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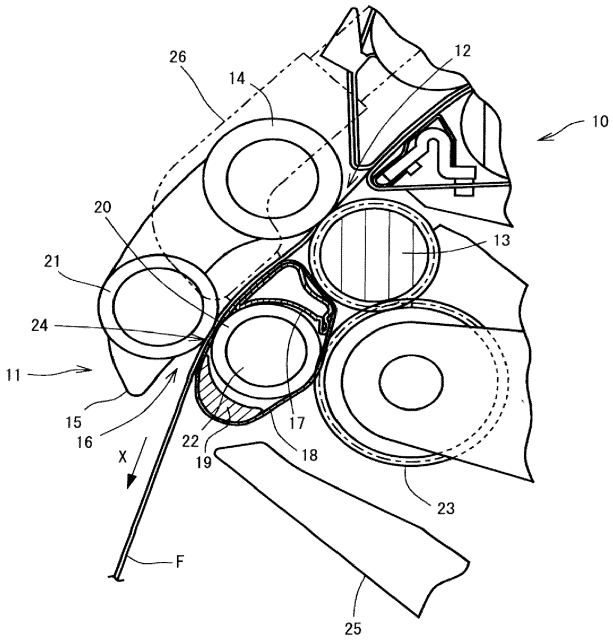
(54) FIBER BUNDLE CONDENSING DEVICE OF SPINNING MACHINE

(57) A fiber bundle condensing device (11) of a spinning machine includes a suction pipe (17, 80) and a guide member (40, 60, 86) having a guide portion (41, 61, 87). The fiber bundle condensing device (11) condenses a fiber bundle (F). The suction pipe (17, 80) has a suction hole (30, 31, 81) extending from an upstream side to a downstream side in a moving direction of the fiber bundle (F). The guide member (40, 60, 86) has a suction slit (44, 45, 64, 65, 88) formed in the guide portion (41, 61, 87) and aligned with the suction hole (30, 31, 81). A width of the suction hole (30, 31, 81) and a width of the suction slit (44, 45, 64, 65, 88) are different at least on the upstream sides of the suction hole (30, 31, 81) and the suction slit (44, 45, 64, 65, 88).

FIG. 1



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Description

BACKGROUND ART

[0001] The present disclosure relates to a fiber bundle condensing device of a spinning machine.

[0002] As a conventional technique for a fiber bundle condensing device of a spinning machine, for example, a fiber bundle condensing device of a spinning machine disclosed in Japanese Patent Application Publication No. 2020-090734 has been known. The fiber bundle condensing device of the spinning machine disclosed in the Publication includes a suction pipe disposed downstream of a draft device, and an air-permeable apron wound on the suction pipe, and condenses fiber bundles stretched by the draft device. This fiber bundle condensing device of the spinning machine includes a guide member to be mounted on the suction pipe at a position where the air-permeable apron is wound on the suction pipe. The guide member has a guide surface guiding movement of the air-permeable apron and a suction slit formed in the guide surface. The guide member is mounted on the suction pipe with the suction slit aligned with a suction hole formed in a first outer surface of the suction pipe. Since the suction slit is disposed so as to be aligned with the suction hole, it is said that the suction hole of the suction pipe preferably has the same shape and dimension as those of the suction slit of the guide member.

[0003] However, in the fiber bundle condensing device of the spinning machine of the Publication, when the suction hole of the suction pipe and the suction slit of the guide member have the same shape and the same dimension, a hole wall surface of the suction hole is flush with a slit wall surface of the suction slit. As a result, a gap formed between the suction pipe and the guide member by mounting the guide member on the suction pipe is positioned near the hole wall surface of the suction hole. If a fiber due to fluff and a fallen fiber is attached to the hole wall surface by any reason, such a fiber enters the gap and gets caught on the suction slit. When any fiber is caught on the suction slit, fibers may be accumulated on the fiber caught on the suction slit, and cause the clogging of the suction slit. As a result, the quality of yarn may be degraded.

[0004] The present invention has been made in view of the above problem, and is directed to providing a fiber bundle condensing device of a spinning machine that prevents a fiber from being caught on a suction slit as much as possible.

Summary

[0005] In accordance with an aspect of the present disclosure, there is provided a fiber bundle condensing device of a spinning machine including a suction pipe disposed on a downstream side of a draft device, and a guide member mounted on the suction pipe at a position where an air-permeable apron is wound on the suction pipe, and having a guide portion configured to guide a movement of the air-permeable apron, wherein the fiber bundle condensing device is configured to condense a fiber bundle drafted by the draft device. The suction pipe has a suction hole extending from an upstream side to a downstream side in a moving direction of the fiber bundle, the guide member has a suction slit that is formed in the guide portion and aligned with the suction hole. A width of the suction hole and a width of the suction slit are different at least on the upstream sides of the suction hole and the suction slit.

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

BRIEF DESCRIPTION OF THE DRAWINGS

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

FIG. 1 is a partial cross-sectional side view of a fiber bundle condensing device of a spinning machine according to a first embodiment;

FIG. 2 is a perspective view of a suction pipe of the fiber bundle condensing device of the spinning machine according to the first embodiment;

FIG. 3 is a front view of a guide member of the fiber bundle condensing device of the spinning machine according to the first embodiment;

FIG. 4 is a partially enlarged front view of the guide member;

FIG. 5A is a cross-sectional view, taken along line A1-A1 of FIG. 3, and FIG. 5B is a cross-sectional view, taken along line B1-B1 of FIG. 3;

FIG. 6 is a front view of a guide member of a fiber bundle condensing device of a spinning machine according to a second embodiment;

FIG. 7 is a partially enlarged front view of the guide member;

FIG. 8A is a cross-sectional view, taken along line A2-A2 of FIG. 6, and FIG. 8B is a cross-sectional view, taken along line B2-B2 of FIG. 6;

FIG. 9 is a perspective view of a suction pipe of a fiber bundle condensing device of a spinning machine according to a third embodiment;

FIG. 10 is a front view of a guide member of the fiber bundle condensing device of the spinning machine according to the third embodiment; and

FIG. 11A is a cross-sectional view, taken along line A3-A3 of FIG. 10, and FIG. 11B is a cross-sectional view, taken along line B3-B3 of FIG. 10.

DETAILED DESCRIPTION OF THE EMBODIMENTS

First Embodiment

[0008] The following will describe a fiber bundle condensing device of a spinning machine (hereinafter, simply referred to as a fiber bundle condensing device) according to a first embodiment of the present invention. The present embodiment is an example of a fiber bundle condensing device of a spinning flame.

[0009] As illustrated in FIG. 1, a fiber bundle condensing device 11 is disposed downstream of a draft device 10. The draft device 10 includes a delivery roller pair 12. The delivery roller pair 12 includes a front bottom roller 13 and a front top roller 14. The front top roller 14 is supported by a support member 15.

[0010] The fiber bundle condensing device 11 includes a delivery portion 16, a suction pipe 17, an air-permeable apron 18, and an apron guide portion 19. The delivery portion 16 includes a bottom nip roller 20 and a top nip roller 21. The bottom nip roller 20 corresponds to a nip roller configured to rotate integrally with a rotary shaft 22 disposed in parallel with the front bottom roller 13 of the delivery roller pair 12. A gear (not illustrated) is attached to the rotary shaft 22, and an intermediate gear 23 engages with the gear. The intermediate gear 23 engages with a gear (not illustrated) integrally rotatable with the front bottom roller 13. This allows a rotating force of the front bottom roller 13 to be transmitted to the bottom nip roller 20 through the intermediate gear 23.

[0011] As is the case of the front top roller 14 of the draft device 10, the top nip roller 21 is supported by a weighting arm (not illustrated) via the support member 15 at every two spindles stations. The top nip roller 21 is pressed against the bottom nip roller 20 via the air-permeable apron 18. This pressing mechanism configures a nip portion 24 of the delivery portion 16. The support member 15 is formed integrally with a support member of the front top roller 14. A fiber bundle F together with the air-permeable apron 18 is placed on the nip portion 24 of the delivery portion 16

[0012] The suction pipe 17 is disposed downstream of the delivery roller pair 12 of the draft device 10 and upstream of the nip portion 24 of the delivery portion 16 in a moving direction X in which the fiber bundle F is moved. The suction pipe 17 is connected to a suction source (not illustrated) via a connection pipe 25.

[0013] The air-permeable apron 18 is an endless belt having no end. For example, the air-permeable apron 18 is formed of a mesh woven fabric having an appropriate air permeability. The air-permeable apron 18 is wound on the suction pipe 17, the apron guide portion 19, and the bottom nip roller 20 so that the air-permeable apron 18 passes through the nip portion 24 of the delivery portion 16. The air-permeable apron 18 transfers the fiber bundle F in the moving direction X while moving along with the rotation of the bottom nip roller 20. A suction nozzle 26 is disposed below the apron guide portion 19. The suction nozzle 26 is provided for suction of the fiber bundle F discharged from the draft device 10 when fiber breakage occurs, and the fiber bundle F is sucked from a tip end of the suction nozzle 26. A base end (not illustrated) of the suction nozzle 26 is connected to a pneumatic duct (not illustrated) commonly provided for all spindle stations.

[0014] As illustrated in FIG. 2, the suction pipe 17 is an elongated member having a hollow shape. The suction pipe 17 is disposed extending perpendicularly to the moving direction X of the fiber bundle F, i.e., in a direction in parallel with an axis of the rotary shaft 22. For example, the suction pipe 17 is formed by injection molding of aluminum. The suction pipe 17 has a first wall portion 27, a second wall portion 28, and a third wall portion 29. The first wall portion 27, the second wall portion 28, and the third wall portion 29 form an outer surface of the suction pipe 17.

[0015] The first wall portion 27 is curved so as to protrude outwardly along a moving path of the fiber bundle F. The second wall portion 28 is formed continuously with the first wall portion 27, extends from a downstream side of the first wall portion 27 in the moving path of the fiber bundle F, and is curved so as to depress inwardly. The third wall portion 29 is formed continuously with the first wall portion 27, extends from an upstream side of the first wall portion 27 in the moving path of the fiber bundle F, and is curved so as to depress inwardly. The second wall portion 28 and the third wall portion 29 are connected to each other.

[0016] The first wall portion 27 has a plurality of suction holes 30, and a plurality of suction holes 31. The suction holes 30, 31 are through holes each having a slit shape, and extend in a direction that intersects with a longitudinal direction of the suction pipe 17. That is, the suction holes 30, 31 extend from an upstream side to the downstream side of the suction pipe 17 in the moving direction X of the fiber bundle F. The suction holes 30, 31 are disposed so that a plurality of pairs of the suction holes 30, 31 is formed. When the first wall portion 27 is viewed from the front, the suction holes 30, 31 that forms a pair are symmetrical to each other in the longitudinal direction of the suction pipe 17. The suction holes 30, 31 are disposed so that the suction holes 30, 31 that forms a pair approach to each other from the upstream side to the downstream side of the moving path of the fiber bundle F on the first wall portion 27. The pairs of suction holes 30, 31 are disposed at regular intervals in the longitudinal direction of the suction pipe 17 so that each of the pairs of suction holes 30, 31 correspond to each of the positions of the spindle stations.

[0017] As illustrated in FIG. 3, each of the suction holes 30 has a hole wall including an upper end wall portion 32 that has an arc shape and forms an upstream end of the suction hole 30, a lower end wall portion 33 that forms a downstream end of the suction hole 30, and a facing wall portion 34 and a condensing guide wall portion 35 that extend between the upper end wall portion 32 and the

lower end wall portion 33. The facing wall portion 34 is a part of the hole wall close to the suction hole 31, and the condensing guide wall portion 35 is a part of the hole wall that faces the facing wall portion 34 and is positioned far from the suction hole 31 as compared with the facing wall portion 34.

[0018] As illustrated in FIG. 3, each of the suction holes 31 has a hole wall including an upper end wall portion 36 that has an arc shape and forms an upstream end of the suction hole 31, a lower end wall portion 37 that forms a downstream end of the suction hole 31, and a facing wall portion 38 and a condensing guide wall portion 39 that extend between the upper end wall portion 36 and the lower end wall portion 37. The facing wall portion 38 is a part of the hole wall close to the suction hole 30, and the condensing guide wall portion 39 is a part of the hole wall that faces the facing wall portion 38 and is positioned far from the suction hole 30 as compared with the facing wall portion 38.

[0019] As illustrated in FIGS. 2 and 3, a guide member 40 is mounted on the suction pipe 17. The guide member 40 is made of a metal thin plate. The guide member 40 is mounted on the suction pipe 17 at a position where the air-permeable apron 18 is wound on the suction pipe 17. The fiber bundle condensing device 11 includes a plurality of the guide members 40 disposed at intervals along the longitudinal direction of the suction pipe 17. It is noted that only two of the guide members 40, i.e., one guide member 40 mounted on the suction pipe 17, and one guide member not mounted on the suction pipe 17, are illustrated in FIG. 2. For the sake of explanation, only one of the guide members 40, and one of the pairs of the suction holes 30, 31 will be described in the following description.

[0020] The guide members 40 are mounted on the suction pipe 17 in such a manner that each of the guide members 40 corresponds to each of the pairs of the suction holes 30, 31. That is, the guide members 40 are mounted on the suction pipe 17 correspondingly to a position on which the air-permeable apron 18 is wound. The guide members 40 each have a guide portion 41 for guiding the movement of the air-permeable apron 18 on the moving path of the fiber bundle F. The air-permeable apron 18 is moved with the rotation of the bottom nip roller 20 while being in contact with the guide portions 41 of the guide members 40. The guide portion 41 is curved in such a manner that the guide portion 41 protrudes outwardly along the first wall portion 27 of the suction pipe 17 (see FIG. 2).

[0021] As illustrated in FIG. 3, the guide members 40 each have a rectangular shape as viewed from the front. As illustrated in FIG. 2, the guide members 40 each have a first curved portion 42 and a second curved portion 43. The first curved portion 42 is formed continuously with the guide portion 41 by bending the guide portion 41 at a downstream side thereof in the moving direction X of the fiber bundle F. The first curved portion 42 is curved so as to extend along a curved shape of a portion of the suction pipe 17 connecting the first wall portion 27 and the second wall portion 28. The second curved portion 43 is formed continuously with the guide portion 41 by bending the guide portion 41 at an upstream side thereof in the moving direction X of the fiber bundle F. The second curved portion 43 is curved so as to extend along a curved shape of a portion of the suction pipe 17, the portion connecting the first wall portion 27 and the third wall portion 29.

[0022] The guide members 40 each have suction slits 44, 45 formed in the guide portion 41. The guide members 40 are mounted on the suction pipe 17 in a state where the suction slits 44, 45 are aligned with the suction holes 30, 31 formed in the first wall portion 27 of the suction pipe 17. The suction slit 44 is formed so as to correspond to the suction hole 30, and the suction slit 45 is formed so as to correspond to the suction hole 31. Thus, the suction slit 44 is aligned with the suction hole 30, and the suction slit 45 is aligned with the suction hole 31.

[0023] As illustrated in FIG. 3, the suction slit 44 has a slit wall including an upper end wall portion 46, a lower end wall portion 47, a facing wall portion 48, and a condensing guide wall portion 49. The upper end wall portion 46 forms an upstream end of the suction slit 44 in an end of the guide portion 41 near the second curved portion 43. The lower end wall portion 47 forms a downstream end of the suction slit 44 in an end of the guide portion 41 near the first curved portion 42. The facing wall portion 48 and the condensing guide wall portion 49 extend between the upper end wall portion 46 and the lower end wall portion 47. The facing wall portion 48 is a part of the slit wall close to the suction slit 45, and the condensing guide wall portion 49 is a part of the slit wall that faces the facing wall portion 48 and is positioned far from the suction slit 45 as compared with the facing wall portion 48.

[0024] As illustrated in FIG. 4, the facing wall portion 48 has a first slit wall surface 48A, a second slit wall surface 48B, and a third slit wall surface 48C. As illustrated in FIG. 5A, the first slit wall surface 48A is formed so that a step S1 is formed between the upstream side of the suction slit 44 and the upstream side of the suction hole 31 in the longitudinal direction of the suction pipe 17. The first slit wall surface 48A extends to the downstream side from the upper end wall portion 46 so as to form a predominant part of the facing wall portion 48 in the guide member 40 beyond half the length of the guide member 40 in the moving direction X of the fiber bundle F. By providing the step S1, a small gap G1 between the suction pipe 17 and the guide member 40 is positioned away from the facing wall portion 34 of the suction hole 30.

[0025] As illustrated in FIG. 5B, the second slit wall surface 48B is formed so that the step S1 is not formed between the suction slit 44 and the suction hole 30 on the downstream side of the guide member 40 in the moving direction X of the fiber bundle F. The third slit wall surface 48C is formed between the first slit wall surface 48A and the second slit wall surface 48B. The first slit

wall surface 48A and the second slit wall surface 48B are disposed in parallel, or substantially in parallel, with each other, and the third slit wall surface 48C is not disposed in parallel, or substantially in parallel, with the first slit wall surface 48A and the second slit wall surface 48B.

[0026] As illustrated in FIG. 4, the condensing guide wall portion 49 has a first slit wall surface 49A, a second slit wall surface 49B, and a third slit wall surface 49C. As illustrated in FIG. 5A, the first slit wall surface 49A is formed so that the step S1 is formed between the suction slit 44 and the suction hole 31 in the longitudinal direction of the suction pipe 17. The first slit wall surface 49A extends from the upper end wall portion 46 to the downstream side so as to form a predominant part of the condensing guide wall portion 49 in the guide portion 41 from an end of the guide portion 41 close to the second curved portion 43 beyond the center of the guide portion 41 in the moving direction X of the fiber bundle F. By providing the step S1, the gap G1 between the suction pipe 17 and the guide member 40 is positioned away from the facing wall portion 34 of the suction hole 30. According to the present embodiment, it can be said that the widths of the suction hole 30 and the suction slit 44 are different at least on the upstream sides of the suction hole 30 and the suction slit 44.

[0027] The second slit wall surface 49B is formed so that the step S1 is not formed between the suction slit 44 and the suction hole 30 on the downstream side of the guide member 40 in the moving direction X of the fiber bundle F. The third slit wall surface 49C is formed between the first slit wall surface 49A and the second slit wall surface 49B. The first slit wall surface 49A and the second slit wall surface 49B are disposed in parallel, or substantially in parallel, with each other, and the third slit wall surface 49C is not disposed in parallel, or substantially in parallel, with the first slit wall surface 49A and the second slit wall surface 49B.

[0028] As illustrated in FIG. 4, the first slit wall surfaces 48A, 49A are disposed in parallel, or substantially in parallel, with each other, and the width of the suction slit 44 (the dimension of the suction slit 44 in a direction perpendicular to the longitudinal direction of the suction slit 44) is greater than the width of the suction hole 30. In a state where the guide member 40 is mounted on the suction pipe 17, a part of the first wall portion 27 of the suction pipe 17 as well as the suction hole 30 is exposed from the suction slit 44. Although the first slit wall surfaces 48A, 49A extend beyond the center of the guide portion 41 in the moving direction X of the fiber bundle F from the upper end wall portion 46 so that the first slit wall surfaces 48A, 49A form the predominant parts of the facing wall portion 48 and the condensing guide wall portion 49, respectively, in the guide portion 41 in the present embodiment, the configuration is not limited thereto. For example, the first slit wall surfaces 48A, 49A need not necessarily extend beyond the center of the guide portion 41 in the moving direction X of the fiber bundle F from the upper end wall portion 46.

[0029] The second slit wall surfaces 48B, 49B of the suction slit 44 extend substantially in parallel with each other, and the width of the suction slit 44 (the dimension of the suction slit 44 in the direction perpendicularly to the longitudinal direction of the suction slit 44) is the same as the width of the suction hole 30. That is, the step S1 does not exist between the downstream side of the suction slit 44 and the downstream side of the suction hole 30. Since it is known that changing a condition of the downstream side of the suction slit 44 tends to affect the quality of yarn, the suction slit 44 and the suction hole 30 are provided so as not to form the step S1 therebetween to maintain the quality of yarn. The third slit wall surfaces 48C, 49C do not extend in parallel, or substantially in parallel, with each other, which decreases the width of the suction slit 44 from the first slit wall surfaces 48A, 49A towards the second slit wall surfaces 48B, 49B.

[0030] As illustrated in FIGS. 3 and 4, when the longitudinal direction of the suction pipe 17 is set as the right-left direction, the suction slit 45 and the suction slit 44 are symmetric in the right and left. Similarly to the suction slit 44, the slit wall of the suction slit 45 has an upper end wall portion 56, a lower end wall portion 57, a facing wall portion 58, and a condensing guide wall portion 59. The upper end wall portion 56 has an arc shape and forms an upstream end of the suction slit 45 in an end of the guide portion 41 near the second curved portion 43. The lower end wall portion 57 forms a downstream end of the suction slit 45 in an end of the guide portion 41 near the first curved portion 42. The facing wall portion 58 and the condensing guide wall portion 59 extend between the upper end wall portion 56 and the lower end wall portion 57. The facing wall portion 58 is a part of the slit wall close to the suction slit 44, and the condensing guide wall portion 59 is a part of the slit wall that faces the facing wall portion 58 and is positioned far from the suction slit 44 as compared with the facing wall portion 58.

[0031] As illustrated in FIG. 4, the facing wall portion 58 has a first slit wall surface 58A, a second slit wall surface 58B, and a third slit wall surface 58C. The first slit wall surface 58A is the same as the first slit wall surface 48A of the suction slit 44, and the second slit wall surface 48B is the same as the second slit wall surface 48B of the suction slit 44. The third slit wall surface 58C is the same as the third slit wall surface 48C of the suction slit 44.

[0032] The condensing guide wall portion 59 has a first slit wall surface 59A, a second slit wall surface 59B, and a third slit wall surface 59C. The first slit wall surface 59A is the same as the first slit wall surface 49A of the suction slit 44, and the second slit wall surface 59B is the same as the second slit wall surface 49B of the suction slit 44. The third slit wall surface 59C is the same as the third slit wall surface 49C of the suction slit 44. Thus, the step S1 is formed between the upstream side of the suction slit 45 and the upstream side of the suction hole 31. Therefore, it can be said that at least, the width of the suction hole 31 and the width of the suction slit 45 are

not the same on the upstream sides of the suction hole 31 and the suction slit 45.

[0033] The second slit wall surface 59B is formed so that the step S1 is not formed between the suction slit 45 and the suction hole 31 on the downstream side of the guide member 40 in the moving direction X of the fiber bundle F. That is, the width of the suction slit 45 on the downstream side of the guide member 40 and the width of the suction hole 31 are the same, and the step S1 does not exist between the downstream side of the suction slit 45 and the downstream side of the suction hole 31. The width of the suction slit 45 (the dimension of the suction slit 45 in a direction perpendicular to the longitudinal direction of the suction slit 45) is made greater than the width of the suction hole 31 by the first slit wall surfaces 58A, 59A. In a state where the guide member 40 is mounted on the suction pipe 17, a part of the first wall portion 27 of the suction pipe 17, as well as the suction hole 31, is exposed from the suction slit 45.

[0034] The following will describe an operation of the fiber bundle condensing device 11 of the present embodiment. When the spinning flame is operated, the fiber bundle F is stretched by the draft device 10 and is then guided to the fiber bundle condensing device 11 from the delivery roller pair 12. The bottom nip roller 20 and the top nip roller 21 are rotated at a surface velocity substantially the same as that of the delivery roller pair 12. Thus, the fiber bundle F drafted by the draft device 10 passes the nip portion 24 of the bottom nip roller 20 and the top nip roller 21 while maintaining a suitable tension, then, changes its direction, and moves downward while being twisted. In addition, the fiber bundle F moves while being traversed by an operation of a traverse device (not illustrated). The speed of traversing operation is set sufficiently low relative to a moving speed of the fiber bundle F.

[0035] Additionally, suction of a duct (not illustrated) reaches the suction pipe 17 through the connection pipe 25 and suction of the suction slits 44, 45 formed in the guide portion 41 of the guide member 40 reaches the fiber bundle F through the air-permeable apron 18. The fiber bundle F moves to a position corresponding to the suction slits 44, 45 while being sucked and condensed. Thus, since fluff and a fallen fiber are suppressed, the quality of yarn is improved as compared with a case of the spinning machine not provided with the fiber bundle condensing device 11.

[0036] The fiber bundle F discharged from the delivery roller pair 12 receives a force, by traversing, in a direction perpendicular to a transferring direction of the air-permeable apron 18 (the width direction of the suction slits 44, 45). The fiber bundle F is pressed against a surface of the air-permeable apron 18 at the position corresponding to the suction slits 44, 45 by the suction of the suction slits 44, 45, which makes it difficult for the fiber bundle F to move in the width direction of the suction slits 44, 45.

[0037] According to the present embodiment, the step S1 is formed between the suction slit 44 and the suction hole 30 except for a part thereof on the downstream side in the moving direction X of the fiber bundle F. Thus, even if a fiber, which falls from the fiber bundle F while passing the suction slit 44, is attached to the facing wall portion 34 and the condensing guide wall portion 35, the fiber hardly enters the gap G1 and is easily separated from the facing wall portion 34 and the condensing guide wall portion 35. Thus, clogging of the suction slit 44 with fibers hardly occurs. In addition, since the step S1 is not formed on the downstream side of the suction slit 44, the quality of yarn may be stably maintained even after the fiber bundle F passes through the suction slit 44. The suction slit 45 operates in the same manner as the suction slit 44.

[0038] The fiber bundle condensing device 11 offers the following effects.

(1) The widths of the suction hole 30 and the suction slit 44 (the widths of the suction hole 31 and the suction slit 45) are made different on the upstream side of the suction hole 30 and the suction slit 44 (the suction hole 31 and the suction slit 45) where the fiber bundle F starts being guided. As a result, the gap G1 formed between the suction pipe 17 and the guide member 40 with the guide member 40 mounted on the suction pipe 17 is positioned away from the facing wall portion 34 of the suction hole 30 and the condensing guide wall portion 35 (the facing wall portion 38 and the condensing guide wall portion 39 of the suction hole 31. This makes it difficult for fibers to enter the gap G1 formed with the guide member 40 mounted on the suction pipe 17, which makes it easy for fibers to be separated from the facing wall portion 34 and the condensing guide wall portion 35 of the suction hole 30 (the facing wall portion 38 and the condensing guide wall portion 39 of the suction hole 31) even when the fibers are caught on the facing wall portion 34 and the condensing guide wall portion 35 of the suction hole 30 (the facing wall portion 38 and the condensing guide wall portion 39 of the suction hole 31). Accordingly, the configuration of the present embodiment prevents a fiber from getting caught on the suction slit 44 (the suction slit 45) as much as possible. Since the step S1 does not exist between the suction hole 30 and the suction slit 44 (between the suction hole 31 and the suction slit 45) on the downstream side at a position before the guiding of the fiber bundle F is ended, the fiber bundle F is guided smoothly, which permits securing the quality of yarn. It is noted that the difference in the widths of the suction hole 30 and the suction slit 44 (the suction hole 31 and the suction slit 45) does not include a slight difference in width due to errors in manufacturing and assembling.

(2) The step S1 is formed by making the width of the suction slit 44 (the suction slit 45) on the upstream side greater than that of the suction hole 30 (the suction hole 31) on the upstream side. This allows the

gap G1 formed between the suction pipe 17 and the guide member 40 to be distanced from the suction hole 30 (the suction hole 31), which permits preventing a fiber from getting caught on the suction slit 44 (the suction slit 45) as much as possible.

(3) The suction slit 44 (the suction slit 45) having a width greater than that of the suction hole 30 (the suction hole 31) is formed in the guide member 40 so as to form the step S1 between the suction slit 44 (the suction slit 45) and the suction hole 30 (the suction hole 31). Thus, the guide member 40 does not cover a part of the suction hole 30 through which suction force is applied, so that the suction of the suction holes 30, 31 does not change. As compared with a case where the suction hole and the suction slit have the same shape, positioning of the guide member 40 relative to the suction hole 30 (the suction hole 31) may become easier.

(4) A small part of the hole wall of the suction hole 30 (the suction hole 31) is flushed with the slit wall of the suction slit 44 (the suction slit 45). In a case where all the hole wall of the suction hole is flush with the slit wall of the suction slit, i.e., the suction hole and the suction slit have the same shape, the width of the suction hole and the width of the suction slit need to be the same so that the hole wall of the suction hole and the slit wall of the suction slit are flush with each other, which requires high precision in processing the slit wall of the suction slit. According to the present embodiment, on the other hand, requirements for precision in processing the slit wall of the suction slit 44 (the suction slit 45) may be less strict, as compared with a case where the suction hole and the suction slit have an identical shape.

(5) Since the widths of the suction hole 30 and the suction slit 44 (the widths of the suction hole 31 and the suction slit 45) are the same on the downstream side at a position before the guiding of the fiber bundle F is ended, the fiber bundle F is guided smoothly, which permits securing the quality of yarn. It is noted that the widths of the suction hole 30 and the suction slit 44 (the suction hole 31 and the suction slit 45) being the same includes a case where there is a slight difference in width due to errors in manufacturing and assembling.

Second Embodiment

[0039] The following will describe a fiber bundle condensing device 11 according to a second embodiment. The second embodiment differs from the first embodiment in that a shape of a suction slit in a guide member is changed. For parts and configuration the same as those of the first embodiment, the descriptions thereof are not repeated, and the same reference characters and numerals will be used.

[0040] As illustrated in FIG. 6, suction slits 64, 65 are formed in a guide portion 61 of a guide member 60. The guide member 60 is mounted on the suction pipe 17 in a state where the suction slits 64, 65 are aligned with the suction holes 30, 31 formed in the first wall portion 27 of the suction pipe 17. The suction slit 64 and the suction slit 65 are formed in the guide portion 61 so as to align with the suction hole 30 and the suction hole 31, respectively.

[0041] The suction slit 64 has a slit wall including an upper end wall portion 66, a lower end wall portion 67, a facing wall portion 68, and a condensing guide wall portion 69. The upper end wall portion 66 has an arc shape and forms an upstream end of the suction slit 64. The lower end wall portion 67 forms a downstream end of the suction slit 64. The facing wall portion 68 and the condensing guide wall portion 69 extend between the upper end wall portion 66 and the lower end wall portion 67.

[0042] As illustrated in FIG. 7, the facing wall portion 68 has a first slit wall surface 68A, a second slit wall surface 68B, and a third slit wall surface 68C. As illustrated in FIG.8A, the first slit wall surface 68A is formed so that a step S2 is formed between the suction slit 64 and the suction hole 30 in the longitudinal direction of the suction pipe 17. The step S2 is formed on the inner surface side of the guide portion 61. The first slit wall surface 68A extends from the upper end wall portion 66 to the downstream side so that the first slit wall surface 68A forms a predominant part of the facing wall portion 68. By providing the step S2, a gap G2 formed between the suction pipe 17 and the guide member 60 is positioned away from the first slit wall surface 68A.

[0043] As illustrated in FIG. 7, the condensing guide wall portion 69 has a first slit wall surface 69A, a second slit wall surface 69B, and a third slit wall surface 69C. As illustrated in FIG.8A, the first slit wall surface 69A is formed so that the step S2 is formed between the suction slit 64 and the suction hole 30 in the longitudinal direction of the suction pipe 17. The step S2 is formed on the inner surface side of the guide portion 61. The first slit wall surface 69A extends from the upper end wall portion 66 to the downstream side so that the first slit wall surface 69A forms a predominant part of the condensing guide wall portion 69. By providing the step S2, the gap G2 between the suction pipe 17 and the guide member 60 is positioned away from the first slit wall surface 69A.

[0044] The second slit wall surface 69B is formed so that the step S2 is not formed on the downstream side of the guide member 60 in the moving direction X of the fiber bundle F. That is, the step S2 does not exist between the downstream side of the suction slit 64 and the downstream side of the suction hole 30. The third slit wall surface 69C is formed between the first slit wall surface 69A and the second slit wall surface 69B.

[0045] As illustrated in FIG. 7, the first slit wall surfaces 68A, 69A are disposed in parallel, or substantially in parallel, with each other, and the width of the suction slit 64

(the dimension of the suction slit 64 in a direction perpendicular to the longitudinal direction of the suction slit 64) is smaller than the width of the suction hole 30. The width of the suction hole 30 and the width of the suction slit 64 are different on the upstream side of the suction hole 30 and the suction slit 64. It is noted that the widths of the suction hole and the suction slit being different does not include a case where there is a slight difference in width due to errors in manufacturing and assembling. In a state where the guide member 60 is mounted on the suction pipe 17, the first wall portion 27 of the suction pipe 17 cannot be seen when it is viewed from the suction slit 64 side. Although the first slit wall surfaces 68A, 69A extend beyond the center of the guide portion 61 in the moving direction X of the fiber bundle F from the upper end wall portion 66 so that the first slit wall surfaces 68A, 69A form the predominant parts of the facing wall portion 68 and the condensing guide wall portion 69, respectively, in the present embodiment, the configuration is not limited thereto. For example, the first slit wall surfaces 68A, 69A need not necessarily extend beyond the center of the guide portion 61 in the moving direction X of the fiber bundle F from the upper end wall portion 66.

[0046] The second slit wall surfaces 68B, 69B of the suction slit 64 extend substantially in parallel with each other, and the width of the suction slit 64 (the dimension of the suction slit 64 extending in the direction perpendicularly to the longitudinal direction of the suction slit 64) is the same as the width of the suction hole 30. It is noted that the widths of the suction slit and the suction hole being the same includes a case where there is a small difference in width due to errors in manufacturing and assembling. The third slit wall surfaces 68C, 69C do not extend in parallel, or substantially in parallel, with each other, so that the width of the suction slit 64 is decreased from the first slit wall surfaces 68A, 69A towards the second slit wall surfaces 68B, 69B.

[0047] As illustrated in FIGS. 6 and 7, when the longitudinal direction of the suction pipe 17 is set as the right-left direction, the suction slit 65 and the suction slit 64 are symmetric in the right and left. Similarly to the suction slit 64, the slit wall of the suction slit 65 has an upper end wall portion 76, a lower end wall portion 77, a facing wall portion 78, and a condensing guide wall portion 79. The upper end wall portion 76 has an arc shape and forms an upstream end of the suction slit 65. The lower end wall portion 77 forms a downstream end of the suction slit 65. The facing wall portion 78 and the condensing guide wall portion 79 extend between the upper end wall portion 76 and the lower end wall portion 77. The facing wall portion 78 is a part of the slit wall close to the suction slit 64, and the condensing guide wall portion 79 is a part of the slit wall that faces the facing wall portion 78 and is positioned far from the suction slit 64 as compared with the facing wall portion 78.

[0048] As illustrated in FIG. 7, the facing wall portion 78 has a first slit wall surface 78A, a second slit wall surface 78B, and a third slit wall surface 78C. The first slit wall surface 78A is the same as the first slit wall surface 68A of the suction slit 64, and the second slit wall surface 78B is the same as the second slit wall surface 68B of the suction slit 64. The third slit wall surface 78C is the same as the third slit wall surface 68C of the suction slit 64. As illustrated in FIG. 6, the step S2 is formed on the inner surface side of the guide portion 61. Thus, the step S2 is formed between the suction slit 65 and the suction hole 31 on the upstream side.

[0049] The condensing guide wall portion 79 has a first slit wall surface 79A, a second slit wall surface 79B, and a third slit wall surface 79C. The first slit wall surface 79A is the same as the first slit wall surface 69A of the suction slit 64, and the second slit wall surface 79B is the same as the second slit wall surface 69B of the suction slit 64. The third slit wall surface 79C is the same as the third slit wall surface 69C of the suction slit 64.

[0050] As illustrated in FIG. 7, the second slit wall surface 79B is formed so that the step S2 is not formed between the suction slit 65 and the suction hole 31 on the downstream side of the guide member 60 in the moving direction X of the fiber bundle F. Therefore, the width of the suction slit 65 on the downstream side and the width of the suction hole 31 are the same, and the step S2 does not exist between the downstream side of the suction slit 65 and the downstream side of the suction hole 31. The width of the suction slit 65 (the dimension of the suction slit 65 in a direction perpendicular to the longitudinal direction of the suction slit 65) is made smaller than the width of the suction hole 31 by the first slit wall surfaces 78A, 79A. In a state where the guide member 60 is mounted on the suction pipe 17, the first wall portion 27 of the suction pipe 17 cannot be seen when it is viewed from the suction slit 65 side.

[0051] The second embodiment offers effects similar to the above-described effects (1), (4) of the first embodiment. The step S2 is formed by making the width of the suction slit 64 (the suction slit 65) on the upstream side smaller than that of the suction hole 30 (the suction hole 31). Thus, the width of the suction slit 64 (the suction slit 65) and the width of the suction hole 30 (the suction hole 31) are different, and the step S2 is formed inner surface side of the guide member 60. Since the gap G2 is positioned away from the facing wall portion 68 and the condensing guide wall portion 69 of the suction slit 64 (the facing wall portion 78 and the condensing guide wall portion 79 of the suction slit 65), the facing wall portion 34 and the condensing guide wall portion 35 of the suction hole 30 (the facing wall portion 38 and the condensing guide wall portion 39 of the suction hole 31) blocks fibers, so that accumulation of fibers is unlikely to occur even if fibers enter the gap G2. Accordingly, the configuration of the present embodiment prevents a fiber from getting caught on the suction slit 64 (the suction slit 65) as much as possible. Further, as compared with a case where the step S2 is formed on the outer surface of the suction pipe 17, a fiber on the guide member 60 is less likely to enter the gap G2, in addition to that fibers are more likely to be

blocked by the facing wall portion 34 and the condensing guide wall portion 35 of the suction hole 30 (the facing wall portion 38 and the condensing guide wall portion 39 of the suction hole 31).

Third Embodiment

[0052] The following will describe a fiber bundle condensing device according to a third embodiment. The third embodiment differs from the first embodiment in that only one suction slit is formed in a guide member. For parts and configuration the same as those of the first embodiment, the descriptions thereof are not repeated, and the same reference characters and numerals will be used.

[0053] As illustrated in FIG. 9, a suction hole 81 is formed in a first wall portion 27 of a suction pipe 80. The suction hole 81 is a through holes having a slit shape, and extend in a direction that intersects with a longitudinal direction of the suction pipe 80 so as to be inclined relative to the moving direction X of the fiber bundle F. That is, the suction hole 81 extends from an upstream side to the downstream side of the suction pipe 80 in the moving direction X of the fiber bundle F. As illustrated in FIG. 10, the suction hole 81 has a hole wall including an upper end wall portion 82 that forms the upstream end of the suction hole 81, a lower end wall portion 83 that forms the downstream end of the suction hole 81, and a condensing guide wall portion 84 and a facing wall portion 85 that extend between the upper end wall portion 82 and the lower end wall portion 83.

[0054] The upper end wall portion 82 and the lower end wall portion 83 each have a hole wall surface extending in parallel, or substantially in parallel to a longitudinal direction of the suction pipe 80. The condensing guide wall portion 84 has a hole wall surface extending from the upstream side to the downstream side of the first wall portion 27, and a hole wall surface protruding towards the facing wall portion 85 that faces the condensing guide wall portion 84. The inclination of the condensing guide wall portion 84 relative to the moving direction X of the fiber bundle F on the upstream side is greater than the inclination of the condensing guide wall portion 84 relative to the moving direction X of the fiber bundle F on the downstream side. The facing wall portion 85 has a hole wall surface extending from the upstream side to the downstream side of the first wall portion 27, a hole wall surface extending in parallel with the condensing guide wall portion 84 that faces the facing wall portion 85, and a hole wall surface extending along the moving direction X of the fiber bundle F.

[0055] A suction slit 88 is formed in a guide portion 87 of a guide member 86 to be mounted on the suction pipe 80. The guide member 86 is mounted on the suction pipe 80 in a state where the suction slit 88 is aligned with the suction hole 81 formed in the first wall portion 27 of the suction pipe 80. Thus, the suction slit 88 and the suction hole 81 are aligned.

[0056] As illustrated in FIG. 10, the suction slit 88 has a slit wall including an upper end wall portion 89, a lower end wall portion 90, a condensing guide wall portion 91, and a facing wall portion 92. The upper end wall portion 89 forms an upstream end of the suction slit 88, and is disposed flush with, or substantially flush with, the upper end wall portion 82 of the suction hole 81. The lower end wall portion 90 forms a downstream end of the suction slit 88. The condensing guide wall portion 91 is flush with, or substantially flush with, the condensing guide wall portion 84 of the suction hole 81. That is, no step is formed between the condensing guide wall portion 91 and the condensing guide wall portion 84.

[0057] The condensing guide wall portion 91 is for condensing the fiber bundle F. The condensing guide wall portion 91 has a first slit wall surface 91A, and a second slit wall surface 91B. The first slit wall surface 91A is formed protruding in a shape of an arc on the upstream side, and the second slit wall surface 91B extends straight on the downstream side of the first slit wall surface 91A. The inclination of the first slit wall surface 91A relative to the moving direction X of the fiber bundle F is greater than the inclination of the second slit wall surface 91B relative to the moving direction X of the fiber bundle F on the downstream side.

[0058] The facing wall portion 92 faces the condensing guide wall portion 91. The facing wall portion 92 has a first slit wall surface 92A, a second slit wall surface 92B, a third slit wall surface 92C, a fourth slit wall surface 92D, and a fifth slit wall surface 92E. The first slit wall surface 92A extends along the moving direction X of the fiber bundle F on the upstream side of the facing wall portion 92. The second slit wall surface 92B faces the first slit wall surface 91A, and is recessed in an arc shape. The third slit wall surface 92C extends straight and faces the second slit wall surface 91B. The first slit wall surface 92A, the second slit wall surface 92B, and the third slit wall surface 92C are not flush with the facing wall portion 85 of the suction hole 81, thereby forming a step S3 between the suction slit 88 and the suction hole 81. That is, the step S3 is formed between the upstream side of the suction slit 88 and the upstream side of the suction hole 81. FIG. 11A illustrates the step S3 on the third slit wall surface 92C. The width of the suction slit 88 on the upstream side is greater than that of the suction hole 81. Therefore, it can be said that the width of the suction hole 81 and the width of the suction slit 88 are different. It is noted that the widths of the suction hole and the suction slit being different does not include a case where there is a slight difference in width due to errors in manufacturing and assembling.

[0059] The fourth slit wall surface 92D is flush with the facing wall portion 85 of the suction hole 81 on the downstream side of the facing wall portion 92. Thus, the width of the suction slit 88 on the downstream side and the width of the suction hole 81 are the same. That is, the step S3 does not exist between the downstream side of the suction slit 88 and the downstream side of the suction

hole 81. The widths of the suction slit and the suction hole being the same includes a case where there is a slight difference in width due to errors in manufacturing and assembling. As illustrated in FIG. 11B, the fourth slit wall surface 92D is an only part of the facing wall portion 92 flush with the facing wall portion 85 of the suction hole 81. The fifth slit wall surface 92E is a slit wall surface formed between the third slit wall surface 92C and the fourth slit wall surface 92D. Since the step S3 is formed between the suction slit 88 and the suction hole 81, the first slit wall surface 92A, the second slit wall surface 92B, and the third slit wall surface 92C of the facing wall portion 92 is positioned away from a gap G3 between the suction pipe 80 and the guide member 86.

[0060] According to the third embodiment, even the guide member 86 having the suction slit 88 corresponding to one suction hole 81 prevents a fiber from getting caught on the suction slit 88 as much as possible, similarly to the first embodiment. As compared with a case where the suction hole and the suction slit have the same shape, positioning of the guide member 86 relative to the suction hole 81 may become easier. Additionally, requirements for precision in processing the condensing guide wall portion 91 and the facing wall portion 92 of the suction slit 88 may be less strict, as compared with a case where the suction hole and the suction slit have an identical shape.

[0061] The step S3 is not formed between the condensing guide wall portion 91 of the suction slit 88 and the condensing guide wall portion 84 of the suction hole 81. This allows the fiber bundle F to be guided smoothly along the condensing guide wall portion 91 of the suction slit 88 and the condensing guide wall portion 84 of the suction hole 81.

[0062] It is noted that the above described embodiments are examples, and the configuration of the present invention is not limited to the above embodiments, but may be modified in various manners within the technical scope of the invention, as exemplified below.

[0063] In the above-described embodiments, the step is formed only one of the outer surface of the suction pipe and the inner surface of the guide member, but is not limited thereto. The fiber bundle condensing device may have a step on the outer surface of the suction surface on one side of the suction slit and a step formed on the inner surface of the guide member on the other side of the suction slit.

[0064] In the third embodiment, the step between the suction hole and the suction slit is formed on the outer surface of the suction pipe, but is not limited thereto. For example, the step between the suction hole and the suction slit may be formed, for example, on the inner surface of the guide member, similarly to the second embodiment.

[0065] Although the fiber bundle condensing device of the spinning flame as a spinning machine has been described as an example in the above-described embodiments, the spinning machine is not limited to the spinning flame. The spinning machine may be a roving machine.

[0066] A fiber bundle condensing device (11) of a spinning machine includes a suction pipe (17, 80) and a guide member (40, 60, 86) having a guide portion (41, 61, 87). The fiber bundle condensing device (11) condenses a fiber bundle (F). The suction pipe (17, 80) has a suction hole (30, 31, 81) extending from an upstream side to a downstream side in a moving direction of the fiber bundle (F). The guide member (40, 60, 86) has a suction slit (44, 45, 64, 65, 88) formed in the guide portion (41, 61, 87) and aligned with the suction hole (30, 31, 81). A width of the suction hole (30, 31, 81) and a width of the suction slit (44, 45, 64, 65, 88) are different at least on the upstream sides of the suction hole (30, 31, 81) and the suction slit (44, 45, 64, 65, 88).

Claims

1. A fiber bundle condensing device (11) of a spinning machine, the fiber bundle condensing device (11) comprising:

   a suction pipe (17, 80) disposed on a downstream side of a draft device (10); and
   a guide member (40, 60, 86) mounted on the suction pipe (17, 80) at a position where an air-permeable apron (18) is wound on the suction pipe (17, 80), and having a guide portion (41, 61, 87) configured to guide movement of the air-permeable apron (18),
   wherein the fiber bundle condensing device (11) is configured to condense a fiber bundle (F) drafted by the draft device (10),
   the suction pipe (17, 80) has a suction hole (30, 31, 81) extending from an upstream side to a downstream side in a moving direction of the fiber bundle (F), and
   the guide member (40, 60, 86) has a suction slit (44, 45, 64, 65, 88) that is formed in the guide portion (41, 61, 87) and aligned with the suction hole (30, 31, 81),
   characterized in that
   a width of the suction hole (30, 31, 81) and a width of the suction slit (44, 45, 64, 65, 88) are different at least on the upstream sides of the suction hole (30, 31, 81) and the suction slit (44, 45, 64, 65, 88).

2. The fiber bundle condensing device according to claim 1, **characterized in that**,
   the width of the suction slit (44, 45, 88) on the upstream side of the suction slit (44, 45, 88) is greater than the width of the suction hole (30, 31, 81).

3. The fiber bundle condensing device according to claim 1, **characterized in that**,
   the width of the suction slit (64, 65) on the upstream

side of the suction slit (64, 65) is smaller than the width of the suction hole (30, 31).

4. The fiber bundle condensing device according to any one of claims 1 through 3, **characterized in that**,

the suction slit (44, 45, 64, 65, 88) and the suction hole (30, 31, 81) each have a condensing guide wall portion (35, 39, 49, 59, 69, 79, 84, 91) condensing the fiber bundle (F) and a facing wall portion (34, 38, 48, 58, 68, 78, 85, 92) facing the condensing guide wall portion (35, 39, 49, 59, 69, 79, 84, 91), and
a step (S1, S2, S3) is not formed between the condensing guide wall portion (49, 59, 69, 79, 91) of the suction slit (44, 45, 64, 65, 88) and the condensing guide wall portion (35, 39, 84) of the suction hole (30, 31, 81).

5. The fiber bundle condensing device according to any one of claims 1 through 4, **characterized in that**, the width of the suction slit (44, 45, 64, 65, 88) on the downstream side of the suction slit (44, 45, 64, 65, 88) is the same as the width of the suction hole (30, 31, 81).

FIG. 1

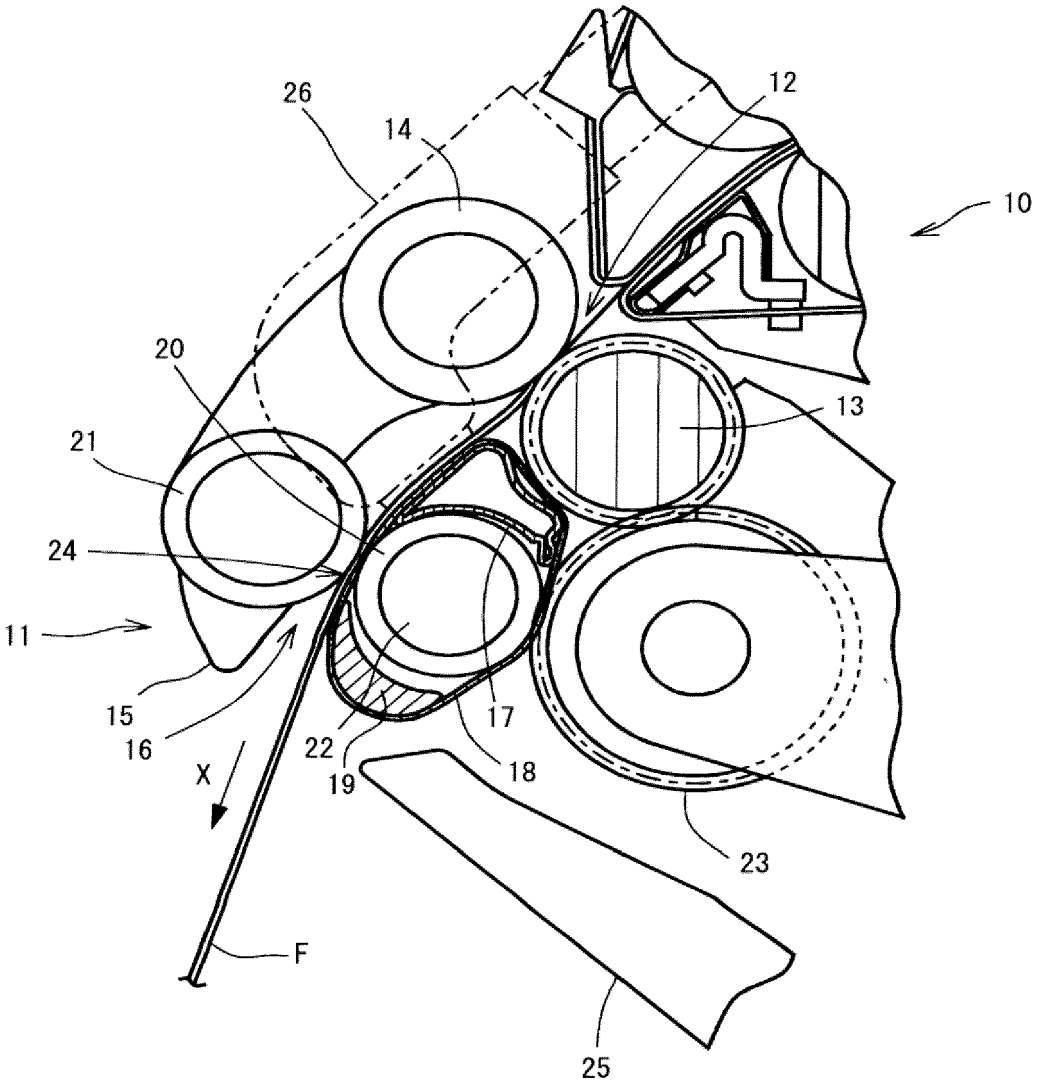


FIG. 2

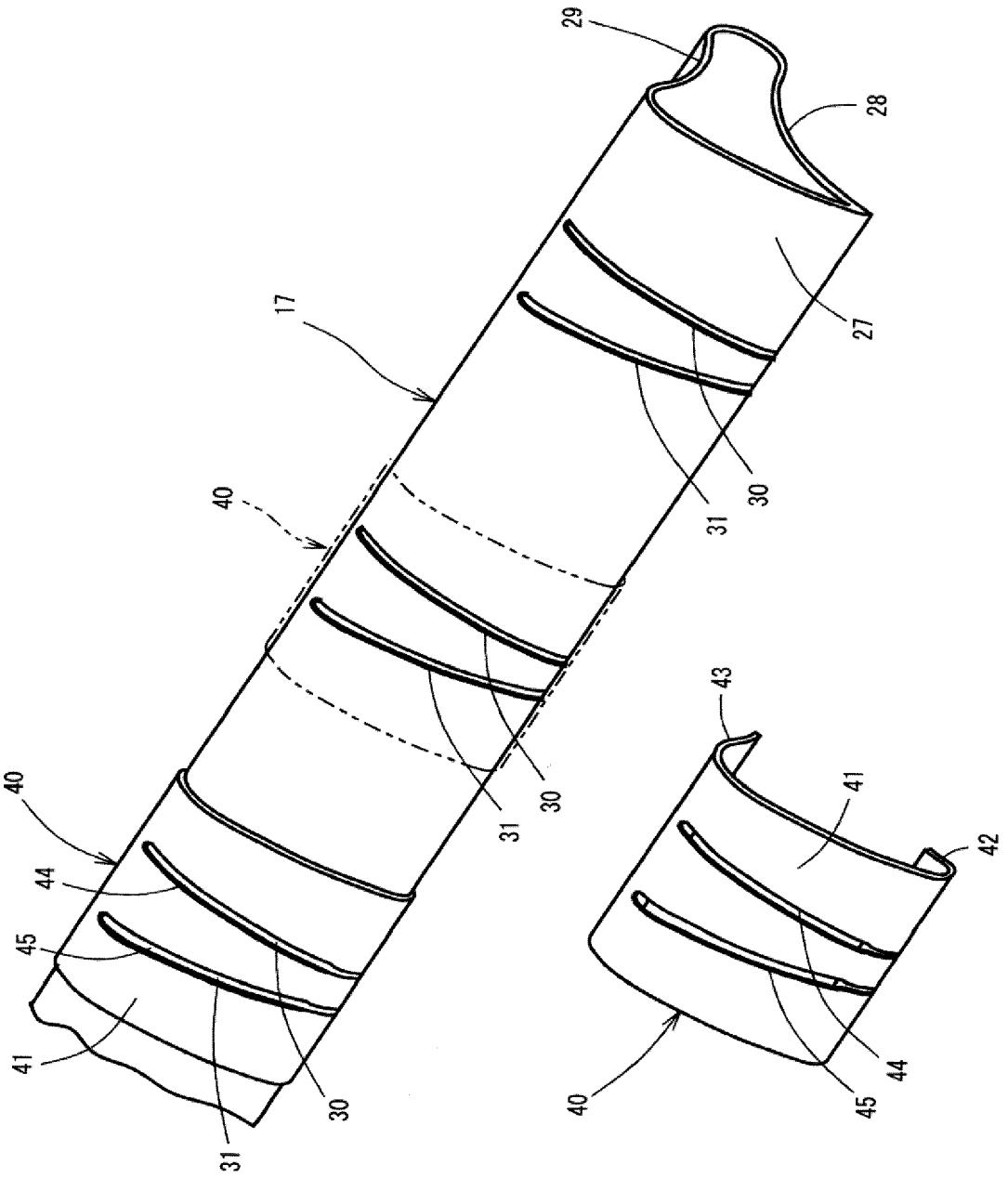


FIG. 3

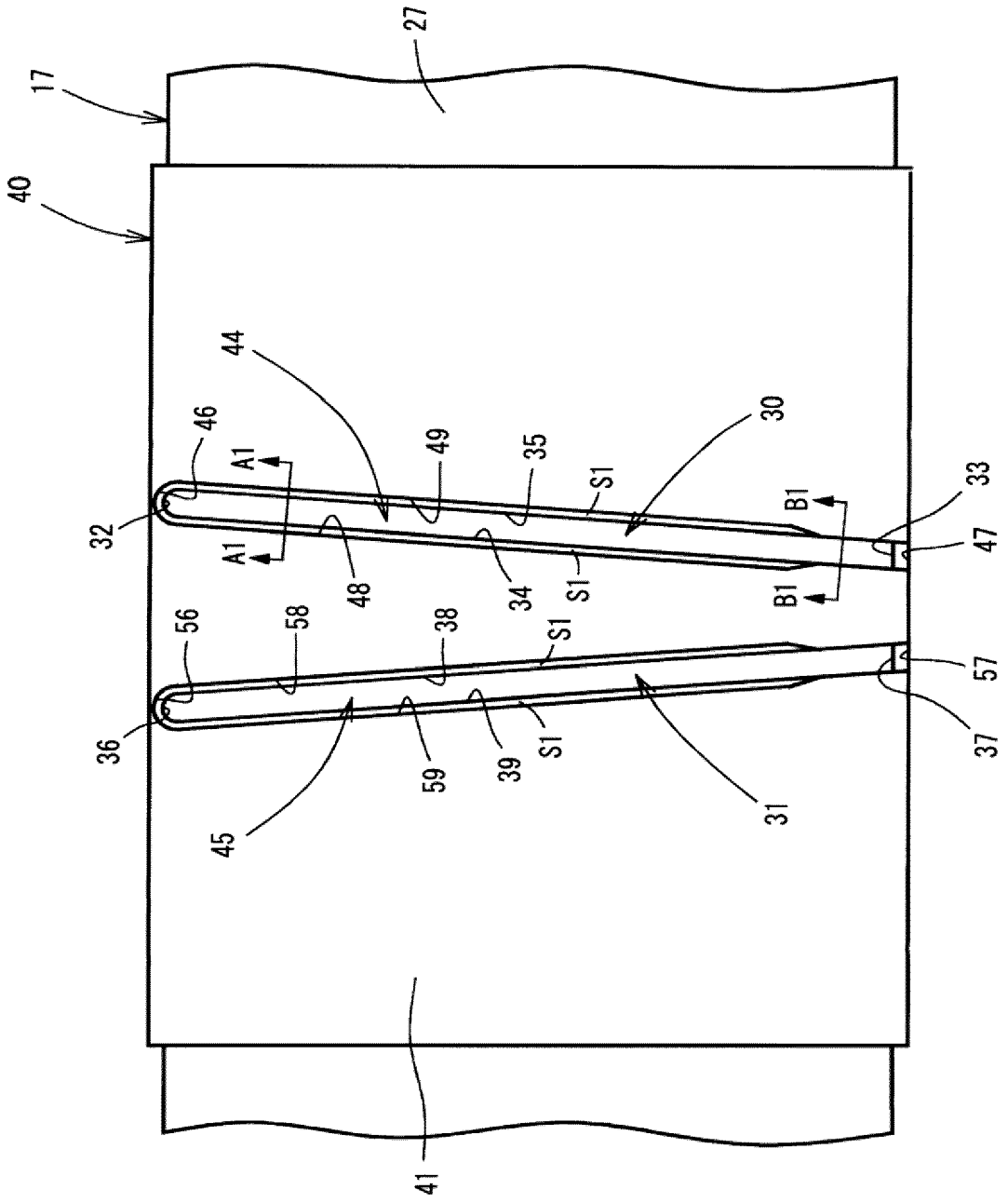

27
17
40
44
46
A1
49
35
S1
30
B1
33
32
A1
48
34
S1
B1
47
56
58
38
S1
57
36
59
39
S1
37
45
31
41

FIG. 4

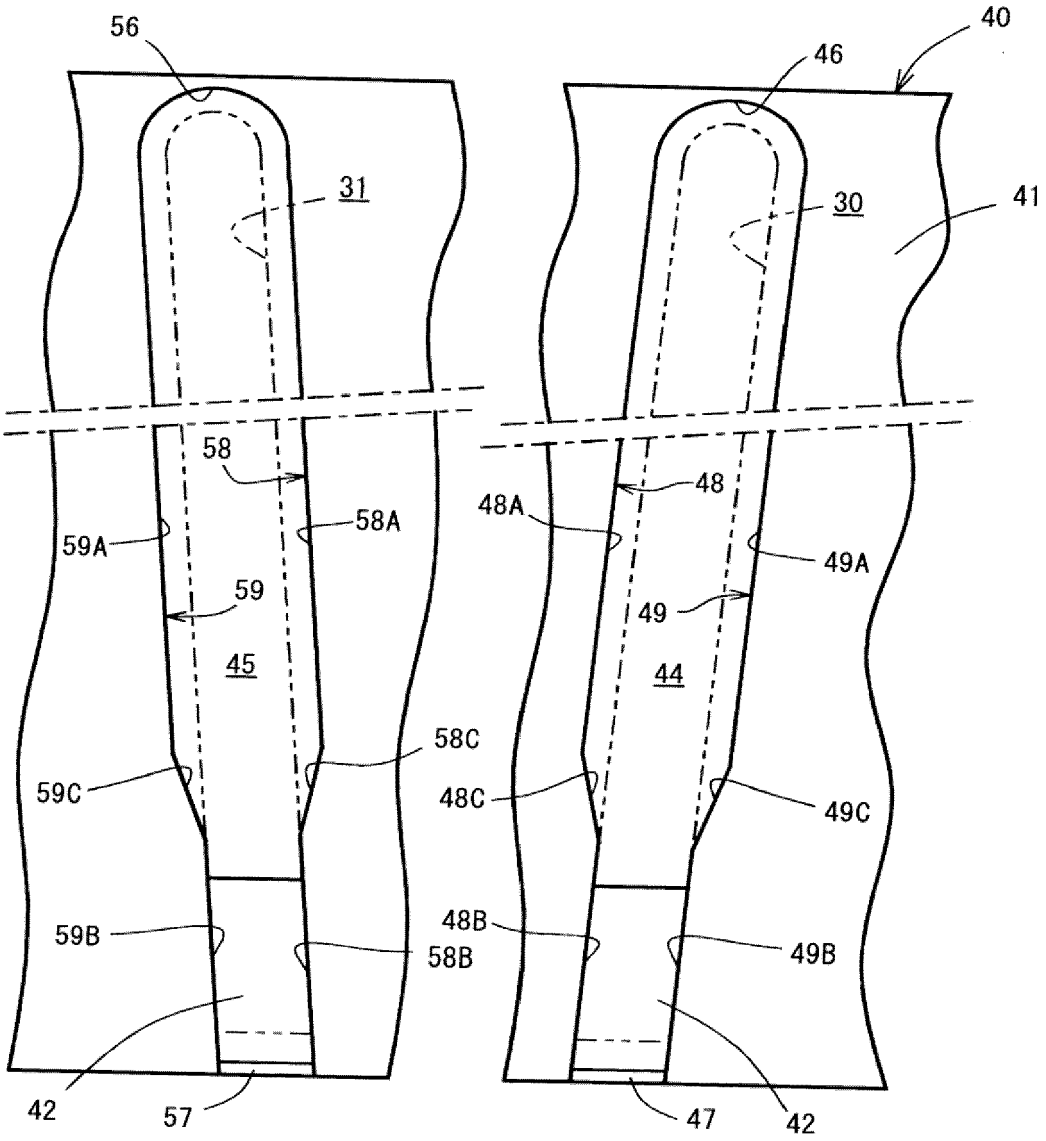

56
40
46
31
30
41
58
48
48A
59A
58A
49A
59
49
45
44
58C
59C
48C
49C
48B
59B
58B
49B
42
57
47
42

FIG. 5A

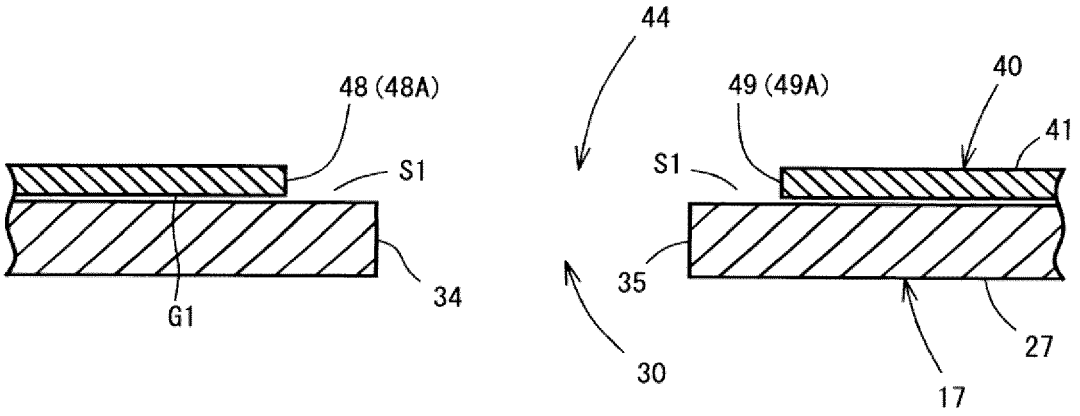

48 (48A)
S1
G1
34
44
49 (49A)
40
41
S1
35
30
27
17

FIG. 5B

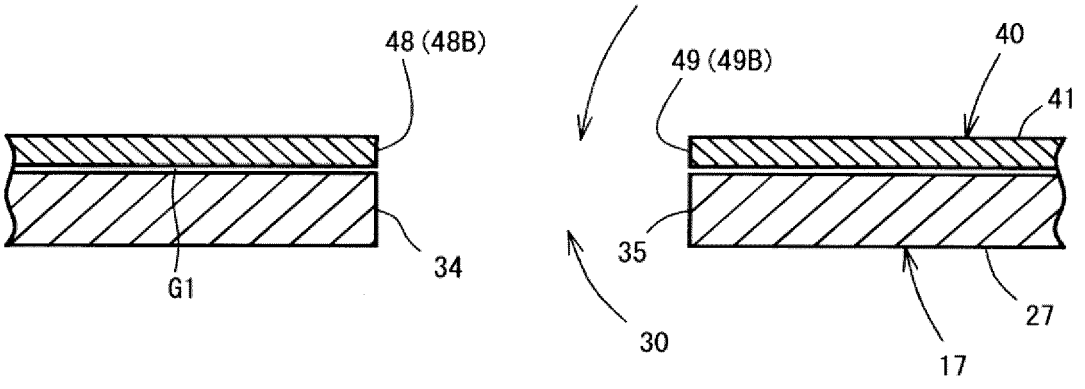
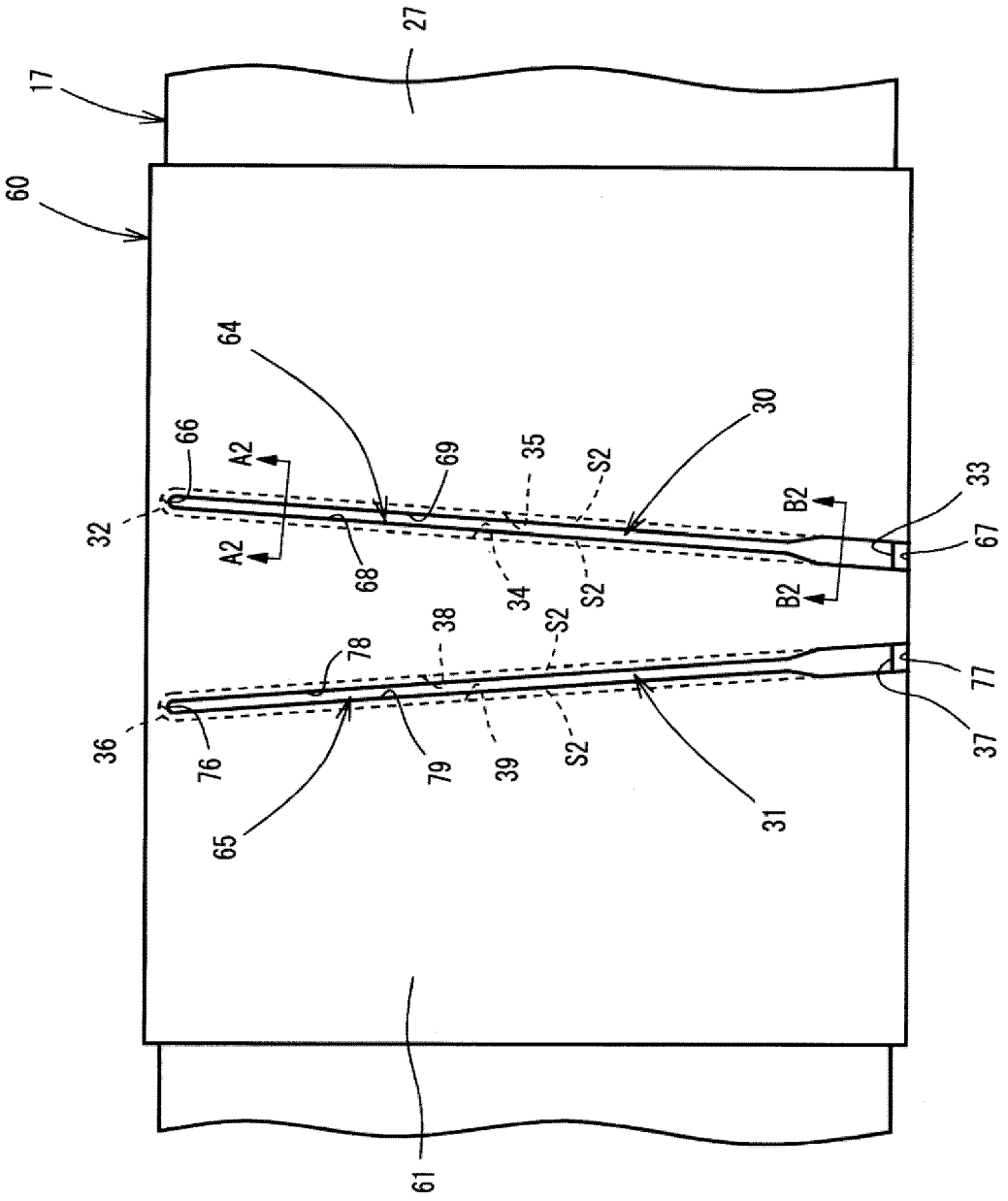

48 (48B)
G1
34
49 (49B)
40
41
35
30
27
17

FIG. 6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17
60
64
66
A2
69
35
S2
30
33
32
A2
68
34
S2
B2
67
B2
38
S2
78
77
36
76
79
39
S2
37
65
31
61

FIG. 7

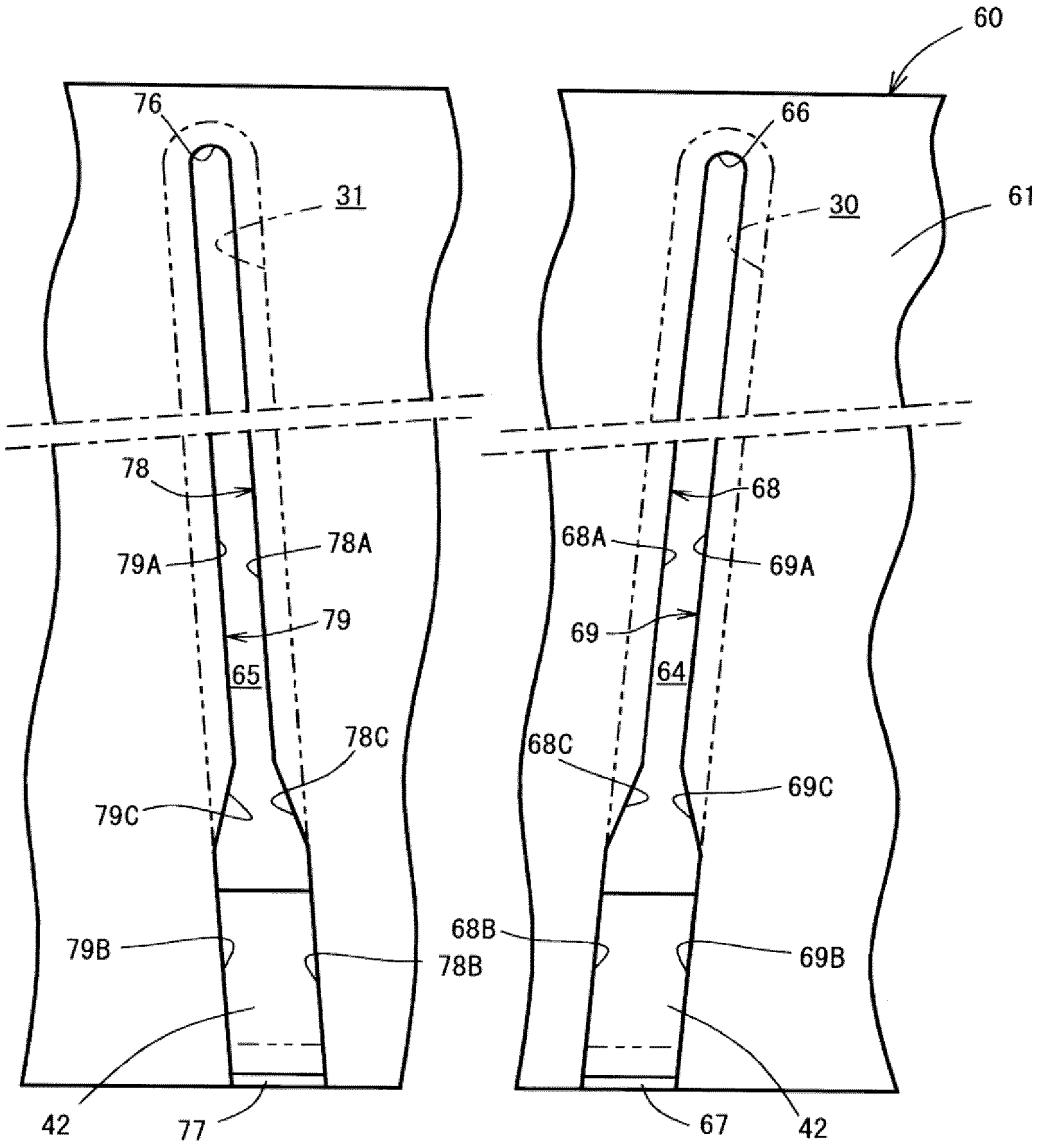

60
76
66
31
30
61
78
68
78A
68A
69A
79A
79
69
65
64
78C
68C
69C
79C
79B
68B
69B
78B
42
77
67
42

FIG. 8A

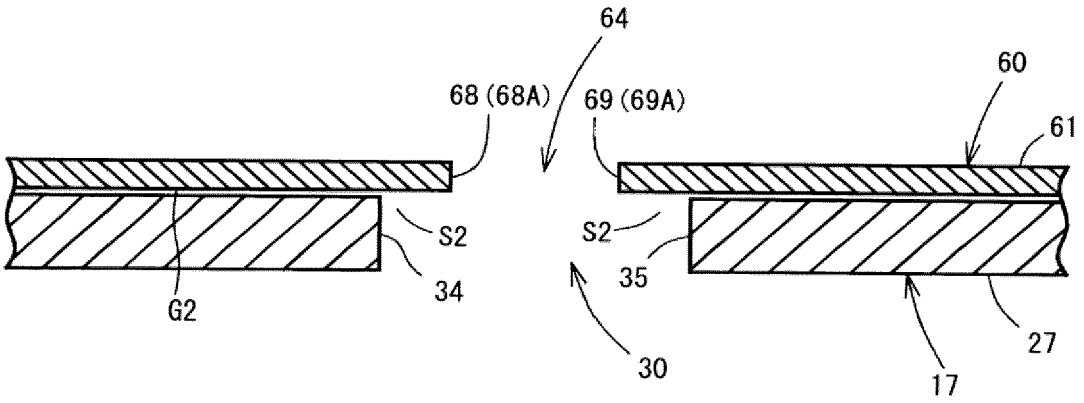

64
68 (68A)
69 (69A)
60
61
S2
S2
35
34
G2
30
17
27

FIG. 8B

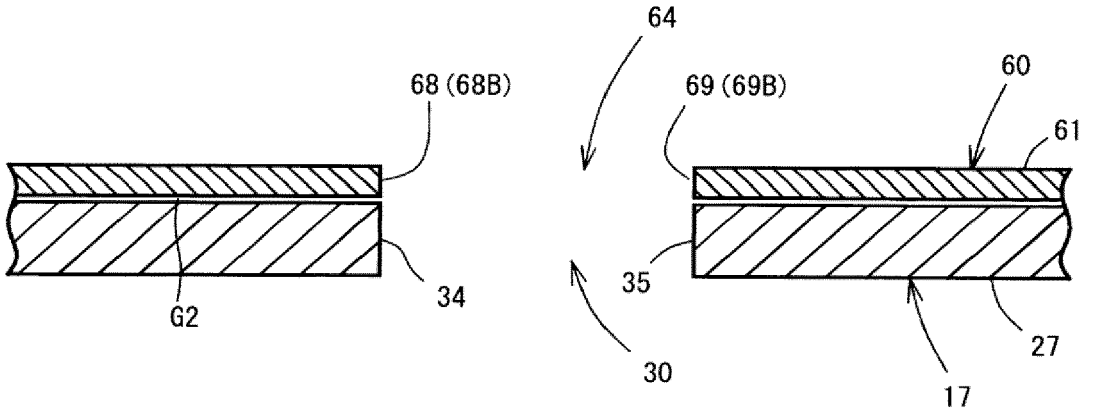

64
68 (68B)
69 (69B)
60
61
35
34
G2
30
17
27

FIG. 9

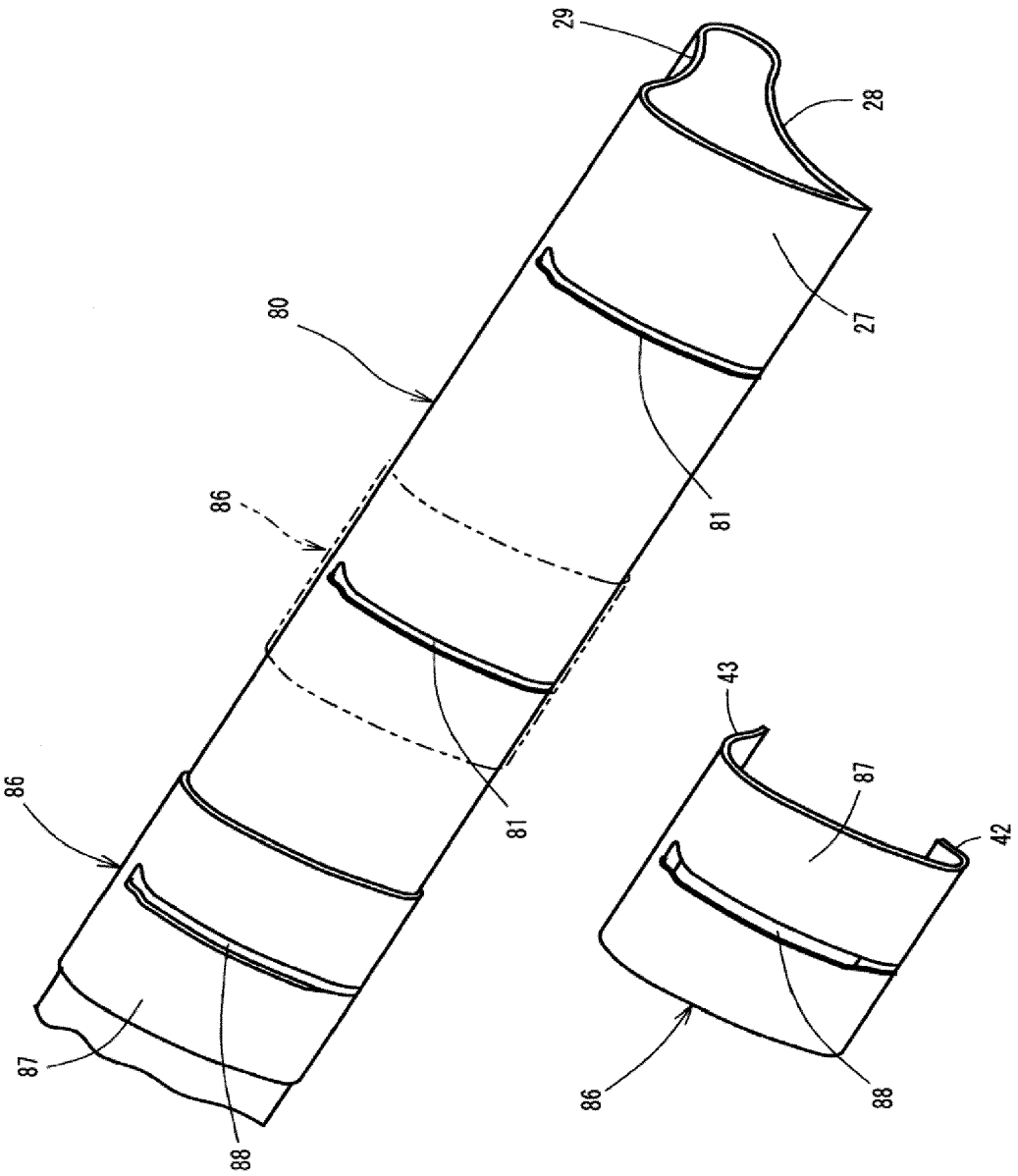
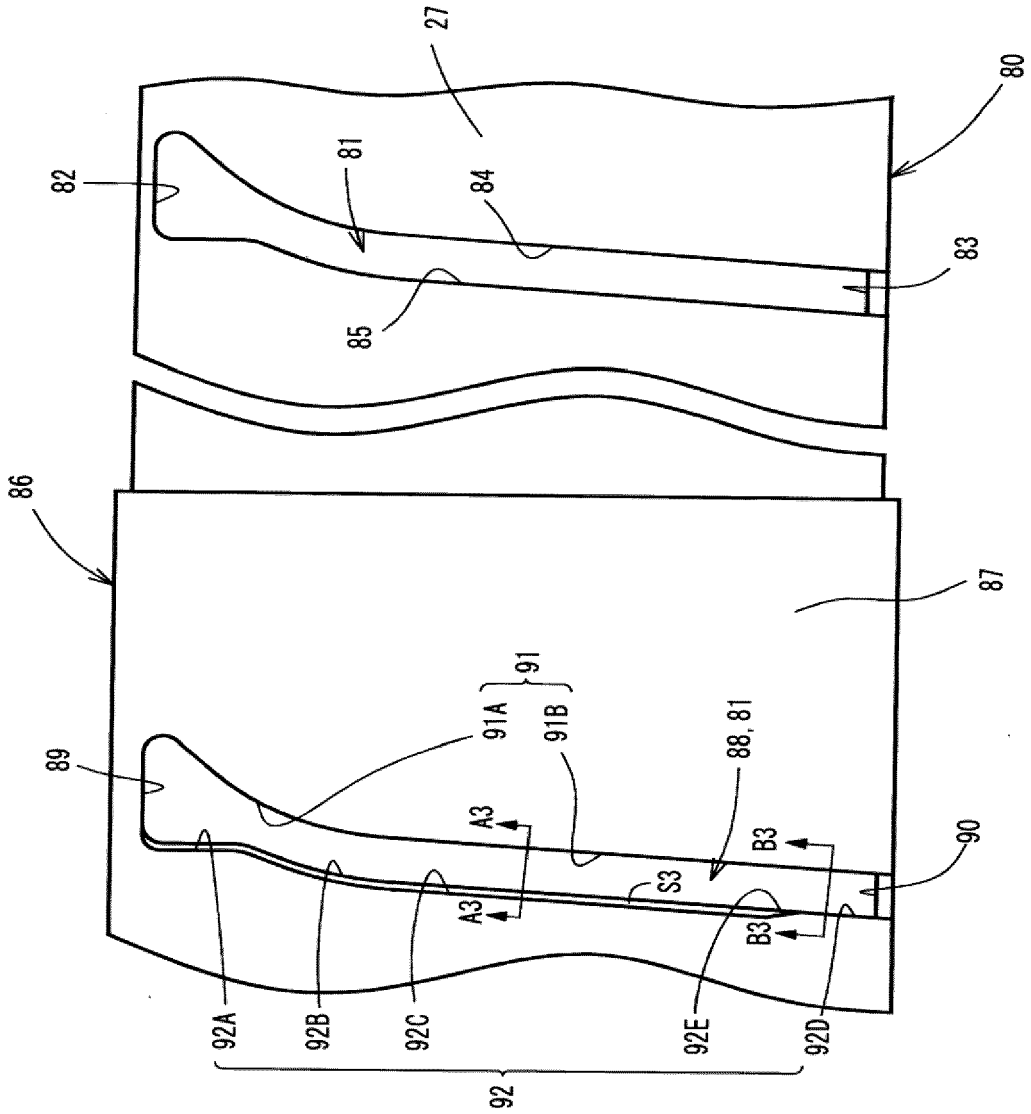


FIG. 10


27
80
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87
91
91A
91B
88, 81
89
A3
B3
90
S3
A3
B3
92A
92B
92C
92E
92D
92

FIG. 11A

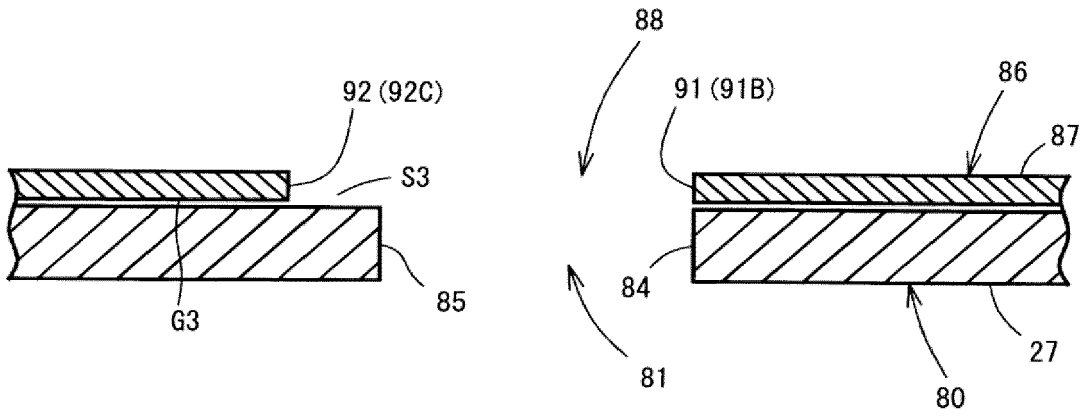
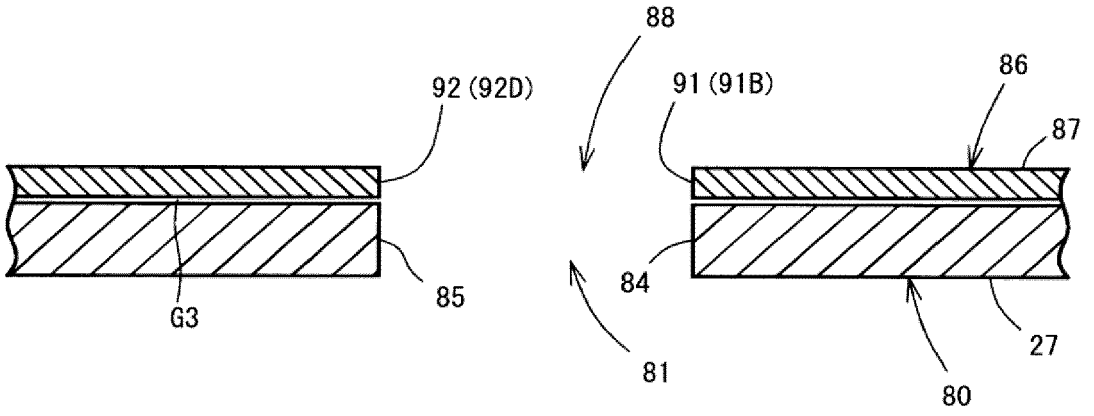


FIG. 11B



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EUROPEAN SEARCH REPORT

Application Number
EP 22 15 2618

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 3 663 446 A1 (TOYOTA JIDOSHOKKI KK [JP]) 10 June 2020 (2020-06-10)	1,3	INV. D01H5/72
A	* paragraph [0014] * * paragraph [0020] - paragraph [0023] * * figures 1, 2 *	4,5	
X	DE 199 03 113 A1 (STAHLECKER FRITZ [DE]; STAHLECKER HANS [DE]) 3 August 2000 (2000-08-03)	1,2	
A	* column 3, line 53 - column 4, line 40 * * column 5, line 19 - line 38 * * figures 6, 7 *	3-5	
X	DE 102 52 777 A1 (STAHLECKER GMBH WILHELM [DE]) 27 May 2004 (2004-05-27)	1,3	
A	* paragraph [0026] - paragraph [0027] * * figures 1, 3 *	2,4,5	

TECHNICAL FIELDS SEARCHED (IPC)

D01H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	5 July 2022	Hausding, Jan

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
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