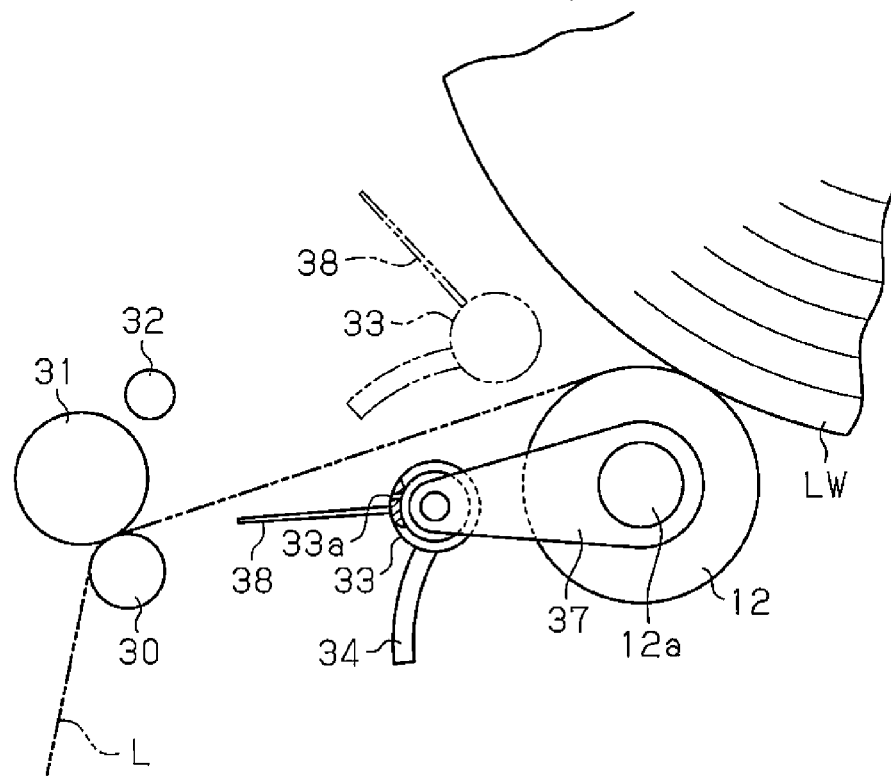


Fig.4

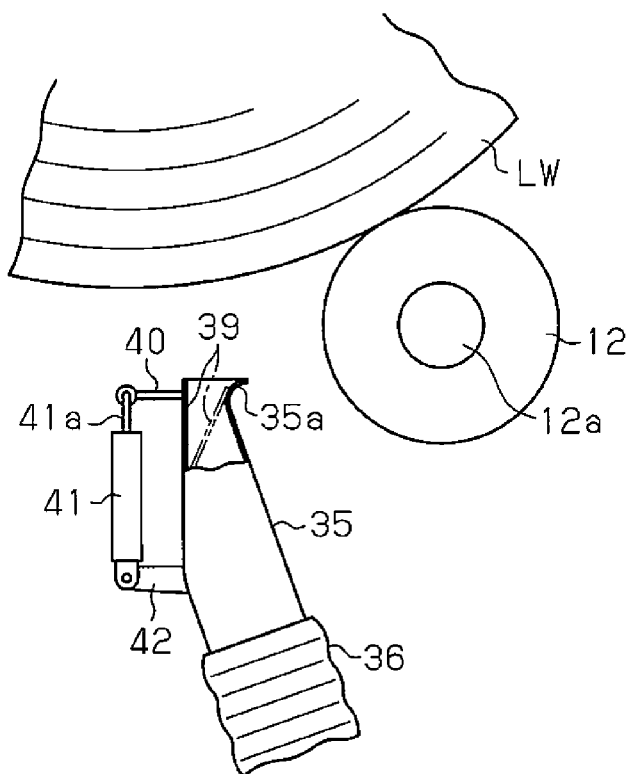


Fig. 6A

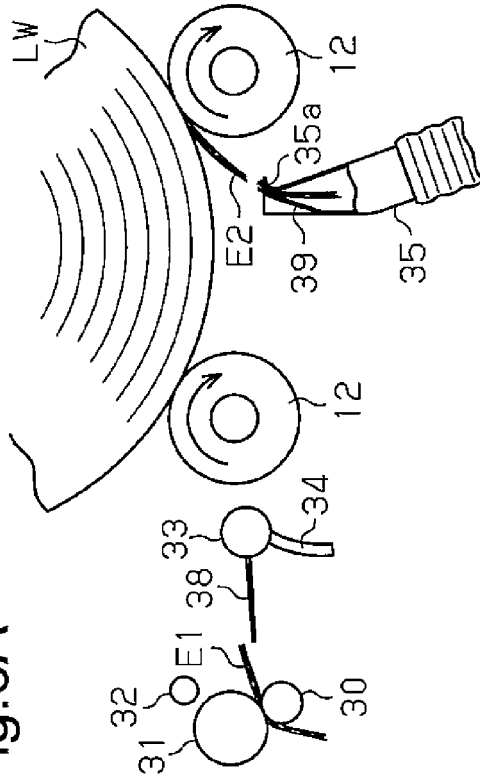


Fig. 6B

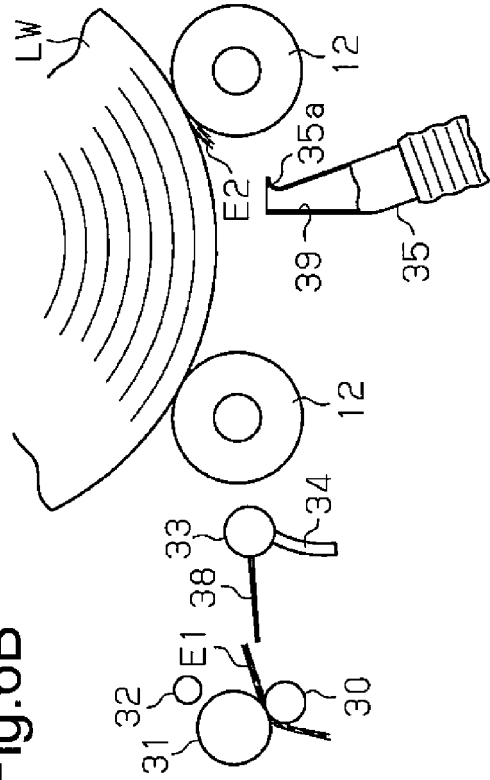


Fig. 5A

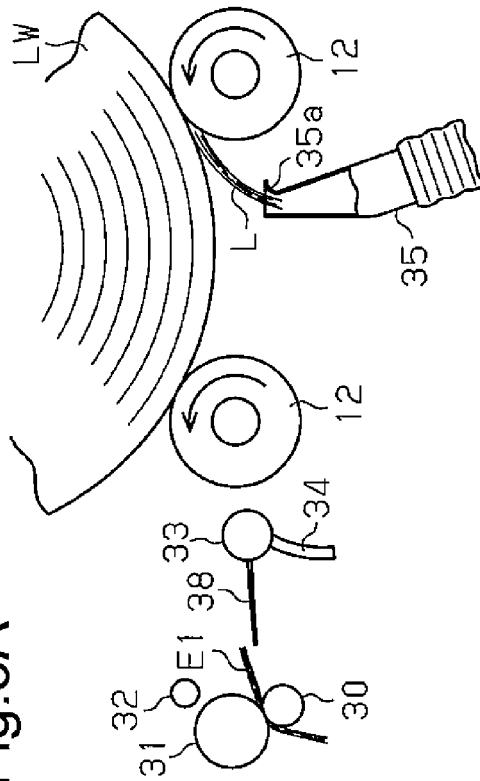


Fig. 5B

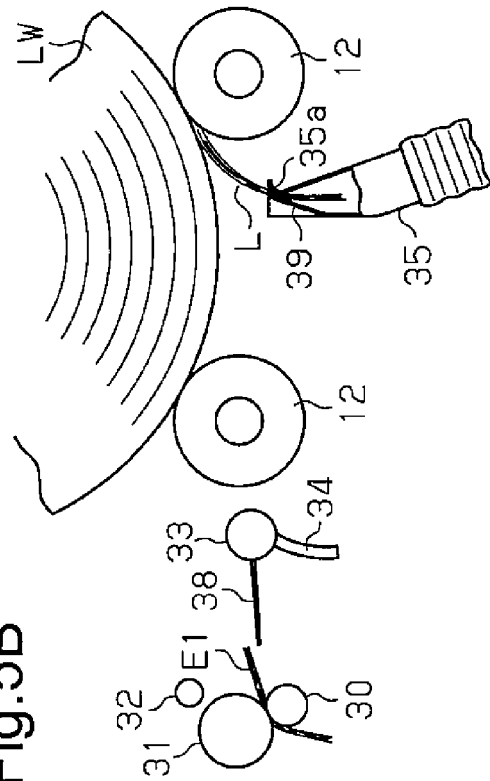


Fig.8A

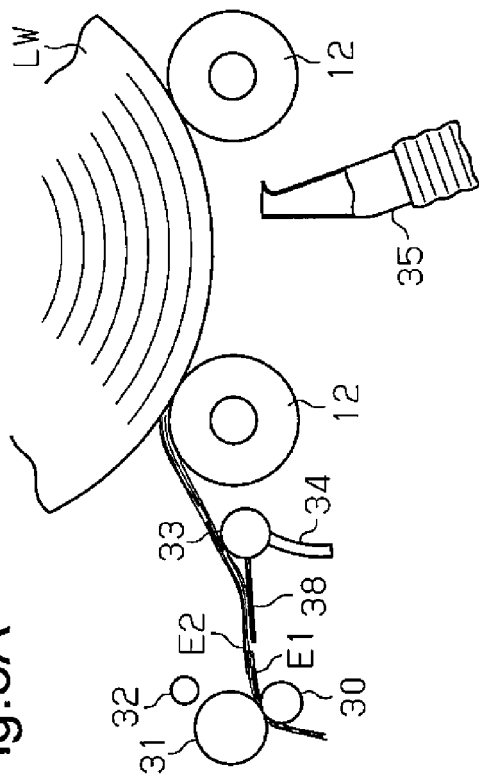


Fig.8B

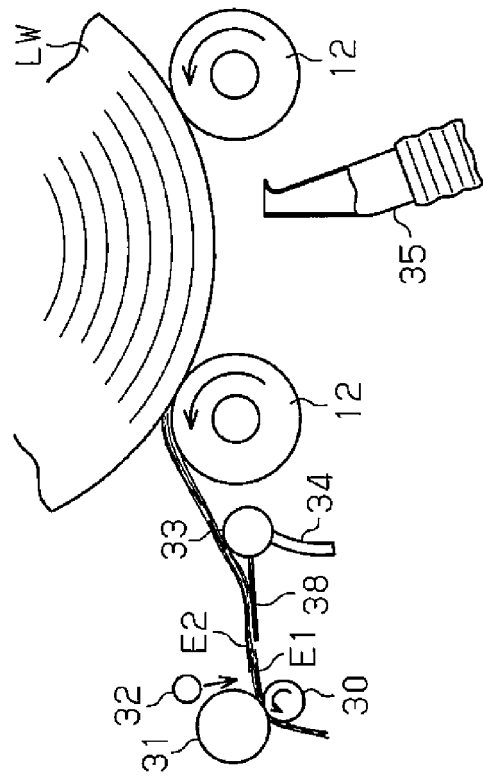


Fig.7A

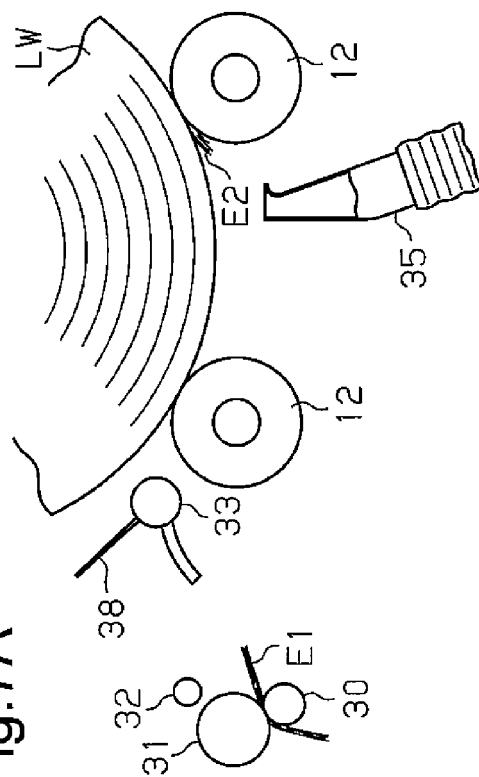


Fig.7B

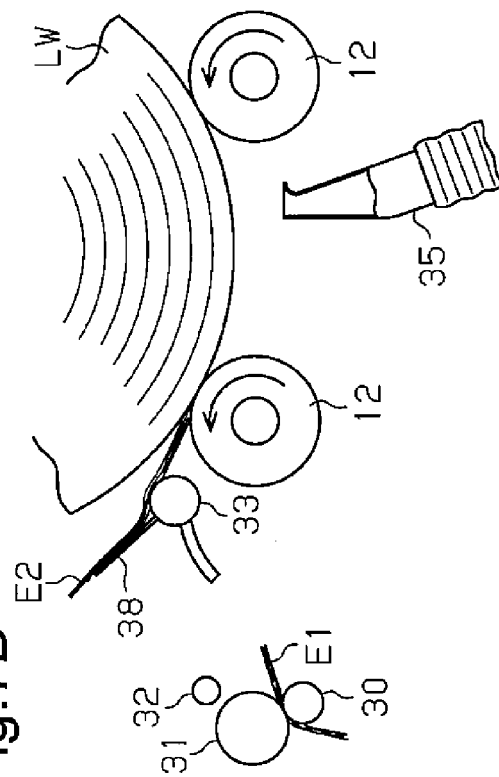


Fig.9A

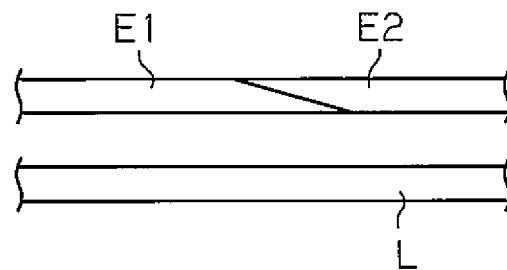


Fig.9B

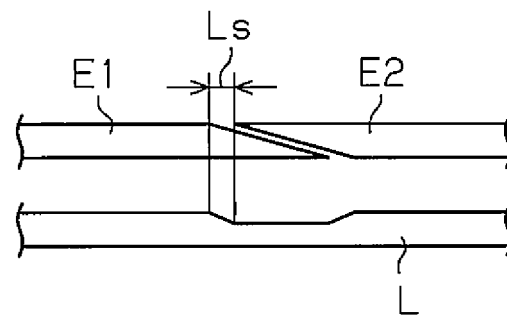
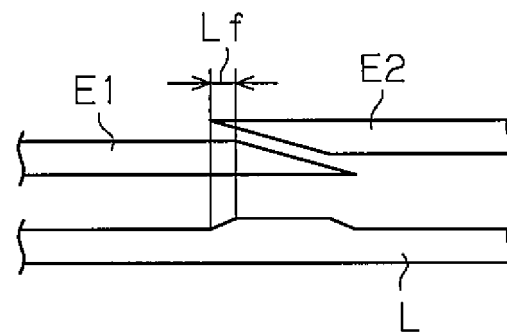


Fig.9C



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 4222234 A [0002]
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