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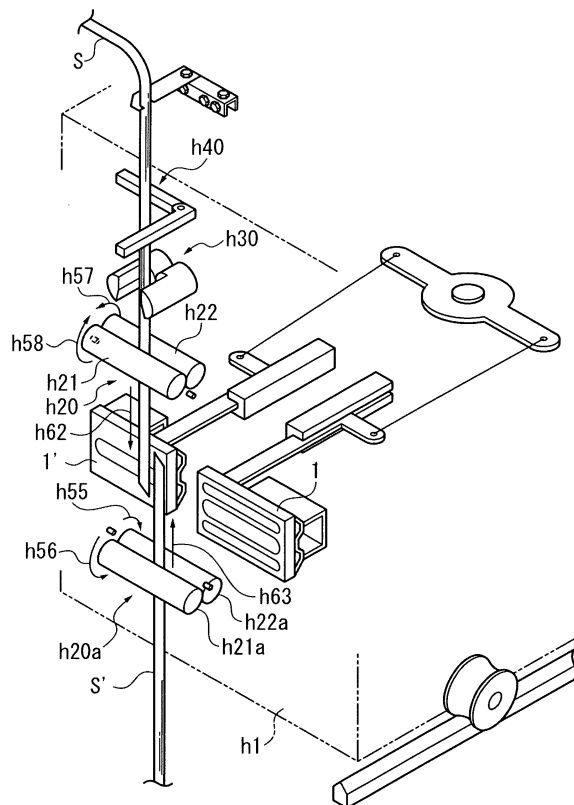
(30) Priority: **20.08.2007 JP 2007213340**

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(54) **Sliver piecing device**

(57) The present invention allows sliver ends to be stably pieced together so that the resulting slivers exhibit a required strength. A sliver piecing device includes a pair of piecing members 1, 1' that slide alternately with ends S11, S11' of a pair of slivers S, S' sandwiched between the piecing members 1, 1' to rub and piece the ends together. The piecing members 1, 1' both comprise respective entanglement preventing groove portions 10, 10' preventing entanglement during rubbing, on respective surfaces 1a, 1a' between which the sliver ends S11, S11' are sandwiched. Each of the entanglement preventing groove portions 10, 10' is formed in a central portion of the sandwiching surface 1a, 1a' so as to extend in a sliding direction 1b, 1b' (Fig. 12).

FIGURE 12



Description

Field of the Invention

[0001] The present invention relates to a sliver piecing device that pieces an old sliver from an empty sliver can and a new sliver from a full sliver can together.

Background of the Invention

[0002] Sliver cans are arranged behind a spinning machine so that slivers from the sliver cans are supplied to the spinning machine for spinning. When the sliver can from which the sliver is being supplied becomes substantially empty (the empty sliver can), a predetermined vehicle replaces the empty sliver can with a sliver can full of sliver (a full sliver can). During the replacement, a sliver piecing device provided on the vehicle pieces an end of the sliver (old sliver) from the empty sliver can and an end of the sliver (new sliver) from the full sliver can together. Thus, the spinning machine can continuously supply the sliver. The sliver piecing device comprises a pair of piecing members that pieces the ends of the slivers together (reference numerals h3, h3' shown in Figure 10 and other figures in the Unexamined Japanese Patent Application Publication (Tokkai-Hei) No. 9-105036).

[0003] The piecing members slide alternately with the ends of the slivers sandwiched between the piecing members to rub and piece the ends together. The piecing members have flat surfaces (sandwiching surfaces) between which the sliver ends are sandwiched and rubbed. Thus, the entire sliver ends are evenly rubbed. Consequently, a pieced portion between the sliver ends may exhibit an insufficient or unstable strength depending on the number of fibers in the slivers. Then, disadvantageously, the pieced portion of the slivers may fail to be evenly drafted by a draft device or the pieced portion may be blocked in a spindle of the spinning machine.

Summary of the Invention

[0004] Thus, an object of the present invention is to provide a sliver piecing device capable of stably piecing the ends of the slivers together so that the resulting slivers exhibit the required strength, in order to solve the above-described problems.

[0005] To accomplish the object, a sliver piecing device according to the present invention comprises a pair of piecing members that slide alternately with the sliver ends sandwiched between the piecing members to rub and piece the sliver ends together.

[0006] The piecing members both comprise respective entanglement preventing groove portions preventing entanglement during rubbing, on respective surfaces between which the sliver ends are sandwiched.

[0007] Each of the entanglement preventing groove portions is formed in a central portion of the sandwiching surface so as to extend in a sliding direction.

[0008] Preferably, any one of the piecing members comprises a groove portion on each of opposite side portions of the entanglement preventing groove portion on the sandwiching surface.

[0009] Preferably, each of the piecing members comprises a resisting portion on each of the opposite side portions of the entanglement preventing groove portion on the sandwiching surface.

[0010] According to the present invention, as described above, the piecing members both comprise the respective entanglement preventing groove portions preventing entanglement during rubbing, on the respective surfaces between which the sliver ends are sandwiched. Moreover, each of the entanglement preventing groove portions is formed in the central portion of the sandwiching surface so as to extend in the sliding direction. Thus, even though the slivers are sandwiched between the piecing members, the entanglement preventing groove portions form a space portion. Consequently, in the space portion (entanglement preventing groove portions), the sliver ends are prevented from being rubbed and are thus unlikely to be entangled with each other. The sliver ends are rubbed and entangled with each other on the opposite ends of each of the entanglement preventing groove portion (space portion).

[0011] That is, in the entanglement preventing groove portions (space portion), the direction of fibers in the sliver ends remains along the direction of a yarn path. The sliver ends are rubbed on the opposite sides of each of the entanglement preventing groove portions and entangled with each other in a direction orthogonal to the yarn path. Consequently, tips of the sliver ends are entangled with the sliver ends, significantly improving and stabilizing piecing strength regardless of the number of fibers in the sliver.

[0012] Other features, elements, processes, steps, characteristics and advantages of the present invention will become more apparent from the following detailed description of preferred embodiments of the present invention with reference to the attached drawings.

Brief Description of the Drawings

[0013]

Figure 1 is a plan view showing a spinning system. Figure 2 is a front view showing the spinning system. Figure 3 is a front view showing the spinning system. Figure 4 is a perspective view illustrating a sliver piecing operation performed by a piecing device. Figure 5 is a perspective view continued from Figure 4. Figure 6 is a perspective view continued from Figure 5. Figure 7 is a perspective view continued from Figure 6. Figure 8 is a perspective view continued from Figure 7.

Figure 9 is a perspective view continued from Figure 8.

Figure 10 is a perspective view continued from Figure 9.

Figure 11 is a perspective view continued from Figure 10.

Figure 12 is a perspective view continued from Figure 11.

Figure 13 is a perspective view continued from Figure 12.

Figure 14 is a perspective view continued from Figure 13.

Figure 15 is a diagram illustrating a piecing member.

Detailed Description of the Preferred Embodiments

[0014] A sliver piecing device according to the present invention will be described with reference to the drawings.

[Operation of the Sliver Piecing Vehicle]

[0015] Figure 1 is a plan view showing a spinning system. Figure 2 and Figure 3 are front views showing the spinning system. As shown in Figure 1, the spinning system comprises a rotor-type open end spinning machine 3. The spinning machine 3 comprises a plurality of spinning units 30. As shown in Figure 2, a sliver can C in which sliver S is housed is located under each of the spinning units 30. The spinning unit 30 traverses the sliver S drawn out of the sliver can C while twisting the sliver S to wind the sliver 32 into a package.

[0016] The spinning system comprises a sliver piecing vehicle 4. As shown in Figure 1, the sliver piecing vehicle 4 circulates around the periphery of the spinning machine 3 along a guide rail 43. As shown in Figure 2, the guide rail 43 is provided on a ceiling. The sliver piecing vehicle 4 comprises a conveying device 42 at the top thereof. The conveying device 42 is coupled to the guide rail 43. The sliver piecing vehicle 4 is conveyed by the hanging conveying device 42.

[0017] The spinning system comprises a control section 5. The control section 5 controls the operation of the spinning machine 3 and the sliver piecing vehicle 4. The spinning system comprises a detecting device (not shown in the drawings) composed of an operation time managing device, a sensor, and the like to detect that the sliver can C has become substantially empty. When the detecting device detects that the sliver can C has become substantially empty, the control section 5 gives an instruction to the spinning machine 3 and the sliver piecing vehicle 4 to perform operations described below.

[0018] The sliver piecing vehicle 4 circulates with the sliver can F full of sliver S' ("full sliver can") mounted thereon. The sliver piecing vehicle 4 has a placement space 44 located adjacent to the full sliver can F (Figure 1). The placement space 44 is a space in which an empty sliver can E is placed. On the basis of an instruction from

the control section 5, the sliver piecing vehicle 4 stops at the spinning unit 30 (hereinafter referred to as the "target spinning unit") for the can E in which the sliver S is to be exhausted (this sliver can is hereinafter referred to as the "empty sliver can") (Figure 1A).

[0019] The target spinning unit 30 stops a spinning operation to stop the supply of the sliver S from the empty can E. As shown in Figure 2, the spinning unit 30 comprises a belt conveyor-type sliver can replacing device 31 at the bottom thereof. Similarly, the sliver piecing vehicle 4 comprises a belt conveyor-type sliver can replacing device 40 at the bottom thereof. As shown in Figures 1A and 2, the sliver can replacing devices 31, 40 transfer the empty sliver can E from the target spinning unit 30 to the placement space 44 on the sliver piecing vehicle 4.

[0020] The sliver piecing vehicle 4 comprises a sliver piecing device 41. Although described below in detail, the sliver piecing device 41 grips an end of the sliver (hereinafter referred to as the "new sliver") S' from the full sliver can F (Figure 2). Then, the sliver piecing device 41 uses a drawing hook 410 to draw the sliver (hereinafter referred to as the "old sliver") S from the empty sliver can E closer to the sliver piecing device 41. The sliver piecing device 41 then pieces the old sliver S (the empty sliver can E is located closer to the reader in Figure 3) and the new sliver S' (the full sliver can F is located farther from the reader in Figure 3).

[0021] After the sliver piecing operation for the old sliver S and the new sliver S' is completed, the sliver piecing device 41 uses a discharging hook (not shown in the drawings) to move the slivers subjected to the sliver piecing, toward the spinning unit 30. In synchronism with this movement, as shown in Figure 1B, the sliver piecing vehicle 4 moves slightly forward and uses the sliver can replacing devices 31, 40 to load the full sliver can F into a position (target spinning unit position) from which the empty sliver can E is discharged.

[Sliver Piecing Operation]

[0022] Figures 4 to 14 are perspective views illustrating the sliver piecing operation performed by the piecing device. Figure 4 shows a standby state of the sliver piecing device 41. The sliver piecing device 41 comprises a piecing main body h1. The piecing main body h1 comprises a pair of piecing members 1, 1'. Although described below in detail, each of the piecing members 1, 1' is composed of a plate-like member. Roller pair portions h20, h20a are provided above and below, respectively, the piecing members 1, 1'. The roller pair portions h20, h20a sandwich the new sliver S' and the old sliver S between rollers at a position where the new sliver S' and the old sliver S are sandwiched between the piecing members 1, 1'.

[0023] The roller pair portion h20 comprises a driven roller h21 and a rotating roller h22, and the roller pair portion h20a comprises a driven roller h21a and a rotating roller h22a. The rotating rollers h22, h22a are fixed to the piecing main body h1 to perform a rotational driving op-

eration. During standby, the driven rollers h21, h21a are arranged at a 90 degrees position (shown by solid lines) where each of the driven rollers h21, h21a and the corresponding one of the rotating rollers h22, h22a form an L shape. To sandwich the slivers between the rollers, the driven rollers h21, h21a move to a position shown by alternate long and two short dashes lines.

[0024] Sensors h23, h24 are arranged between the rotating roller h22 and the driven roller h21 shown by the alternate long and two short dashes line, at the respective ends of the rollers and closer to the piecing members 1, 1' side, respectively (so that the sensors h23, h24 are arranged opposite each other). Sensors h23a, h24a are arranged between the rotating roller h22a and the driven roller h21a shown by the alternate long and two short dashes line, at the respective ends of the rollers and closer to the piecing members 1, 1' side, respectively (so that the sensors are arranged opposite each other). For each of the pair of the sensors h23, h24 and the pair of the sensors h23a, h24a, one of the sensors is a light emitter, while the other is a light receiver.

[0025] A half-moon roller pair portion h30 is provided above the roller pair portion h20. The half-moon roller pair portion h30 is composed of half-moon rollers h31, h32. The half-moon rollers h31, h32 are arranged in parallel in a direction orthogonal to a shaft of the rotating roller h22. In the roller pair portion h30, the half-moon rollers h31, h32 perform a rotational driving operation. The tip side of the half-moon roller pair portion h30 is shaped like a half moon. In a standby state, crescent sides of the half-moon rollers h31, h32 are arranged opposite each other. Thus, a gap is created in the half-moon roller pair portion h30.

[0026] A sandwiching member h40 is provided above the half-moon roller pair portion h30. The roller pair portion h20, the half-moon roller pair portion h30, and the sandwiching member h40 are arranged on a vertical line. The sandwiching member h40 is composed of a fixed member h42 and a movable member h41. The fixed member h42 is fixed to the piecing main body h1. The movable member h41 is rotatable around a shaft h43.

[0027] As shown in Figure 5, in this standby state, a suction arm b1 sucks and grips the end of the new sliver S' from the full sliver can F, located below, through a suction port b2. Subsequently, the suction arm b1 pivots to a substantially vertically upward position (in the direction of arrow b3) (Figure 2).

[0028] As shown in Figure 6, the driven rollers h21, h21a move (in the directions of arrows h50, h51) and lie in parallel, and are then biased by the rotating rollers h22, h22a, respectively. The new sliver S' guided by the suction arm b1 is sandwiched between the driven roller h21a and the rotating roller h22a, and between the driven roller h21 and the rotating roller h22.

[0029] As shown in Figure 7, the rotating rollers h22, h22a of the roller pair portions h20, h20a, respectively, rotate (in the directions of arrows h53, h55) to drivingly rotate the driven rollers h21, h21a of the roller pair por-

tions h20, h20a, respectively, (in the directions of arrows h54, h56). The new sliver S' sandwiched between the rotating roller h22 and the driven roller h21, and between the rotating roller h22a and the driven roller h21a is pulled between the roller pair portions h20, h20a so that the upper side is pulled in the direction of arrow h64, while the lower side is pulled in the direction of arrow h65. The new sliver S' is thus torn and cut between the roller pair portions h20, h20a.

[0030] For the upper side of the cut new sliver S', the sensors h23, h24 detects the end of the new sliver S', and the rotating roller h22 continues to perform a predetermined rotation. The upper side of the new sliver S' is thus sucked into the suction port b2 and then into a dust box (not shown in the drawings). The driven roller h21 moves (in the direction of arrow h52) back to the standby state shown by the alternate long and two short dashes line.

[0031] On the other hand, when the sensor h23a, h24a detects the lower end of the cut new sliver S', the driving of the rotating roller h22a is stopped. The rotating roller h22a and the driven roller h21a are then stopped with the end of the new sliver S' sandwiched between the rollers. Thus, a sliver piecing end is formed on the new sliver S' and located at a sliver piecing position.

[0032] Then, as shown in Figure 8, the old sliver S is transferred to the sliver piecing position by the drawing hook t10 (Figure 3). The piecing main body h1 comprises an appropriate number of wheels h2 and can reciprocate along a rail v1 disposed on the sliver piecing vehicle 4. The piecing main body h1 then moves (in the direction of arrow h66).

[0033] The old sliver S is located at the sandwiching position where the old sliver S is sandwiched between the fixed member h42 and the movable member h41 of the sandwiching member h40, the gap position where the crescent sides of the half-moon rollers h31, h32 of the half-moon roller pair portion h30 are arranged opposite each other, and the sandwiching portion where the old sliver S is sandwiched between the rotating roller h22 and the driven roller h21 of the roller pair portion h20.

[0034] As shown in Figure 9, in this state, the movable member h41 of the sandwiching member h40 moves (in the direction of arrow h67) so that the old sliver S is sandwiched between the fixed member h42 and the movable member h41. The driven roller h21 of the roller pair portion h20 moves (in the direction of arrow h51) so that the old sliver S is sandwiched between the rotating roller h22 and the driven roller h21.

[0035] As shown in Figure 10, in this state, the rotating roller h22 of the roller pair portion h20 rotates (in the direction of arrow h57). The driven roller h21 rotates in conjunction with the rotating roller h22 (in the direction of arrow h58). In conjunction with the rotation, the old sliver S sandwiched between the roller pair portion h20 and the sandwiching member h40 is pulled between the roller pair portion h20 and the sandwiching member h40. The old sliver S is torn and cut between the roller pair

portion h20 and the sandwiching portion h40. For the unwanted lower side of the cut old sliver S, the sensors h23, h24 sense the end of the old sliver S. Then, the roller pair portion h20 continues to perform a predetermined rotation. This portion of the old sliver S is dropped and discharged into the empty sliver can (in the direction of arrow h59). The piecing main body h1 then moves (in the direction of arrow h68).

[0036] As shown in Figure 11, in this state, the movable member h41 of the sandwiching member h40 moves (in the direction of arrow h69) to release the old sliver S. The end of the old sliver S falls toward the roller pair portion h20 owing to the slack and weight of the old sliver S.

[0037] Then, the half-moon roller h31 of the half-moon roller pair portion h30 moves in the direction of arrow h61, while the half-moon roller h32 of the half-moon roller pair portion h30 moves in the direction of arrow h60. Thus, the half-moon rollers h31, h32 of the half-moon roller pair portion h30 sandwich the old sliver S between the arc portions thereof to convey the end of the old sliver S in the direction of arrow h62. The old sliver S is reliably conveyed by the rotating roller h22 rotating in the direction of arrow h57 and by the driven roller h21 rotating in the direction of arrow h58. The end of the old sliver S is sandwiched between the rotating roller h22 and the driven roller h21. When the standby state is established where the crescent portions of the half-moon rollers h31, h32 lie opposite each other, the half-moon roller pair portion h30 stops to release the old sliver S.

[0038] Then, as shown in Figure 12, the rotating roller h22 of the roller pair portion h20 performs a predetermined rotation (in the direction of arrow h57). The rotating roller h22a of the roller pair portion h20a performs a predetermined rotation (in the direction of arrow h55). Then, the end of the old sliver S sandwiched between the rollers of the roller pair portion h20 is conveyed in the direction of arrow h62. On the other hand, the end of the new sliver S' sandwiched between the rollers of the roller pair portion h20a is conveyed in the direction of arrow h63.

[0039] Thus, the ends of the new sliver S' and the old sliver S are conveyed to the piecing portions 1, 1'. The ends of the new sliver S' and the old sliver S fed to the piecing portions 1, 1' are arranged so as not to collide against each other. The rotating rollers h22, h22a are rotationally controlled such that the new sliver S' and the old sliver S are fed to the piecing portions 1, 1' by a predetermined length so as to form an even pieced portion between the new sliver S' and the old sliver S after piecing.

[0040] As shown in Figure 13, the piecing members 1, 1' are coupled to sliding members h5, h5' via a pin h4 respectively. In the standby state, the piecing members 1, 1' are biased (open) so as to leave each other in opposite directions by means of appropriate spring members such as coil springs which are provided on the pin h4. The piecing main body h1 comprises guide blocks h6, h6'. Each of the guide blocks h6, h6' comprises a guide groove h7 in an axial direction. Each of the sliding

members h5, h5' is inserted and fitted into the guide groove h7.

[0041] The piecing member h1 comprises a lever h10. The lever h10 is rotatable around a shaft h9 provided upright in the vertical direction. The piecing main body h1 comprises rods h8, h8'. One end of each of the rods h8, h8' is coupled to the sliding member h5, h5', and the other end is coupled to a corresponding one of the opposite ends of the lever h10. Each of the piecing members 1, 1' comprises a presser member h11 on a rear surface side (opposite the sandwiching surface). The presser members h11 press the piecing members 1, 1' via appropriate numbers of rotating rollers h12, h13, respectively. The presser members h11 move rotationally around shafts h14, h14', respectively, provided upright on the piecing main body h1.

[0042] A predetermined driving device (not shown in the drawings) allows the presser members h11 to pivot around the shafts h14, h14', respectively, in the direction in which the presser members h11 approach each other. Thus, the presser members h11 move (close) the piecing members 1, 1' via the rotating rollers h12, h13 so that the piecing members 1, 1' approach each other. The piecing members 1, 1' sandwich the ends of the new sliver S' and the old sliver S between the piecing members 1, 1'.

[0043] Subsequently, the predetermined driving device (not shown in the drawings) swingably moves the lever h10 around the shaft h9. The sliding members h5, h5' thus slide along the guide grooves h7 in the guide blocks h6, h6', respectively. The piecing members 1, 1' then slide alternately in sliding directions (lateral directions) 1b, 1b' orthogonal to a yarn path direction (vertical direction) to rub against each other. The piecing members 1, 1' thus rub and piece the ends of the new sliver S' and the old sliver S sandwiched between the piecing members 1, 1'. The rotating rollers h12, h13, disposed on the presser members h11, allow the piecing members 1, 1' to rub smoothly against each other.

[0044] After the piecing of the old sliver S and the new sliver S' is completed, as shown in Figure 14, an operation is performed to open the piecing members 1, 1' as in the case of the standby state and to release the new sliver S' and the old sliver S from the roller pair portions h20, h20a. Moreover, all the members are returned to the standby states thereof. Then, the sliver piecing process is completed.

[Description of the Piecing Members]

[0045] Figure 15 is a diagram illustrating the piecing members. Figure 15A is a diagram showing that the piecing members 1, 1' are open (the slivers S, S' are not sandwiched between the piecing members 1, 1'). Figure 15B is a diagram showing that the piecing members 1, 1' are closed (the slivers S, S' are sandwiched between the piecing members 1, 1').

[0046] The piecing members 1, 1' are plate-like members having the same rectangular shape. The piecing

members 1, 1' comprises sandwiching surfaces 1a, 1a' between which the slivers S, S' are sandwiched (Figure 15A). The sandwiching surfaces 1a, 1a' of the piecing members 1, 1' stand opposite each other to sandwich the slivers S, S' between the sandwiching surfaces 1a, 1a'. With the ends S11, S11' of the slivers S, S' sandwiched between the sandwiching surfaces 1a, 1a' (Figure 15B), the piecing members 1, 1' slide alternately or only one of the piecing members 1, 1' slides, in the direction orthogonal (lateral direction) 1b, 1b' to the yarn path direction (vertical direction) S10 of the slivers S, S' to rub against each other. Then, as described above, the slivers S, S' are entangled with and pieced to each other (Figure 13).

[0047] Figure 15C is a sectional view taken along line I-I in Figure 15B. The old sliver S extends from above to below. The end S11 of the old sliver S is located substantially all over the sandwiching surfaces 1a, 1a' in the vertical direction. Furthermore, the new sliver S' extends from below to above. The end S11 of the old sliver S' is located substantially all over the sandwiching surfaces 1a, 1a' in the vertical direction. Thus, the ends S11, S11' of the slivers S, S' are overlappingly arranged substantially all over the sandwiching surfaces 1a, 1a' in the vertical direction. Therefore, the tip S12 of the old sliver S is located at the bottom of the sandwiching surfaces 1a, 1a'. The tip S12' of the new sliver S' is located at the top of the sandwiching surfaces 1a, 1a'.

[0048] The piecing members 1, 1' comprise entanglement preventing grooves 10, 10' formed in central portions of the sandwiching surfaces 1a, 1a', respectively, in the yarn path direction (vertical direction) S10 so as to extend in the sliding direction (lateral direction) 1b, 1b'. The entanglement preventing groove portions 10, 10' are formed relatively deep. With the slivers S, S' sandwiched between the piecing members 1, 1', the entanglement preventing groove portions 10, 10' form areas in which the slivers S, S' are not sandwiched (space portions 10, 10') and which correspond to the central portions of the sliver ends S11, S11' (Figure 15C). Consequently, the ends S11, S11' of the slivers S, S' are not sandwiched between the sandwiching surfaces 1a, 1a' in the area in which the ends are located in the entanglement preventing groove portions (space portions) 10, 10'.

[0049] Thus, even though the piecing members 1, 1' slide, the central portions of the sliver ends S11, S11' are prevented from being rubbed by the entanglement preventing groove portions (space portions) 10, 10' and remain in the yarn path direction S10 without being entangled with each other. The slivers S, S' are rubbed above and below the entanglement preventing groove portions 10, 10' on the sandwiching surfaces 1a, 1a'. Consequently, the sliver tips S12, S12' of the slivers S, S', which are arranged above and below the entanglement preventing groove portions 10, 10', are sandwiched between the sandwiching surfaces 1a, 1a' and rubbed and entangled with each other.

[0050] Thus, as shown in Figure 15D, the central por-

tions of the ends S11, S11' of the slivers S, S' are prevented from being rubbed or entangled with each other and remain arranged in the yarn path direction (vertical direction) S10. The tips S12, S12' are rubbed and shifted in the lateral direction and thus entangled with the slivers S, S'. Consequently, the tips S12, S12' of the slivers S, S' are entangled with the sliver ends S11, S11'. Piecing strength is thus significantly improved and stabilized regardless of the number of fibers members or the like.

[0051] Furthermore, one of the piecing members 1, 1', that is, the piecing member 1, comprises entangling groove portions 11, 11' above and below the entanglement preventing groove portions 10 on the sandwiching surface 1a. Moreover, the piecing members 1, 1' comprise resisting members 12, 12' above and below the entanglement preventing groove portions 10, 10' on the sandwiching surfaces 1a, 1a', respectively; the resisting members 12, 12' are rubber sheets or the like and exhibit a predetermined slipperiness and a predetermined adhesion. Thus, the sliver ends S11, S11' are likely to be rubbed and entangled with each other above and below the entanglement preventing groove portions 10, 10' on the sandwiching surfaces 1a, 1a', respectively. Consequently, the sliver tips S12, S12' are firmly and stably entangled with the slivers S, S'.

[0052] While the present invention has been described with respect to preferred embodiments thereof, it will be apparent to those skilled in the art that the disclosed invention may be modified in numerous ways and may assume many embodiments other than those specifically set out and described above. Accordingly, it is intended by the appended claims to cover all modifications of the present invention that fall within the true spirit and scope of the invention.

Claims

1. A sliver piecing device that pieces a pair of slivers together, the device being **characterized by** comprising a pair of piecing members that slide alternately with sliver ends sandwiched between said piecing members to rub and piece said sliver ends together, and in that said piecing members both comprise respective entanglement preventing groove portions preventing entanglement during rubbing, on respective surfaces between which said sliver ends are sandwiched, and each of said entanglement preventing groove portions is formed in a central portion of said sandwiching surface so as to extend in a sliding direction.
2. A sliver piecing device according to Claim 1, **characterized in that** any one of said piecing members comprises a groove portion on each of opposite side portions of said entanglement preventing groove portion on said sandwiching surface.

3. A sliver piecing device according to Claim 1 or Claim 2, **characterized in that** each of said piecing members comprises a resisting portion on each of the opposite side portions of said entanglement preventing groove portion on said sandwiching surface.

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FIGURE 1B

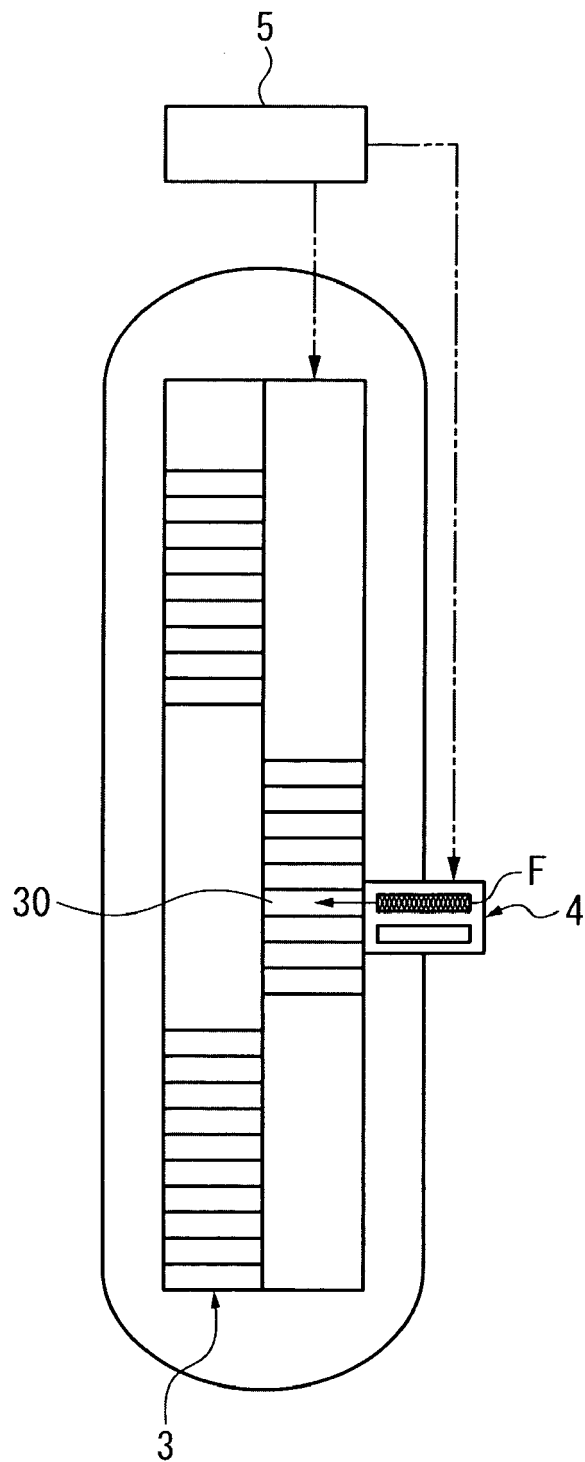


FIGURE 2

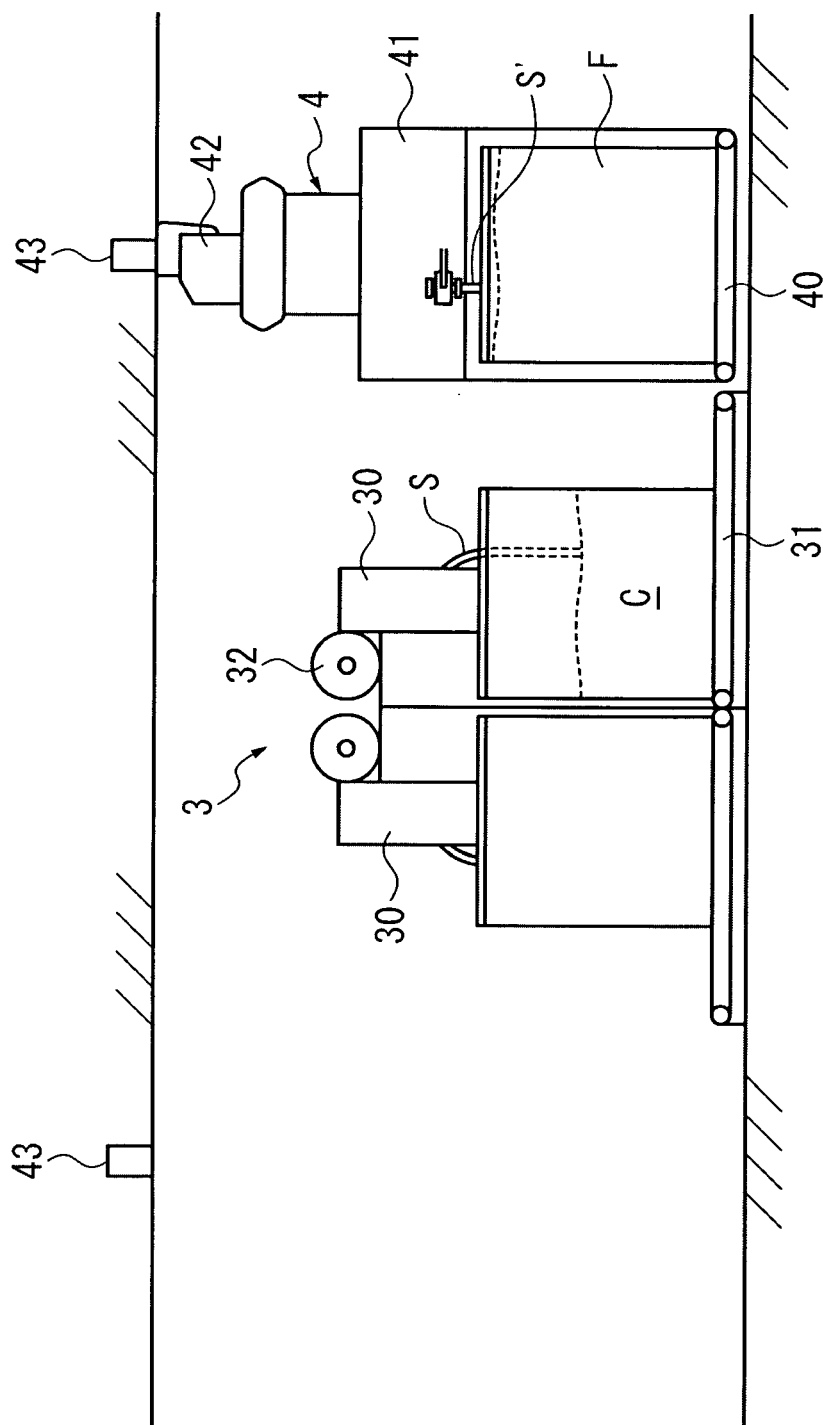


FIGURE 3

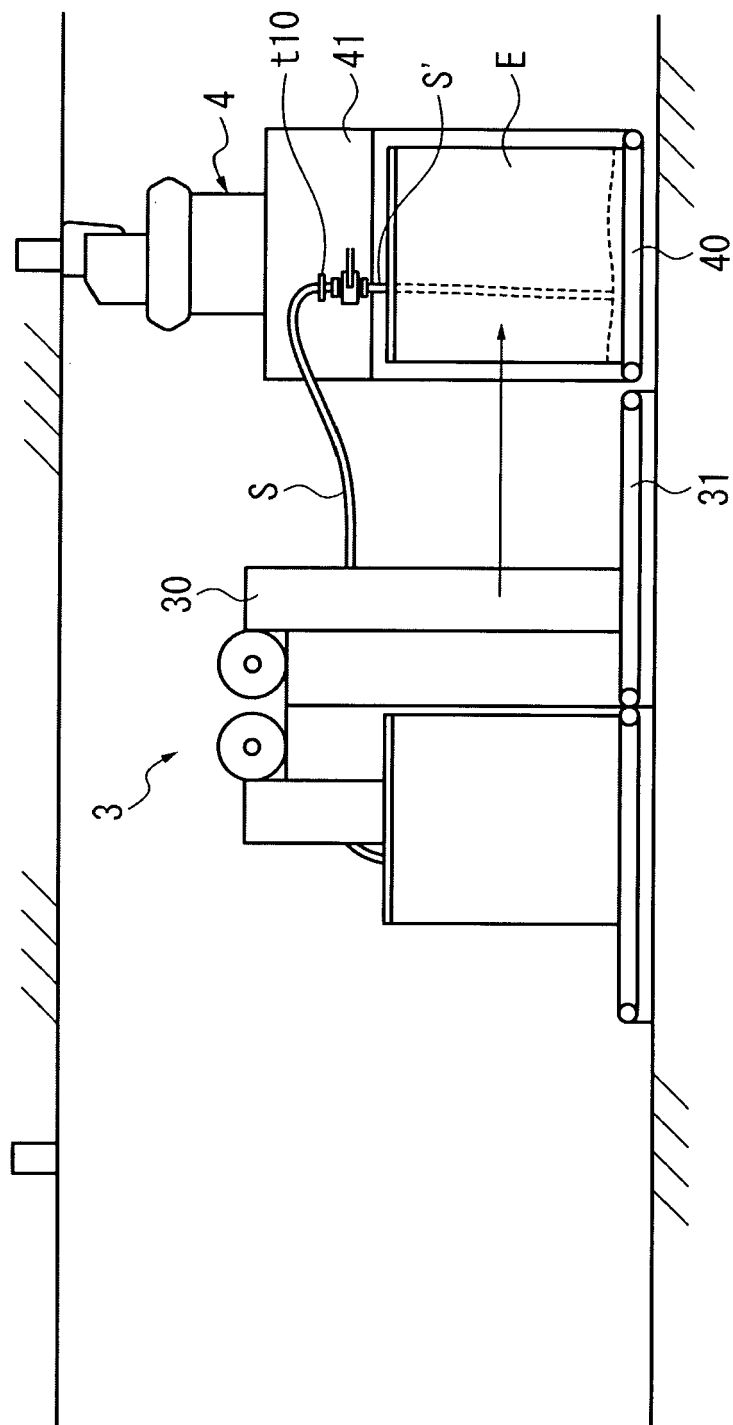


FIGURE 4

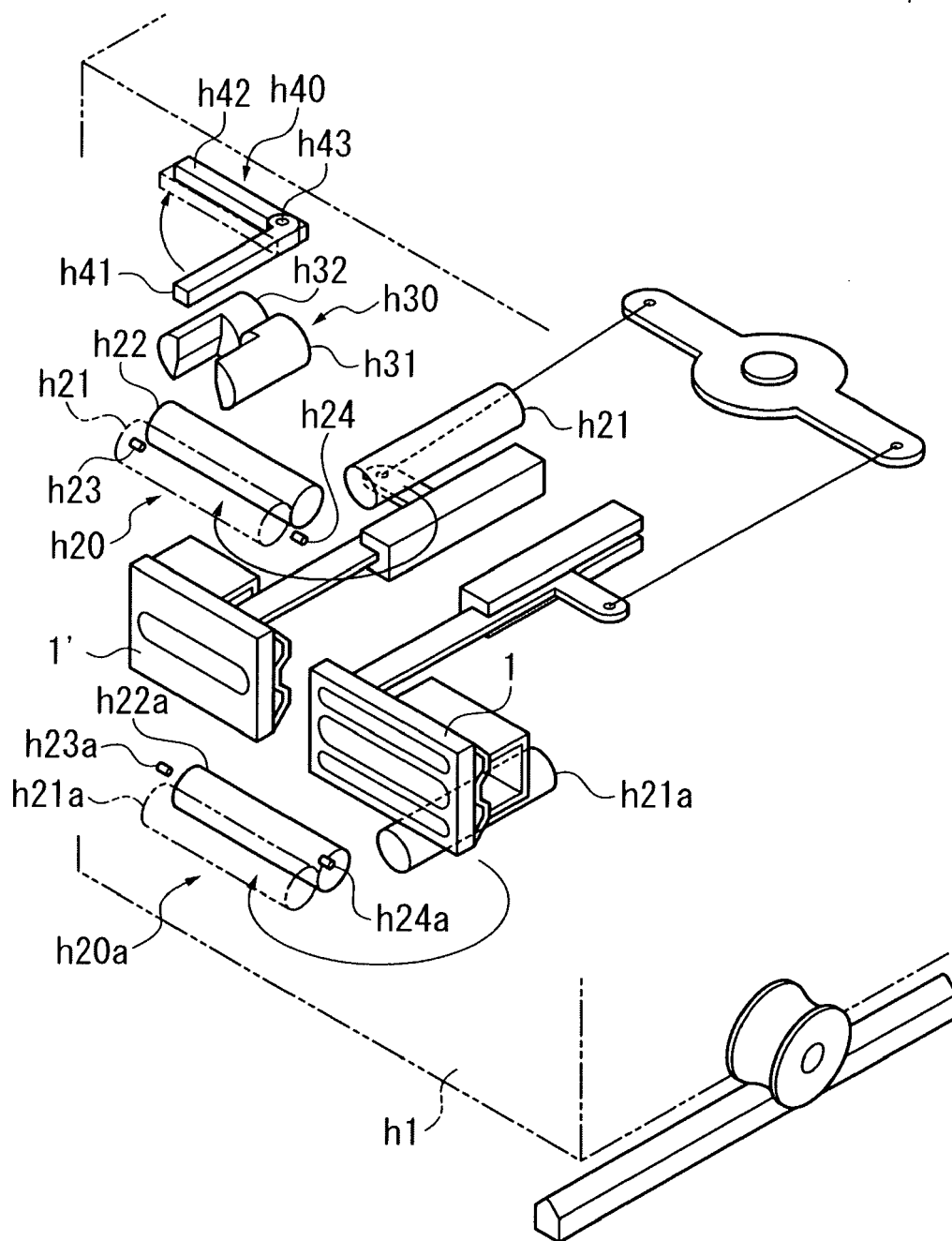


FIGURE 5

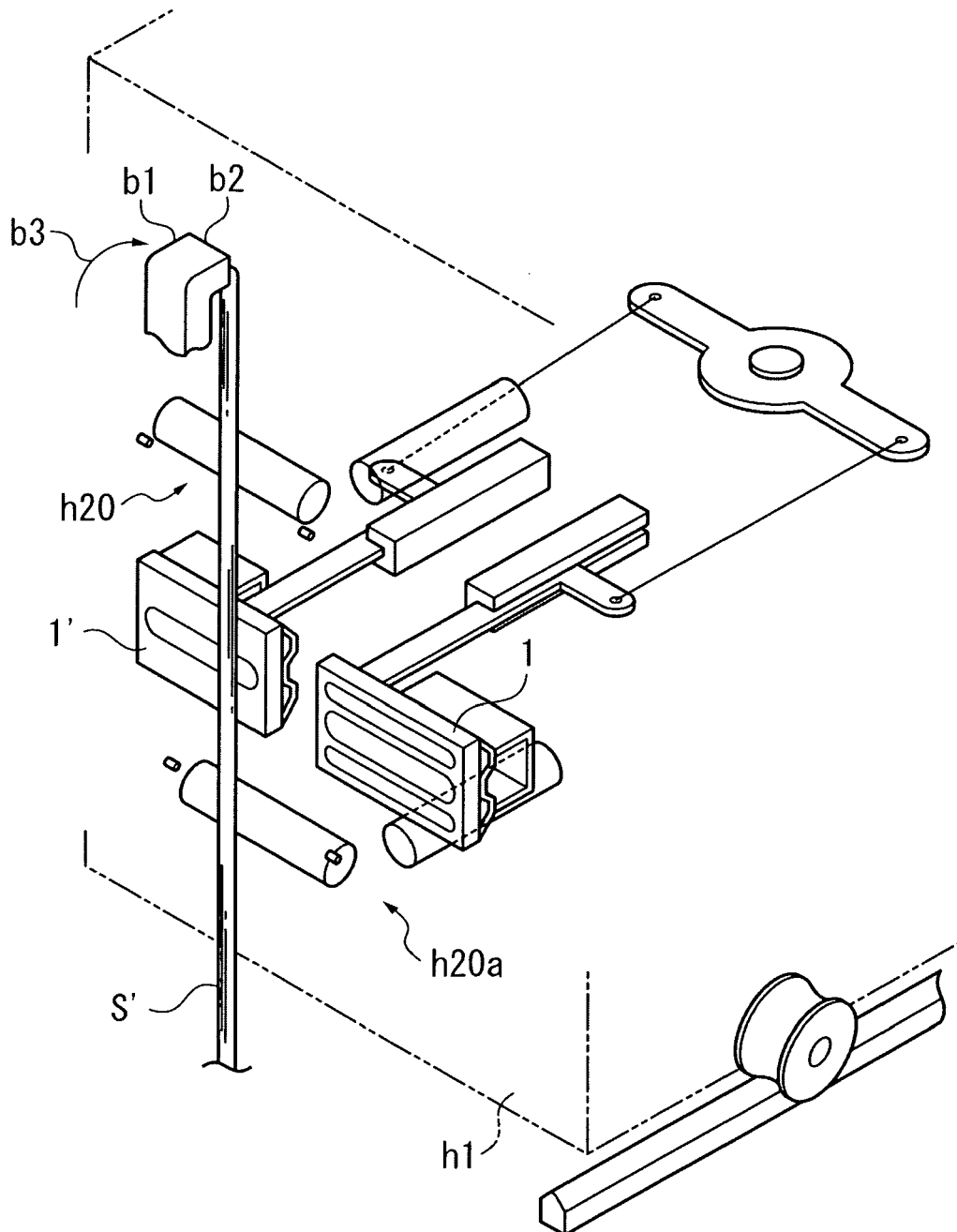


FIGURE 6

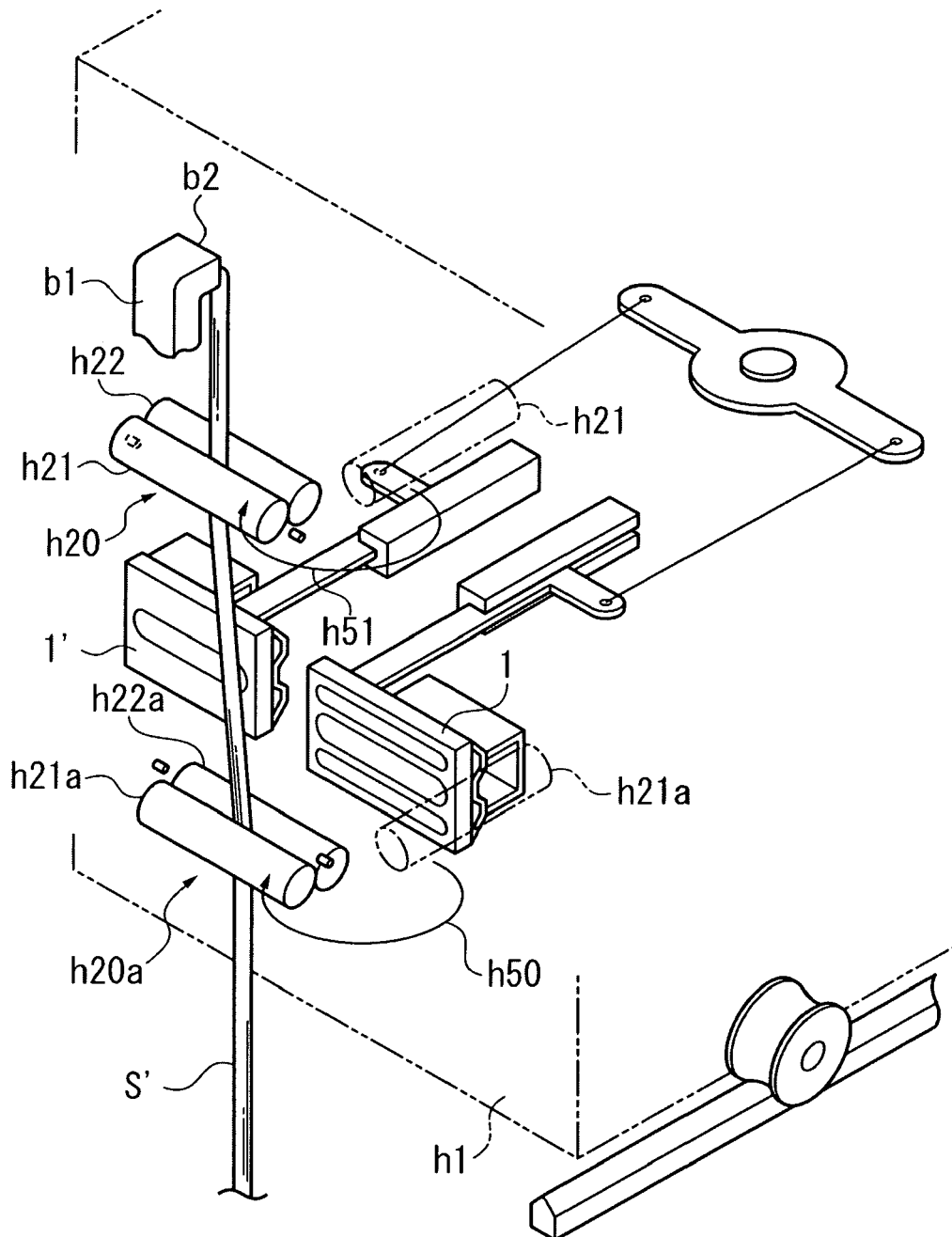


FIGURE 7

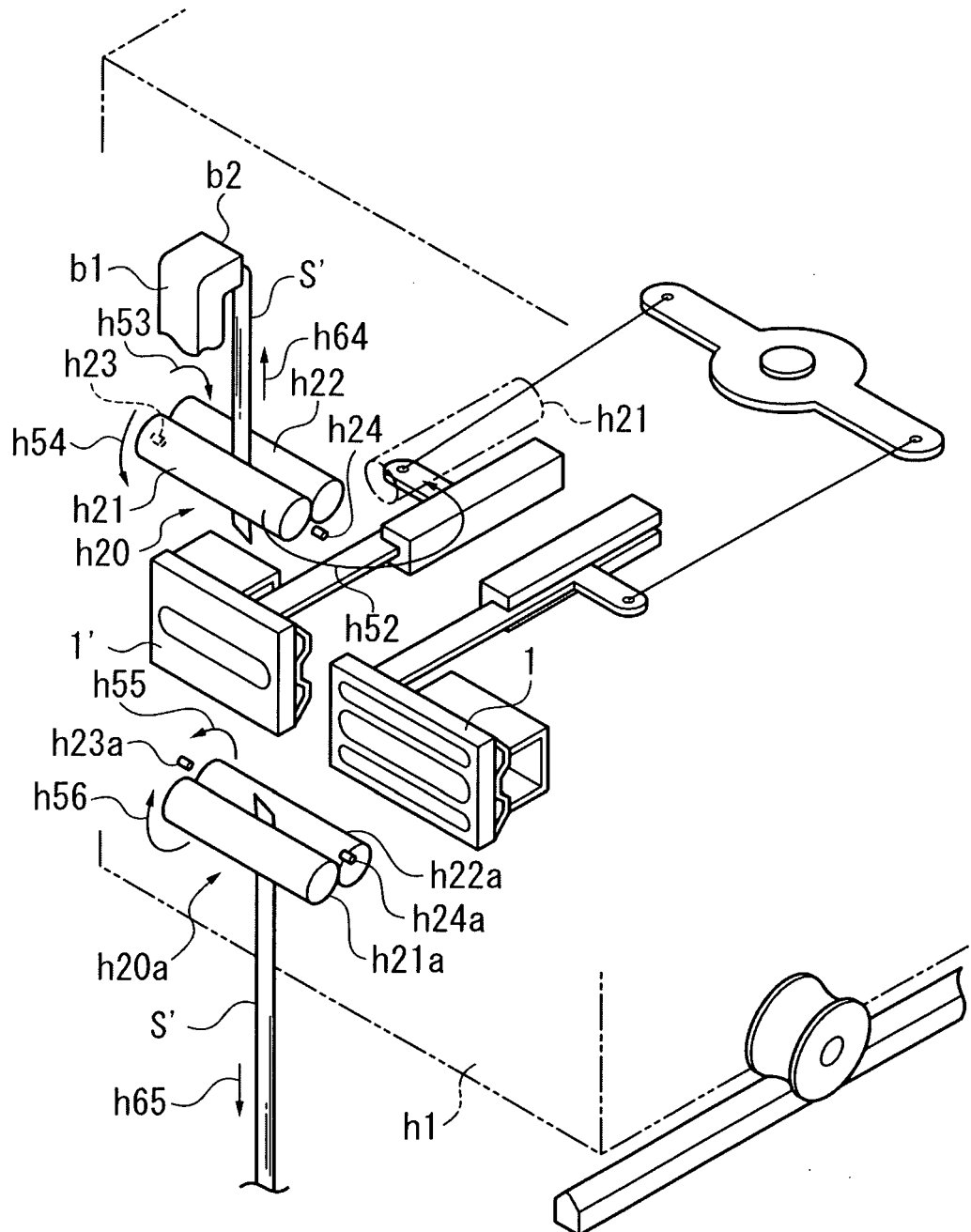


FIGURE 8

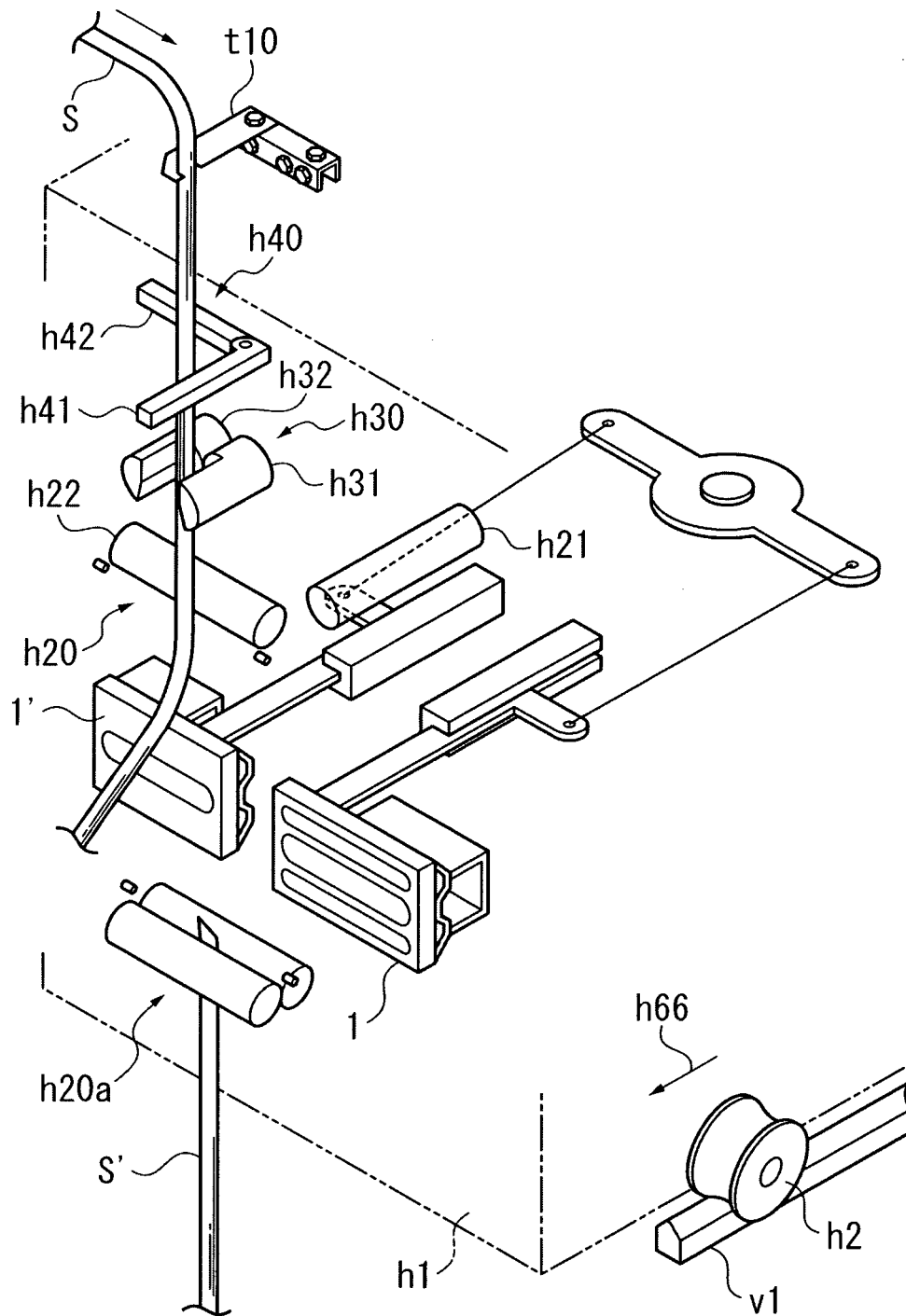


FIGURE 9

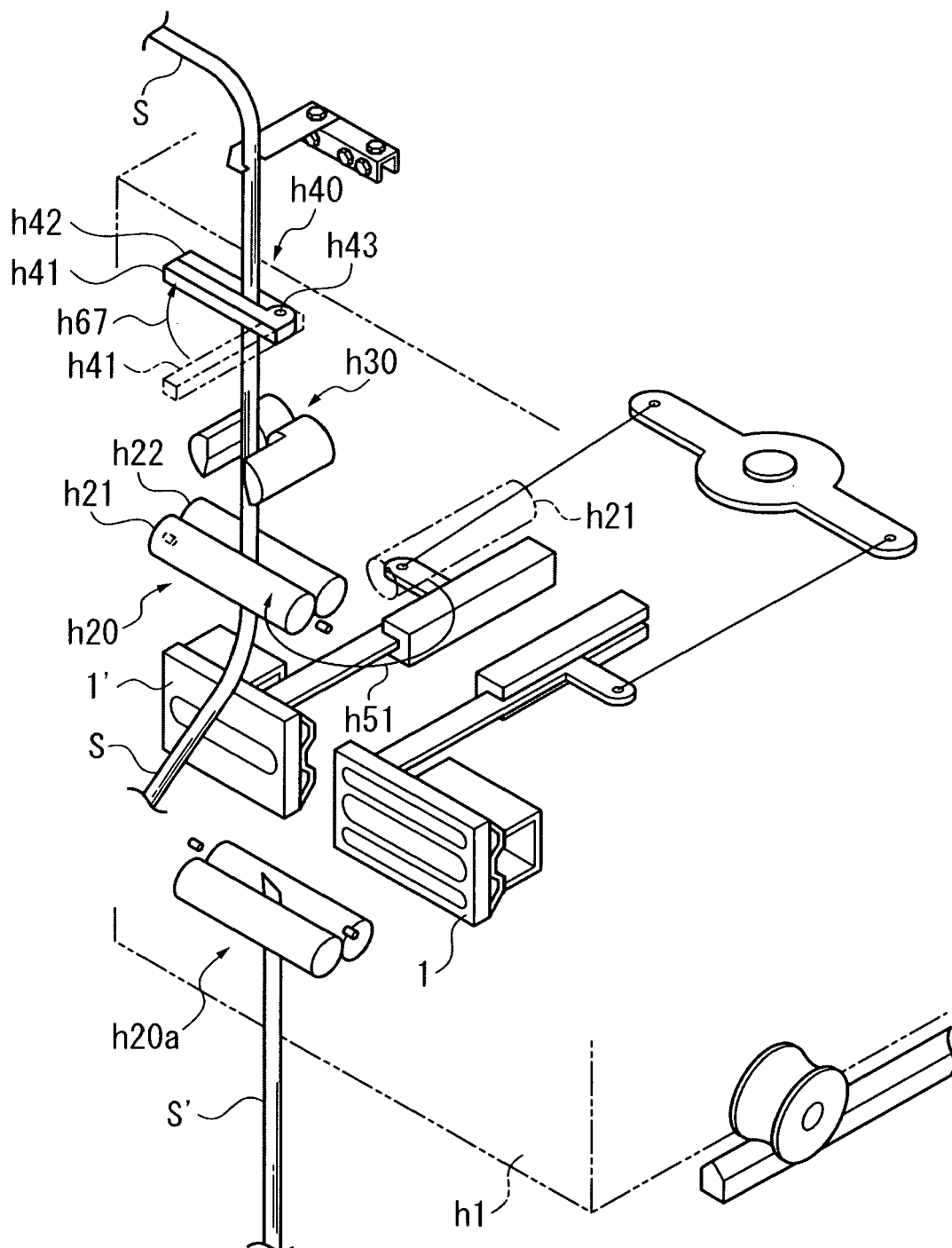


FIGURE 10

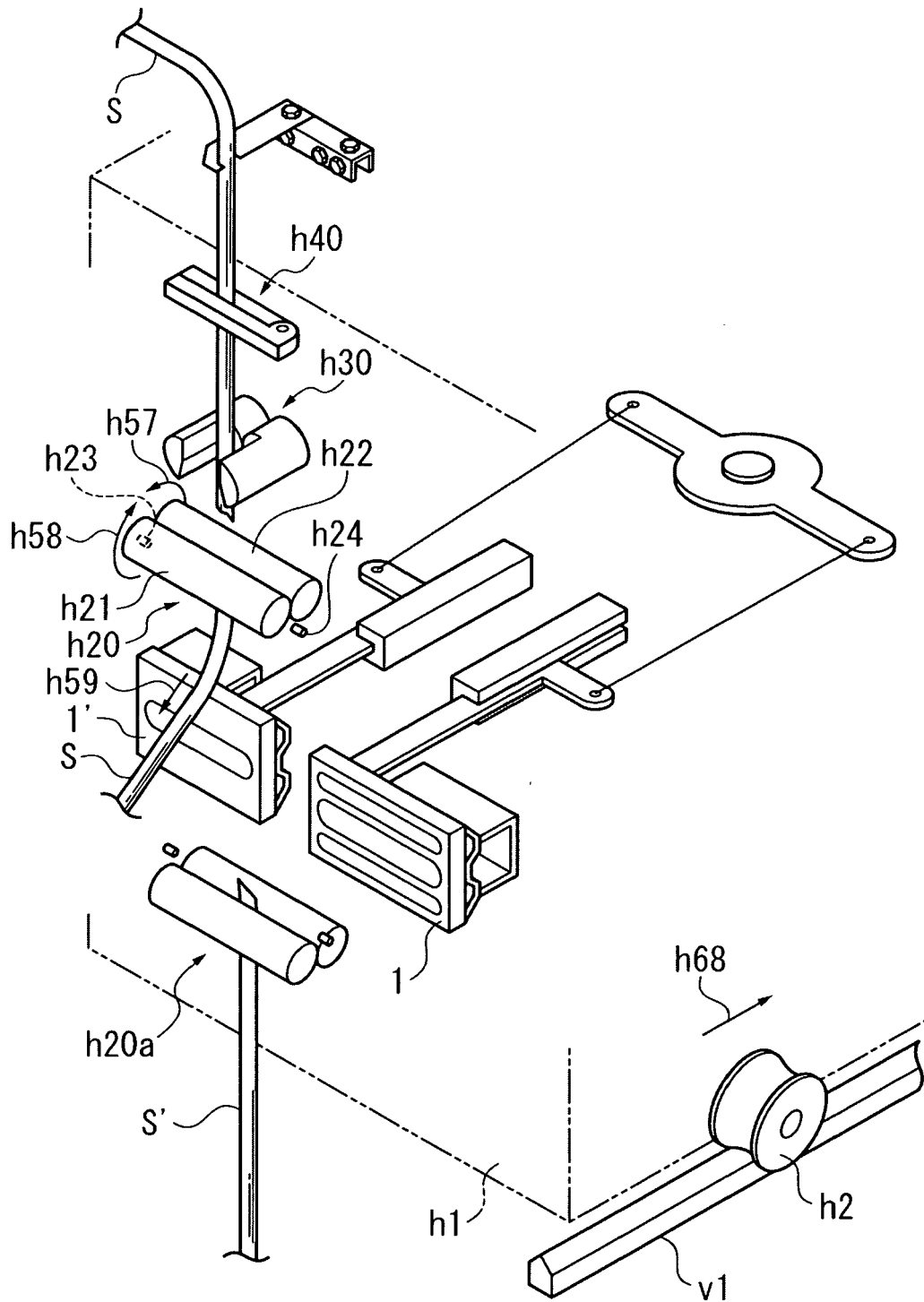


FIGURE 11

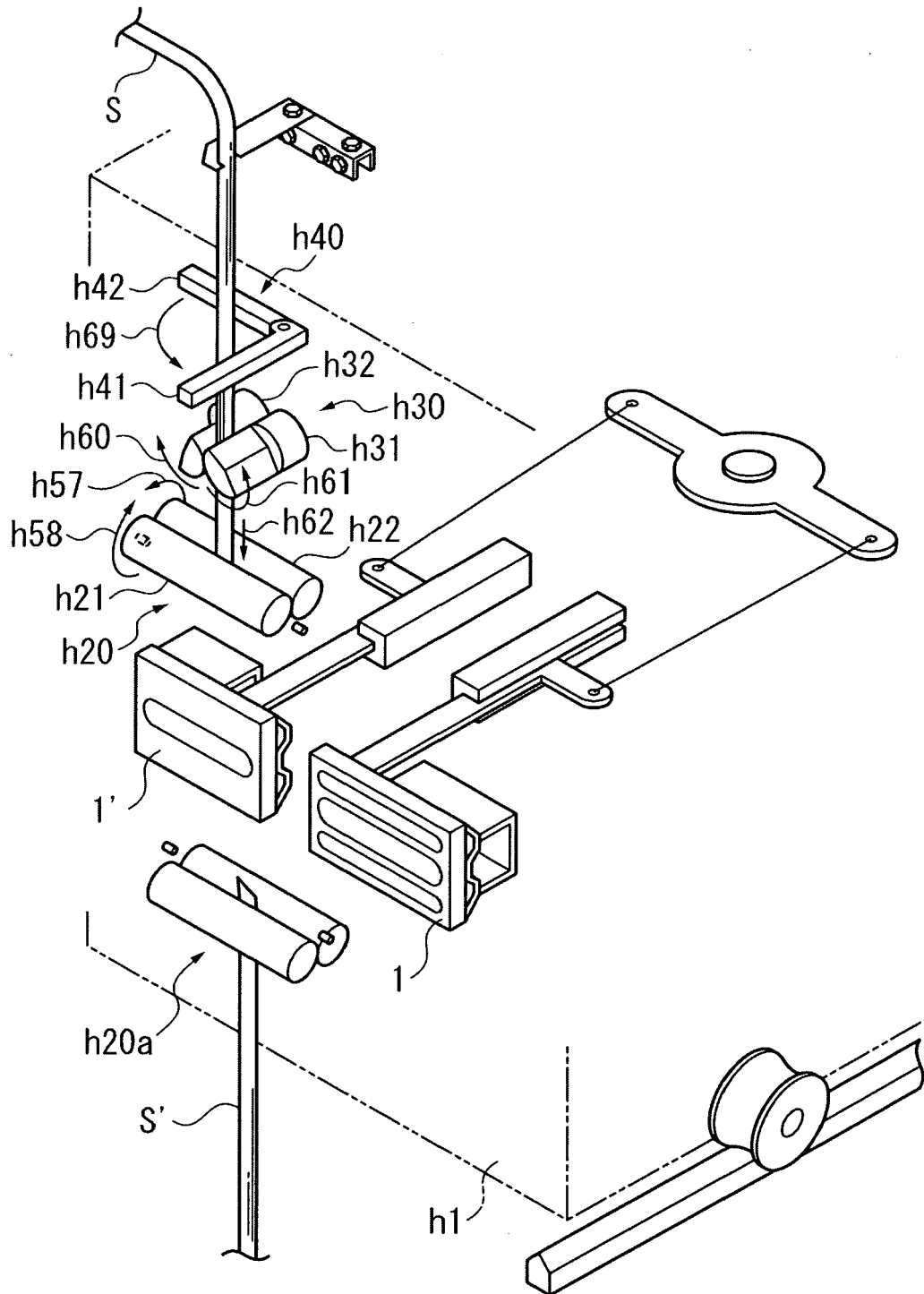


FIGURE 13

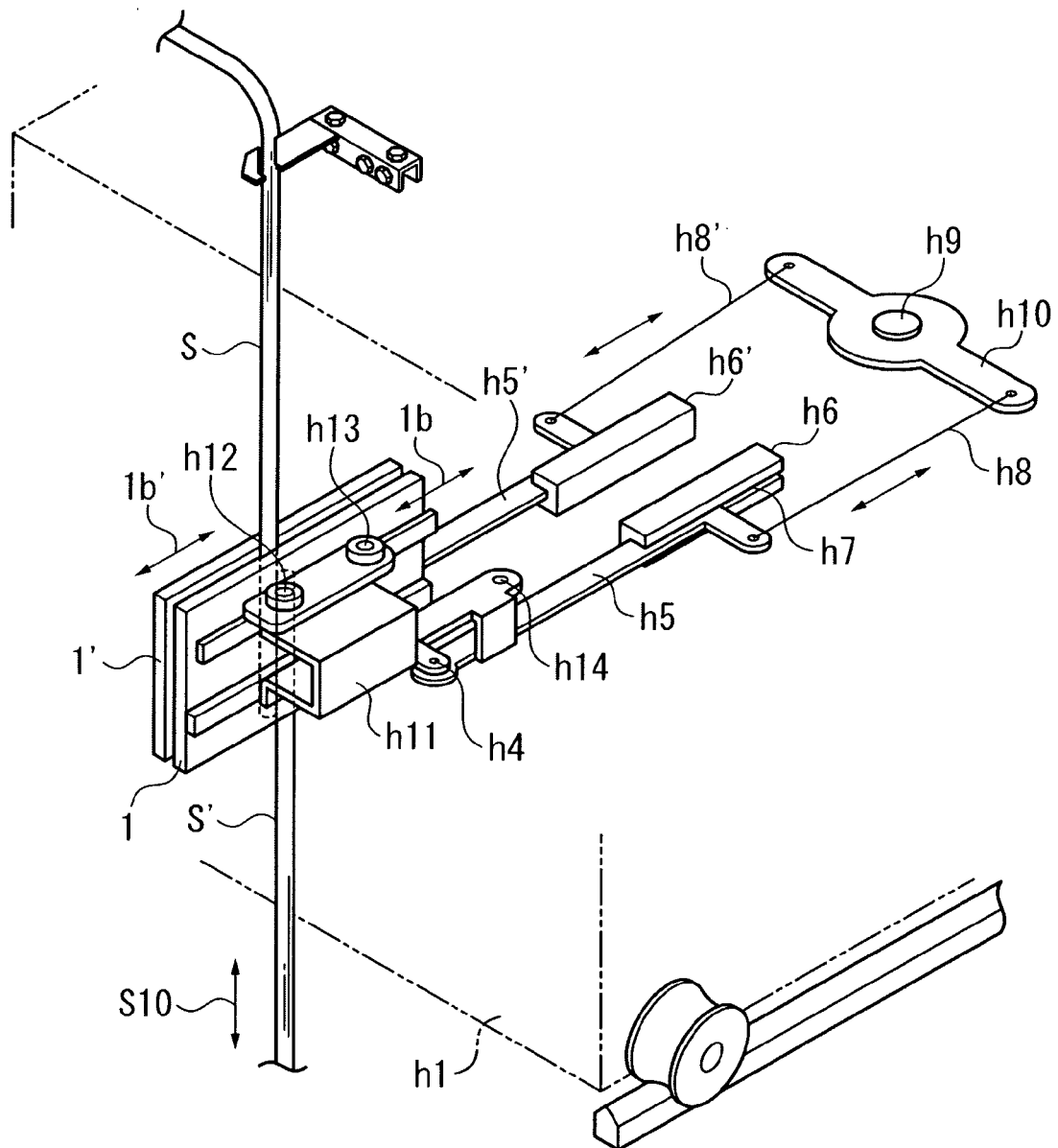


FIGURE 14

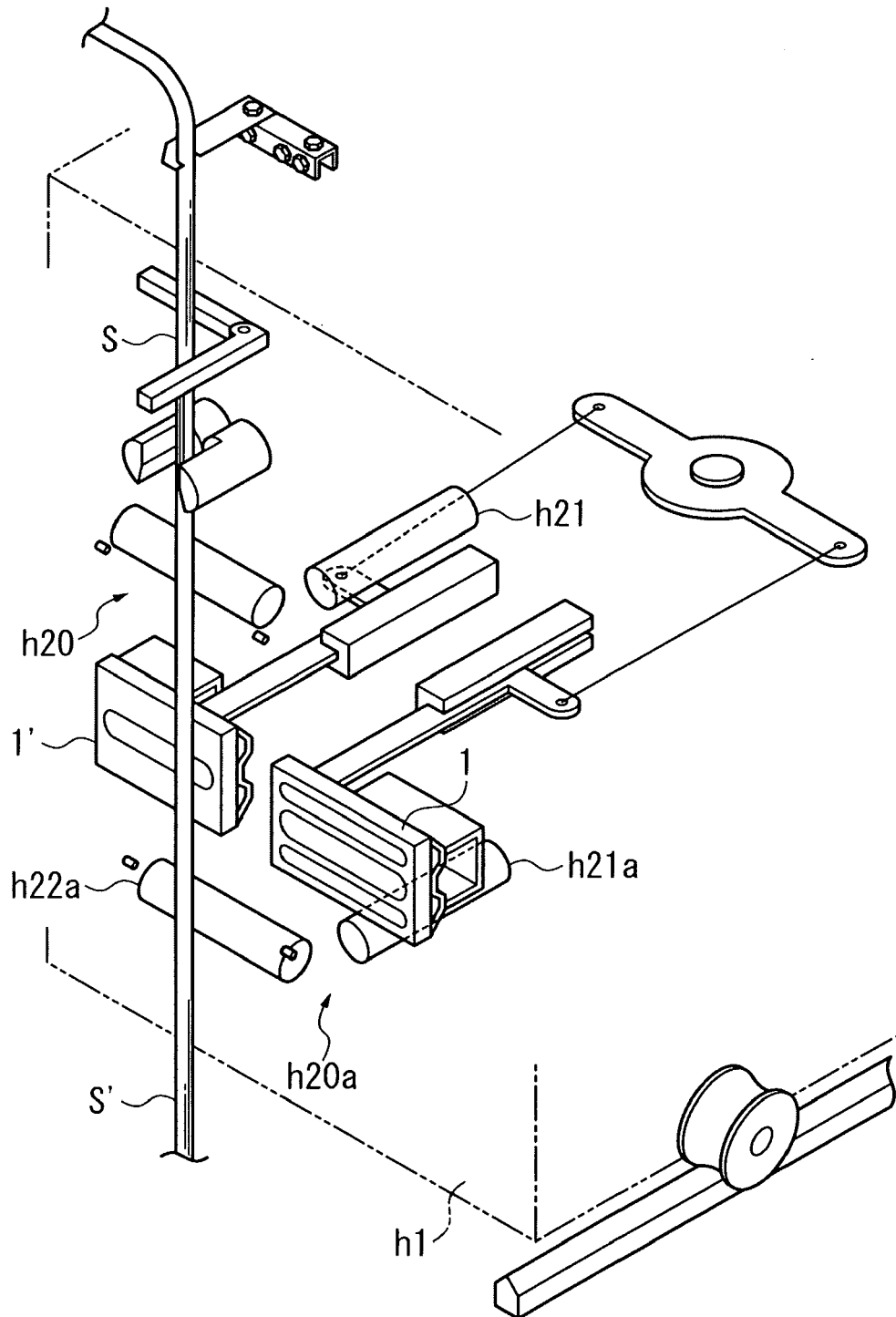


FIGURE 15A

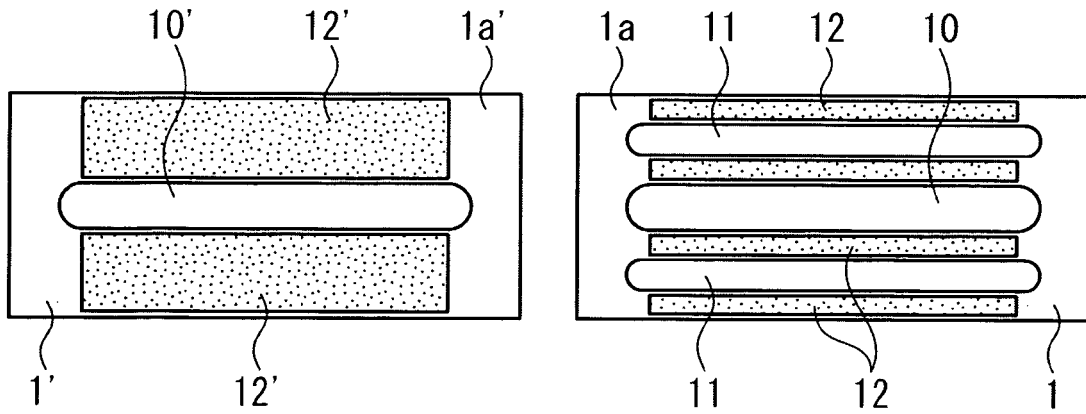


FIGURE 15B

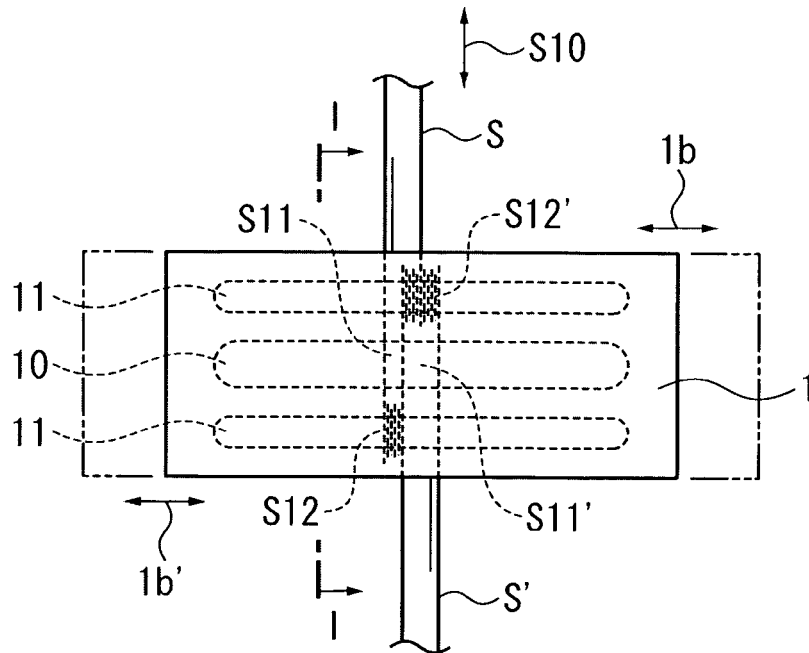


FIGURE 15C

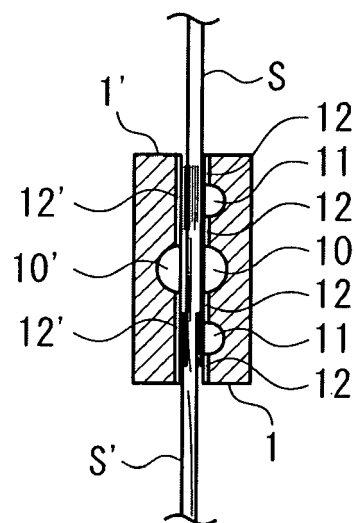
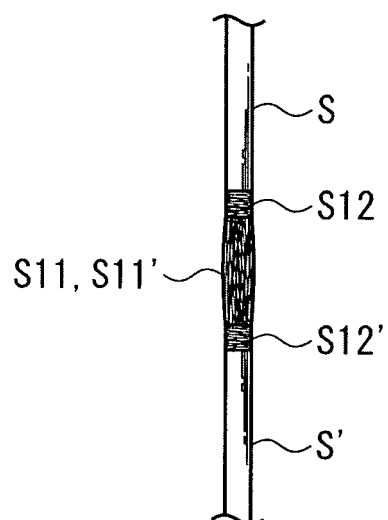


FIGURE 15D



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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