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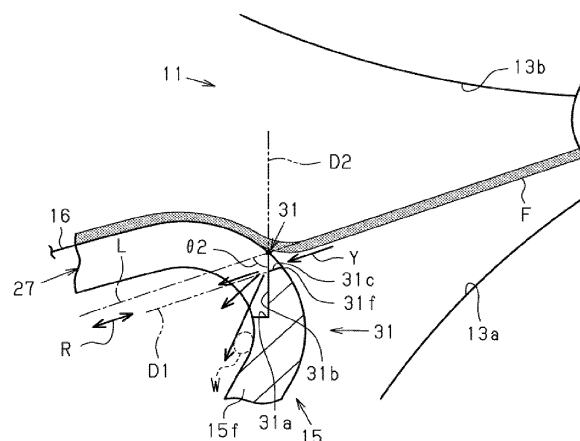
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(54) **FIBER BUNDLE CONDENSING DEVICE OF SPINNING MACHINE**

(57) A fiber bundle condensing device (11) of a spinning machine includes: a suction pipe (15) having a suction slit (27); and an air-permeable transport belt (16) wound on the suction pipe (15). The suction slit (27) has an upstream end (31). The upstream end (31) has: an introduction surface (31c) that is located on a bottom roller (13a) side of delivery roller pair (13) under a common tangent (L) to the delivery roller pair (13) at a nip point (P1) and defines a flow path of air to introduce the air

into the suction slit (27); and a flow expansion surface (31b) obliquely intersecting the introduction surface (31c), located between an outer surface and an inner surface of the suction pipe (15), and expanding the flow path. A first angle ($\theta 1$) between a first imaginary line (D1) along the introduction surface (31c) and the common tangent (L) is smaller than a second angle ($\theta 2$) between a second imaginary line (D2) along the flow expansion surface (31b) and the common tangent (L).

FIG. 6



Description

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

BACKGROUND ART

[0002] Japanese Patent Application Publication No. 2012-087419 discloses a fiber bundle condensing device that is disposed downstream of a delivery roller pair of a draft device of a spinning machine, for example. The fiber bundle condensing device includes a suction pipe and an air-permeable transport belt.

[0003] The suction pipe has a suction slit. The suction pipe is connected to a suction duct via a connection pipe. The air-permeable transport belt is partially wound on the suction pipe. The air-permeable transport belt is made from a woven fabric that ensures appropriate air permeability, for example.

[0004] When the spinning machine operates, the fiber bundle condensing device draws in a fiber bundle via the suction pipe, the connection pipe, and the suction duct. The fiber bundle is subjected to a suction force generated in a suction slit of the suction pipe via the air-permeable transport belt. The fiber bundle is attracted and condensed onto the air-permeable transport belt at a position corresponding to the suction slit, and carried by the air-permeable transport belt.

[0005] The fiber bundle is free from the rollers from when the fiber bundle is fed from the delivery roller pair to when the fiber bundle is attracted onto the air-permeable transport belt on the suction pipe, so that the fiber bundle is likely to get in disorder. In order to suppress the fiber disorder, it is preferable to decrease a distance from the delivery roller pair to the air-permeable transport belt where the fiber bundle is free.

[0006] The fiber bundle is carried along a common tangent to the delivery roller pair at a nip point. Accordingly, one way of decreasing the distance, where the fiber bundle is free, is to extend an upstream end of the suction slit on a bottom roller side under the common tangent so as to increase the suction force generated at the suction slit for quick attraction of the fiber bundle to the air-permeable transport belt.

[0007] However, this configuration may cause air flowing along the upstream end to swirl along the inner surface of the suction pipe. The swirling air flows along the upstream end at a slower flow velocity. The slower flow velocity of the air near the upstream end delays a timing of the attraction of the fiber bundle to the air-permeable transport belt, so that the distance where the fiber bundle is free is not decreased although the upstream end of the suction slit is extended.

[0008] The present invention, which has been made in light of the above-mentioned problem, is directed to providing a fiber bundle condensing device of a spinning machine that has a decreased distance from the delivery roller pair to the air-permeable transport belt, where the

fiber bundle is free.

SUMMARY

- [0009]** In accordance with an aspect of the present invention, there is provided a fiber bundle condensing device of a spinning machine, the fiber bundle condensing device including: a suction pipe disposed downstream of a delivery roller pair including a bottom roller and a top roller and having a suction slit; and an air-permeable transport belt wound on the suction pipe to cover the suction slit and configured to rotate so as to transport a fiber bundle attracted and condensed onto the air-permeable transport belt by air flowing into the suction slit.
- The air-permeable transport belt is configured to transport the fiber bundle in a transport direction. The suction pipe has a curved surface portion facing the bottom roller. The suction slit has an upstream end in the transport direction. The upstream end is formed in the curved surface portion, and has an introduction surface and a flow expansion surface. The introduction surface is located on the bottom roller side under a common tangent to the delivery roller pair at a nip point and defines a flow path of the air to introduce the air into the suction slit. The flow expansion surface obliquely intersects the introduction surface, is located between an outer surface and an inner surface of the suction pipe, and expands the flow path. A first angle between a first imaginary line along the introduction surface and the common tangent is smaller than a second angle between a second imaginary line along the flow expansion surface and the common tangent.

[0010] Other aspects and advantages of the invention will become apparent from the following description, taken in conjunction with the accompanying drawings, illustrating by way of example the principles of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

- [0011]** The invention, 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 schematic cutaway side view of a fiber bundle condensing device according to an embodiment of the present invention;

FIG. 2 is a perspective view of a suction pipe according to the embodiment;

FIG. 3 is an enlarged view of a suction slit according to the embodiment;

FIG. 4 is a partially enlarged sectional view of the suction slit, illustrating an upstream end of the suction slit according to the embodiment;

FIG. 5 is a schematic view illustrating a nip point and the upstream end according to the embodiment;

FIG. 6 is an enlarged sectional view of the upstream end according to the embodiment;

FIG. 7 is a schematic view illustrating a nip point and an upstream end according to a comparative example;

FIG. 8 is an enlarged sectional view of an upstream end according to a modification example; and

FIG. 9 is an enlarged sectional view of an upstream end according to another modification example.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0012] The following will describe a fiber bundle condensing device of a spinning machine according to an embodiment of the present invention, with reference to FIGS. 1 to 7.

Spinning machine

[0013] FIG. 1 illustrates a spinning machine that includes a fiber bundle condensing device 11 and a draft device 12. The draft device 12 includes a delivery roller pair 13 including a front bottom roller 13a that serves as a bottom roller and a front top roller 13b that serves as a top roller. The front bottom roller 13a has a gear portion 13c. The draft device 12 drafts a fiber bundle F, and the delivery roller pair 13 delivers the fiber bundle F toward the fiber bundle condensing device 11.

Fiber bundle condensing device

[0014] The fiber bundle condensing device 11 includes a feeding unit 14, a suction pipe 15, an air-permeable transport belt 16, and a guide unit 17.

Feeding unit

[0015] The feeding unit 14 includes a rotary shaft 18, a bottom nip roller 18a, and a top nip roller 19. The rotary shaft 18 is arranged parallel to and adjacent to the front bottom roller 13a of the delivery roller pair 13, and the bottom nip roller 18a is rotatable together with the rotary shaft 18. The rotary shaft 18 has a gear 22 that is rotatable together with the rotary shaft 18. The gear portion 13c of the front bottom roller 13a and the gear 22 mesh with an intermediate gear 25. A rotational force of the front bottom roller 13a is transferred to the rotary shaft 18 via the gear portion 13c, the intermediate gear 25, and the gear 22. This causes the bottom nip roller 18a to rotate.

[0016] The top nip roller 19 presses the bottom nip roller 18a via the air-permeable transport belt 16. The top nip roller 19 is supported by a weighting arm (not illus-

trated) via a support member 20.

Suction pipe

[0017] The spinning machine includes a suction duct (not illustrated) that extends in the longitudinal direction of the machine frame. The suction pipe 15 is arranged parallel to the suction duct and connected to the suction duct via a connection pipe 26. The suction pipe 15 is disposed downstream of the delivery roller pair 13 of the draft device 12, and has a suction slit 27.

[0018] The suction pipe 15 has a guide surface 28 in which the suction slit 27 is formed. The air-permeable transport belt 16 is partially wound on the suction pipe 15 to cover the suction slit 27, and rotates so as to transport the fiber bundle F. Specifically, the rotating air-permeable transport belt 16 transports the fiber bundle F, which has been attracted and condensed onto the air-permeable transport belt 16 by air flowing into the suction slit 27, in a transport direction V. The air-permeable transport belt 16 is made from a woven fabric that ensures appropriate air permeability, for example.

[0019] The suction pipe 15 is disposed downstream of a nip point P1 of the delivery roller pair 13 in the transport direction V of the fiber bundle F. The suction pipe 15 is disposed upstream of a nip point P2 of the feeding unit 14 in the transport direction V of the fiber bundle F.

[0020] As illustrated in FIGS. 1 and 2, the outer surface of the suction pipe 15 serves as the guide surface 28. The guide surface 28 is an arcuate surface that is gently curved along the transport direction V and has a width in the transport direction V. The guide surface 28 extends between the nip point P1 and the nip point P2 so as to connect the nip point P1 of the delivery roller pair 13 and the nip point P2 of the feeding unit 14. The fiber bundle F fed from the delivery roller pair 13 is guided by the guide surface 28 via the air-permeable transport belt 16 from the nip point P1 of the delivery roller pair 13 toward the nip point P2 of the feeding unit 14.

[0021] The suction pipe 15 has a guide surface forming portion 15a forming the guide surface 28 and having a plate shape that is gently curved along the transport direction V of the fiber bundle F. The suction pipe 15 has a bottom portion 15b facing the guide surface forming portion 15a. The dimension of the bottom portion 15b is smaller than the dimension of the guide surface forming portion 15a in the transport direction V.

[0022] The suction pipe 15 includes a first curved portion 15c that connects the downstream end of the guide surface forming portion 15a and the downstream end of the bottom portion 15b in the transport direction V. The first curved portion 15c is curved in an arc shape along the peripheral surface of the bottom nip roller 18a. The first curved portion 15c faces the peripheral surface of the bottom nip roller 18a.

[0023] The suction pipe 15 has a curved surface portion 15f that is continuous with the upstream end of the guide surface forming portion 15a in the transport direc-

tion V, and a second curved portion 15d that connects the curved surface portion 15f and the upstream end of the bottom portion 15b. The second curved portion 15d is curved in an arc shape along the peripheral surface of the front bottom roller 13a. The second curved portion 15d faces the peripheral surface of the front bottom roller 13a.

[0024] The curved surface portion 15f is disposed downstream of the nip point P1 of the delivery roller pair 13 in the transport direction V of the fiber bundle F. The curved surface portion 15f faces the peripheral surface of the front bottom roller 13a of the delivery roller pair 13 in the transport direction V.

Suction slit

[0025] As illustrated in FIGS. 2 and 3, the width direction of the suction slit 27 corresponds to the longitudinal direction of the suction pipe 15. The suction slit 27 has an upstream end 31 and a downstream end 32 in the transport direction V, and has a guide edge 29 and a side edge 30. The upstream end 31 extends linearly and has opposite ends in the width direction. The guide edge 29 and the side edge 30 extend from one end and the other end of the opposite ends of the upstream end 31, respectively. The downstream end 32 is connected to the guide edge 29 and the side edge 30.

[0026] The guide edge 29 is an edge for condensing the fiber bundle F. The guide edge 29 has a wide portion edge 29a continuous to the upstream end 31, and a downstream edge 29b continuous to the wide portion edge 29a and extending obliquely so as to decrease the slit width of the suction slit 27.

[0027] The direction orthogonal to the longitudinal direction of the suction pipe 15 is defined as an orthogonal direction X. The fiber bundle F fed from the delivery roller pair 13 passes near the curved surface portion 15f of the guide surface 28 along the orthogonal direction X. The downstream edge 29b of the guide edge 29 is inclined with respect to the orthogonal direction X. After passing the guide surface 28 along the orthogonal direction X, the fiber bundle F is guided by the guide edge 29 so as to travel along the wide portion edge 29a and the downstream edge 29b.

[0028] The side edge 30 has a straight edge 30d extending linearly from the upstream end 31, and a downstream edge 30c continuous to the straight edge 30d. The straight edge 30d extends linearly and parallel to the orthogonal direction X. The downstream edge 30c is inclined with respect to the orthogonal direction X.

[0029] The slit width of the suction slit 27 is gradually increased by the wide portion edge 29a and the straight edge 30d from upstream to downstream in the transport direction V, and the slit width is then gradually decreased by the downstream edge 29b and the straight edge 30d. Then, the slit width is made to be substantially constant by the downstream edge 29b of the guide edge 29 and the downstream edge 30c of the side edge 30.

[0030] In the suction slit 27, the ratio of the wide portion edge 29a to the downstream edge 29b of the guide edge 29, and the ratio of the straight edge 30d to the downstream edge 30c of the side edge 30 or the ratio of the straight edge 30d to the side edge 30 are appropriately determined depending on the inclination of the guide edge 29 or the required quality of the yarn to be spun.

Upstream end

[0031] The suction slit 27 is formed in the suction pipe 15, and the upstream end 31 of the suction slit 27 is then formed in the suction pipe 15 with an end mill. Specifically, the upstream end 31 is formed by moving the end mill in the width direction of the suction slit 27 with the end mill in contact with the upstream end 31.

[0032] As illustrated in FIG. 4, the upstream end 31 of the suction slit 27 is formed in the curved surface portion 15f. The upstream end 31 has an intersecting surface 31a, a flow expansion surface 31b, an introduction surface 31c, and an arcuate surface 31f. The intersecting surface 31a, the flow expansion surface 31b, the introduction surface 31c, and the arcuate surface 31f extend over the whole upstream end 31 in the longitudinal direction of the suction pipe 15. The flow expansion surface 31b is formed by machining the inner surface of the suction pipe 15. The flow expansion surface 31b may be formed while the intersecting surface 31a is formed. Accordingly, the flow expansion surface 31b may be easily formed.

[0033] The introduction surface 31c is smoothly continuous to the outer surface of the suction pipe 15 via the arcuate surface 31f. The introduction surface 31c is an inclined surface that is a flat surface and inclined downward in the transport direction V of the fiber bundle F and forms the upstream end 31.

[0034] As illustrated in FIGS. 5 and 6, a first imaginary line D1 extends along the introduction surface 31c in the orthogonal direction X. The first imaginary line D1 is located on the front bottom roller 13a side under a common tangent L at the nip point P1. Specifically, the first imaginary line D1 is located on the bottom portion 15b side of the suction pipe 15 under the common tangent L. The common tangent L extends in a common tangent direction R. The direction in which the first imaginary line D1 extends corresponds to the common tangent direction R. That is, the introduction surface 31c extends in the common tangent direction R. The introduction surface 31c is located on the front bottom roller 13a side under the common tangent L to the delivery roller pair 13 at the nip point P1, and defines a flow path of the air to introduce the air to the suction slit 27. Accordingly, the first imaginary line D1 is located on the front bottom roller 13a side under the common tangent L.

[0035] A first angle $\theta 1$ is an angle between the first imaginary line D1 along the introduction surface 31c and the common tangent L. In this embodiment, the first angle $\theta 1$ is 0 degrees and therefore not illustrated in FIGS. 5

and 6. If the first angle θ_1 is increased, the introduction surface 31c reaches the inner surface of the suction pipe 15, so that the intersecting surface 31a and the flow expansion surface 31b cannot be formed. Accordingly, the maximum value of the first angle θ_1 is set to a value that allows the formation of the intersecting surface 31a and the flow expansion surface 31b.

[0036] If the first angle θ_1 is decreased to 0 degrees, which is the minimum value of the first angle θ_1 , the first imaginary line D1 and the common tangent L become parallel to each other. When the first angle θ_1 is 0 degrees, the direction in which the air flows along the introduction surface 31c corresponds to the common tangent direction R. This allows the air to flow along the transport direction V of the fiber bundle F fed from the nip point P1 for more quick attraction of the fiber bundle F to the air-permeable transport belt 16. That is, in the present embodiment, the first angle θ_1 is 0 degrees.

[0037] The flow expansion surface 31b is a flat surface obliquely intersecting the introduction surface 31c. The flow expansion surface 31b is located between the outer surface and the inner surface of the suction pipe 15, and expands the flow path defined by the introduction surface 31c. The introduction surface 31c is located on the front bottom roller 13a side under the common tangent L, and the flow expansion surface 31b, which is continuous with the introduction surface 31c, is located on the front bottom roller 13a side under the common tangent L. The flow expansion surface 31b extends from the introduction surface 31c so as to become away from the common tangent L.

[0038] A second imaginary line D2 extends along the flow expansion surface 31b in the orthogonal direction X. The direction in which the second imaginary line D2 extends intersects the common tangent direction R. A second angle θ_2 is an angle between the second imaginary line D2 along the flow expansion surface 31b and the common tangent L. The second angle θ_2 is greater than the first angle θ_1 . In other words, the first angle θ_1 is smaller than the second angle θ_2 .

[0039] Decreasing the second angle θ_2 may eliminate the intersecting surface 31a. Accordingly, the minimum value of the second angle θ_2 is determined so as to ensure formation of the intersecting surface 31a. Increasing the second angle θ_2 causes the intersecting surface 31a to extend toward the outer surface of the suction pipe 15, thereby forming a recess that is formed between the flow expansion surface 31b and the intersecting surface 31a and recessed toward the outer surface of the suction pipe 15. This configuration may cause an undesirable swirling airflow in the recess. Accordingly, the second angle θ_2 is preferably determined so that the intersecting surface 31a and the flow expansion surface 31b are perpendicular to each other.

[0040] The intersecting surface 31a intersects the inner surface of the suction pipe 15. The intersecting surface 31a is a flat surface perpendicular to the flow expansion surface 31b. That is, the intersecting surface 31a

is perpendicular to the flow expansion surface 31b, and extends from the inner surface of the suction pipe 15 to the flow expansion surface 31b. The suction pipe 15 has on the inner surface of the curved surface portion 15f a step formed by the intersecting surface 31a and the flow expansion surface 31b.

Operation of embodiment

[0041] When the spinning machine operates, the fiber bundle F is drafted by the draft device 12 and fed from the delivery roller pair 13 toward the fiber bundle condensing device 11. As illustrated in FIG. 5, the fiber bundle F is fed from the delivery roller pair 13 along the common tangent L. The fiber bundle F is drawn via the suction pipe 15 such that the fiber bundle F is carried from the nip point P1 of the delivery roller pair 13 toward the nip point P2 of the feeding unit 14, and attracted onto the air-permeable transport belt 16. The fiber bundle F is then guided by the guide surface 28 via the air-permeable transport belt 16, and carried in the transport direction V by the air-permeable transport belt 16.

Comparative example

[0042] The following will describe an upstream end 71 according to a comparative example.

[0043] As illustrated in FIG. 7, air drawn via a suction duct flows toward the upstream end 71 of the suction slit 27 as indicated by an arrow Y. The upstream end 71 of the comparative example has a flat surface 71a extending from the outer surface of the suction pipe 15 to the inner surface of the suction pipe 15. The flat surface 71a of the upstream end 71 is located on the front bottom roller 13a side under the common tangent L, but does not have the flow expansion surface 31b and the intersecting surface 31a. Accordingly, the air flows along the flat surface 71a of the upstream end 71 of the comparative example in the common tangent direction R. This causes the air to swirl in a region W between the inner surface of the suction pipe 15 and the flow of the air. The swirling air causes a decrease in the flow velocity of the air near the inner surface of the suction pipe 15. Accordingly, in the comparative example, the fiber bundle F fed from the delivery roller pair 13 is attracted onto the air-permeable transport belt 16 at a position on the front top roller 13b side above the common tangent L.

[0044] Next, the following will describe the operation of the upstream end 31 of the embodiment of the present invention in comparison with the operation of the upstream end 71 of the comparative example.

[0045] According to the embodiment of the present invention, as illustrated in FIG. 6, the air drawn via the suction duct flows toward the upstream end 31 of the suction slit 27 as indicated by the arrow Y. The introduction surface 31c of the upstream end 31 is located on the front bottom roller 13a side under the common tangent L. This configuration increases the amount of the air flow-

ing into the suction slit 27 compared with a configuration in which the introduction surface 31c is located on the front top roller 13b side above the common tangent L.

[0046] Furthermore, the flow path of the air defined by the introduction surface 31c so that the air flows along the introduction surface 31c is then expanded by the flow expansion surface 31b. Accordingly, the flow expansion surface 31b causes the air, which has flowed along the introduction surface 31c, to flow away from the common tangent L. That is, the flow path of the air flowed along the introduction surface 31c is expanded by the flow expansion surface 31b. This configuration allows the air to swirl in the region W between the flow of the air flowing through the expanded flow path and the inner surface of the suction pipe 15, but reduces the region W compared with the region W of the comparative example. Accordingly, this configuration suppresses a decrease in the flow velocity of the air even if the air swirls inside the suction pipe 15. The fiber bundle F fed from the delivery roller pair 13 is attracted onto the air-permeable transport belt 16 near the intersection of the common tangent L and the second imaginary line D2. This allows the fiber bundle F fed from the delivery roller pair 13 to be quickly attracted onto the air-permeable transport belt 16, compared with the configuration of the comparative example in which the fiber bundle F fed from the delivery roller pair 13 is attracted onto the air-permeable transport belt 16 at a position on the front top roller 13b side above the common tangent L. This therefore allows a decrease in a distance from the delivery roller pair 13 to the air-permeable transport belt 16, where the fiber bundle F is free.

[0047] The present embodiment obtains the following effects.

(1) The presence of the introduction surface 31c located on the front bottom roller 13a side under the common tangent L increases the amount of the air flowing into the suction slit 27. Furthermore, the presence of the flow expansion surface 31b reduces the region W in which the air swirls along the inner surface of the suction pipe 15. Accordingly, the upstream end 31 of the suction slit 27 allows an increase in the amount of the air flowing into the suction slit 27 and suppresses a decrease in the flow velocity due to the swirling of the air, thereby allowing the fiber bundle F to be quickly attracted onto the air-permeable transport belt 16. This therefore allows a decrease in a distance from the delivery roller pair 13 to the air-permeable transport belt 16, where the fiber bundle F is free, thereby suppressing the fiber disorder in the fiber bundle F.

(2) The introduction surface 31c introduces the air flowing in the common tangent direction R into the suction slit 27. This configuration allows an increase in the amount of the air flowing into the suction slit 27, compared with the configuration without the introduction surface 31c. This configuration therefore

allows the fiber bundle F to be quickly attracted onto the air-permeable transport belt 16 and easily condensed. Furthermore, the presence of the flow expansion surface 31b reduces the region W in which the air swirls. Accordingly, the configuration including the introduction surface 31c and the flow expansion surface 31b generates a suction force, which quickly attracts and condenses the fiber bundle F, without increasing power consumption.

(3) The upstream end 31 allows the fiber bundle F fed from the delivery roller pair 13 to be quickly attracted onto the air-permeable transport belt 16. This stabilizes the quality of the yarn produced from the fiber bundle F.

(4) One way of quickly attracting the fiber bundle F fed from the delivery roller pair 13 onto the air-permeable transport belt 16 is to place the suction pipe 15 near the front bottom roller 13a. However, the fiber bundle F may wrap around the front bottom roller 13a for some reason. If the suction pipe 15 is too close to the front bottom roller 13a, the fiber bundle F wrapping around the front bottom roller 13a may get jammed. The presence of the introduction surface 31c and the flow expansion surface 31b of the upstream end 31 allows the fiber bundle F fed from the delivery roller pair 13 to be quickly attracted onto the air-permeable transport belt 16 without placing the suction pipe 15 near the front bottom roller 13a.

(5) The introduction surface 31c is an inclined surface intersecting the flow expansion surface 31b. Accordingly, the introduction surface 31c efficiently introduces the air into the suction slit 27.

(6) The introduction surface 31c is a flat inclined surface. This configuration allows the air to be more efficiently introduced into the suction slit 27, compared with a configuration in which the introduction surface 31c is a curved inclined surface, for example.

[0048] The present embodiment may be modified in various manners, as exemplified below. The present embodiment and the following modification examples may be combined within the scope of the present invention.

◦ The upstream end 31 of the suction slit 27 extends linearly in the longitudinal direction of the suction pipe 15. However, the shape of the upstream end 31 is not limited thereto, and the upstream end 31 may extend obliquely to the orthogonal direction X, for example.

◦ The air-permeable transport belt 16 is made from a woven fabric. However, the air-permeable transport belt 16 may be made from a knitting fabric, or a rubber belt or an elastic plastic belt having a large number of holes.

◦ As illustrated in FIG. 8, the introduction surface 31c may be formed of a surface that defines a through hole 33 penetrating the curved surface portion 15f in the thickness direction of the curved surface portion 15f.

◦ As illustrated in FIG. 9, the first angle θ_1 between the common tangent L and the first imaginary line D1 may be greater than 0 degrees as long as the first angle θ_1 is smaller than the second angle θ_2 .

◦ The second angle θ_2 may be modified as appropriate as long as the second angle θ_2 is greater than the first angle θ_1 .

◦ The upstream end 31 may not have the intersecting surface 31a that intersects the inner surface of the suction pipe 15. In this configuration, the flow expansion surface 31b is formed along the inner surface of the suction pipe 15.

◦ The intersecting surface 31a does not need to be perpendicular to the flow expansion surface 31b as long as the intersecting surface 31a intersects the flow expansion surface 31b.

A fiber bundle condensing device (11) of a spinning machine includes: a suction pipe (15) having a suction slit (27); and an air-permeable transport belt (16) wound on the suction pipe (15). The suction slit (27) has an upstream end (31). The upstream end (31) has: an introduction surface (31c) that is located on a bottom roller (13a) side of delivery roller pair (13) under a common tangent (L) to the delivery roller pair (13) at a nip point (P1) and defines a flow path of air to introduce the air into the suction slit (27); and a flow expansion surface (31b) obliquely intersecting the introduction surface (31c), located between an outer surface and an inner surface of the suction pipe (15), and expanding the flow path. A first angle (θ_1) between a first imaginary line (D1) along the introduction surface (31c) and the common tangent (L) is smaller than a second angle (θ_2) between a second imaginary line (D2) along the flow expansion surface (31b) and the common tangent (L).

Claims

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

a suction pipe (15) disposed downstream of a delivery roller pair (13) including a bottom roller (13a) and a top roller (13b) and having a suction slit (27); and

an air-permeable transport belt (16) wound on the suction pipe (15) to cover the suction slit (27) and configured to rotate so as to transport a fiber bundle (F) attracted and condensed onto the air-permeable transport belt (16) by air flowing into the suction slit (27), the air-permeable transport

belt (16) being configured to transport the fiber bundle (F) in a transport direction (V), **characterized in that**

the suction pipe (15) has a curved surface portion (15f) facing the bottom roller (13a), the suction slit (27) has an upstream end (31) in the transport direction (V), the upstream end (31) is formed in the curved surface portion (15f), and has:

an introduction surface (31c) that is located on the bottom roller (13a) side under a common tangent (L) to the delivery roller pair (13) at a nip point (P1) and defines a flow path of the air to introduce the air into the suction slit (27); and a flow expansion surface (31b) obliquely intersecting the introduction surface (31c), located between an outer surface and an inner surface of the suction pipe (15), and expanding the flow path, and

a first angle (θ_1) between a first imaginary line (D1) along the introduction surface (31c) and the common tangent (L) is smaller than a second angle (θ_2) between a second imaginary line (D2) along the flow expansion surface (31b) and the common tangent (L).

2. The fiber bundle condensing device (11) of the spinning machine according to claim 1, **characterized in that** the introduction surface (31c) is an inclined surface that forms the upstream end (31).
3. The fiber bundle condensing device (11) of the spinning machine according to claim 2, **characterized in that** the inclined surface is a flat surface.
4. The fiber bundle condensing device (11) of the spinning machine according to claim 1 or 2, **characterized in that** the introduction surface (31c) extends in a common tangent direction (R).
5. The fiber bundle condensing device (11) of the spinning machine according to claim 1 or 2, **characterized in that** the upstream end (31) has an intersecting surface (31a) that is perpendicular to the flow expansion surface (31b), and extends from the inner surface of the suction pipe (15) to the flow expansion surface (31b).

FIG. 1

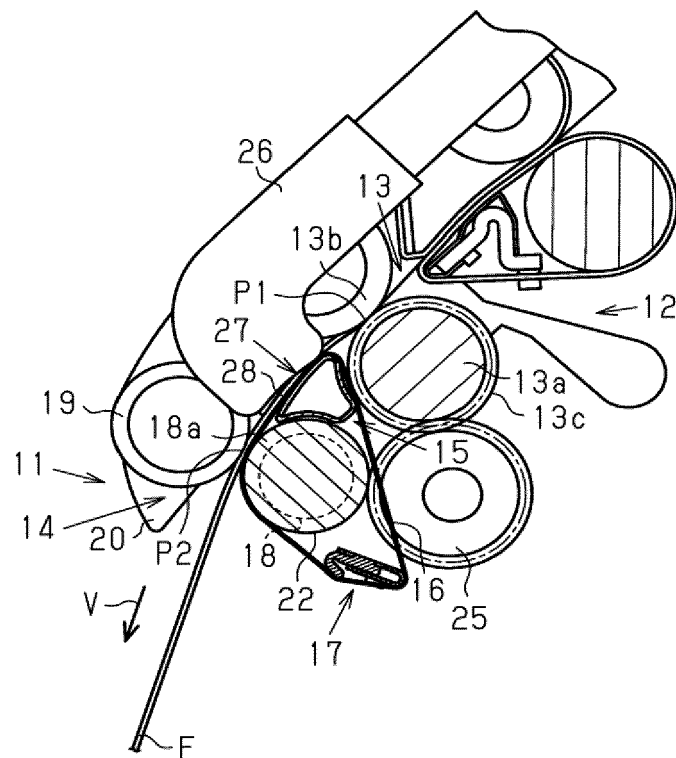


FIG. 2

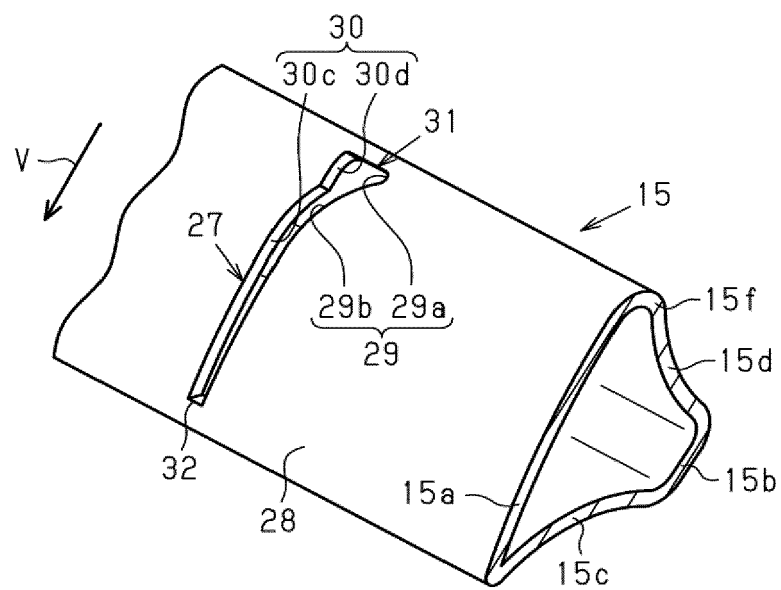


FIG. 3

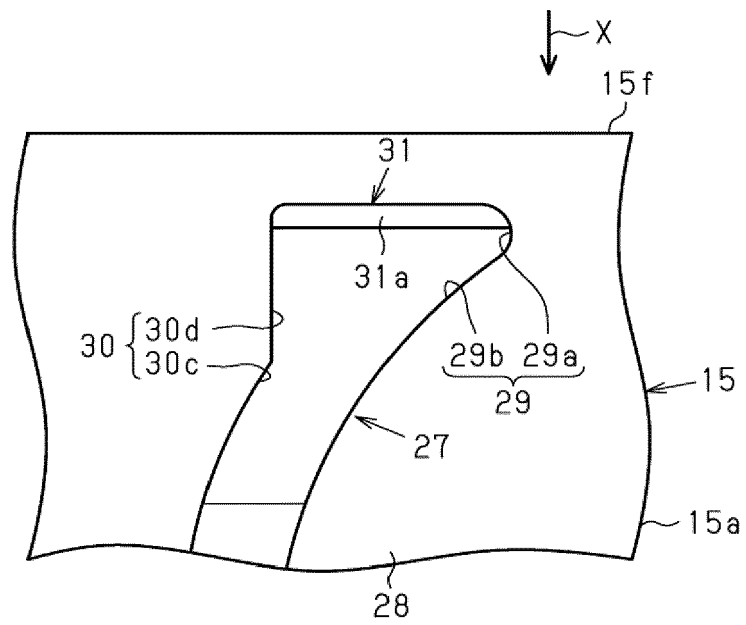


FIG. 4

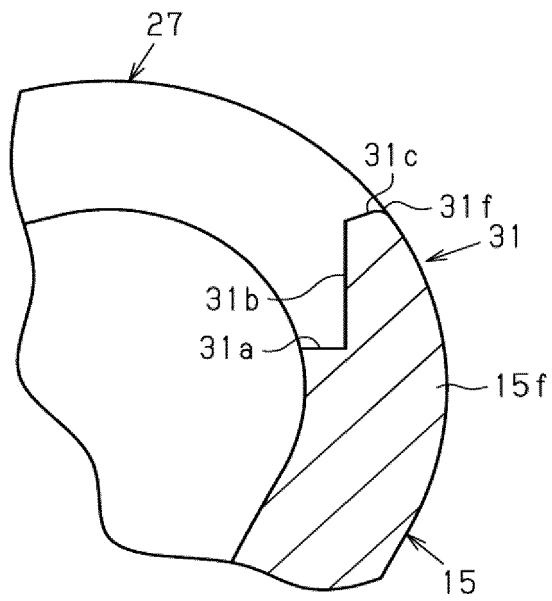


FIG. 5

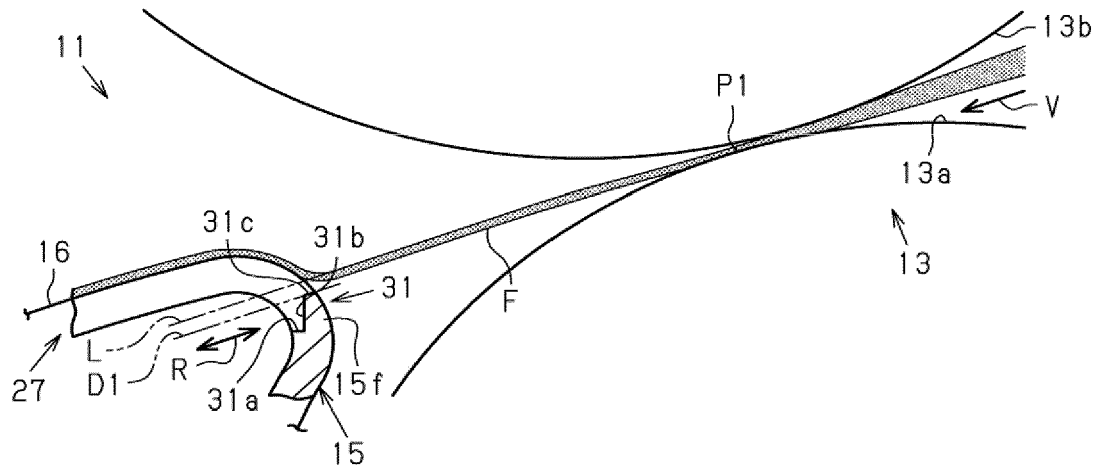


FIG. 6

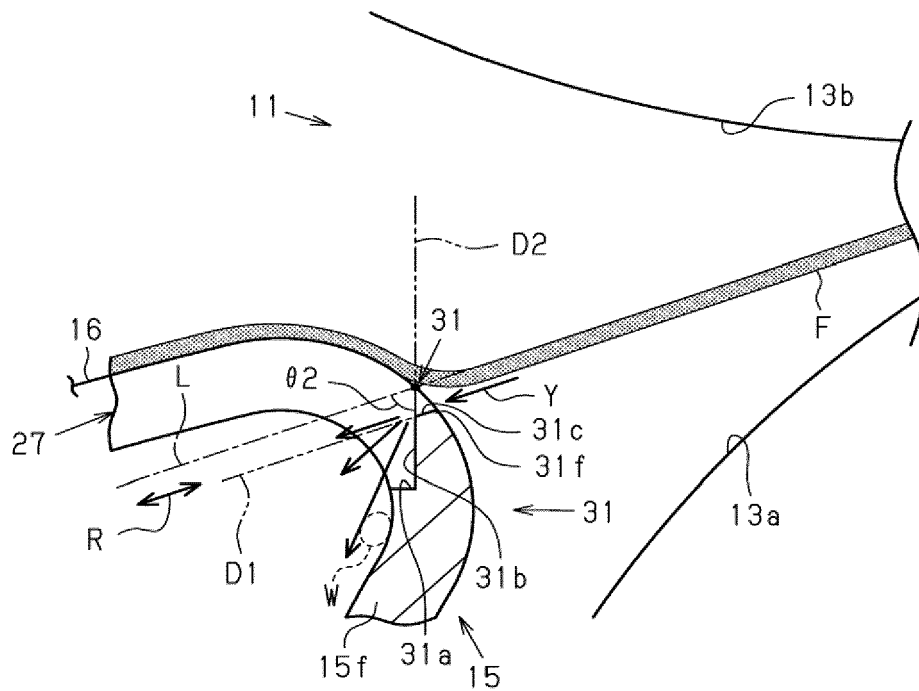


FIG. 7

BACKGROUND ART

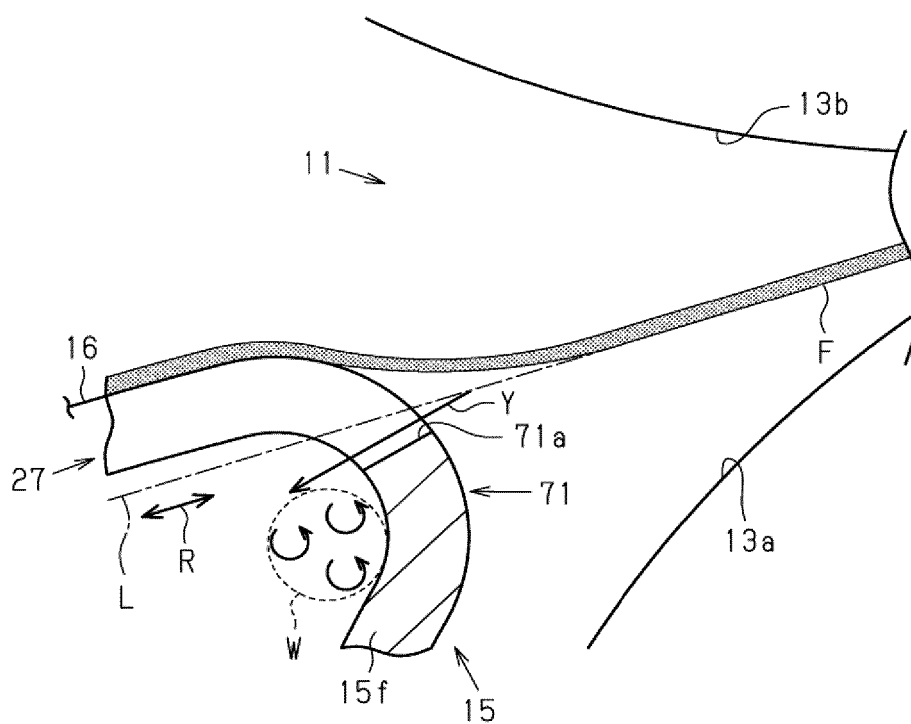


FIG. 8

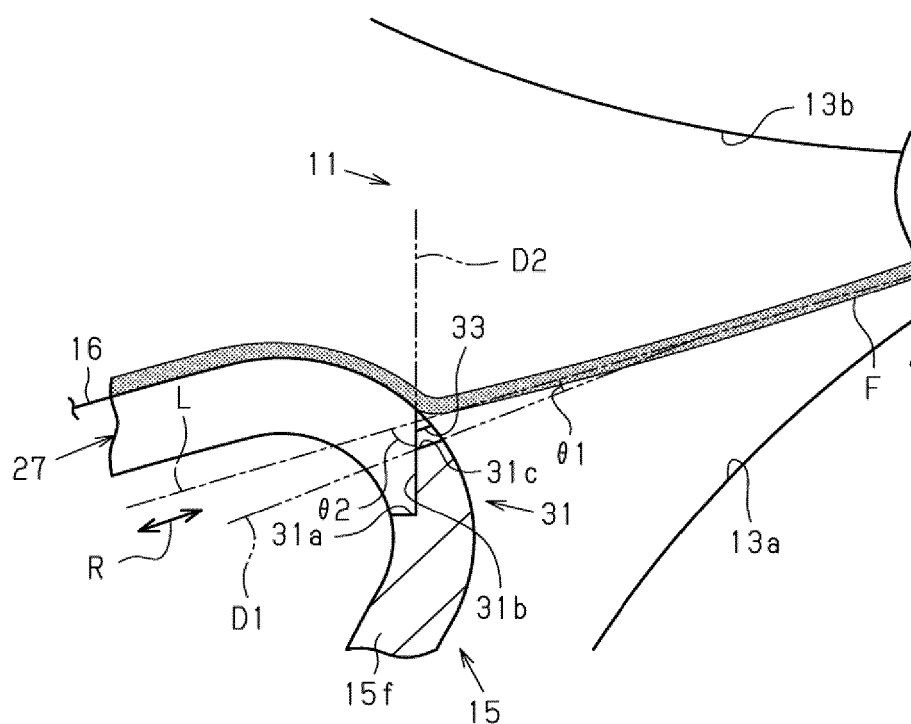
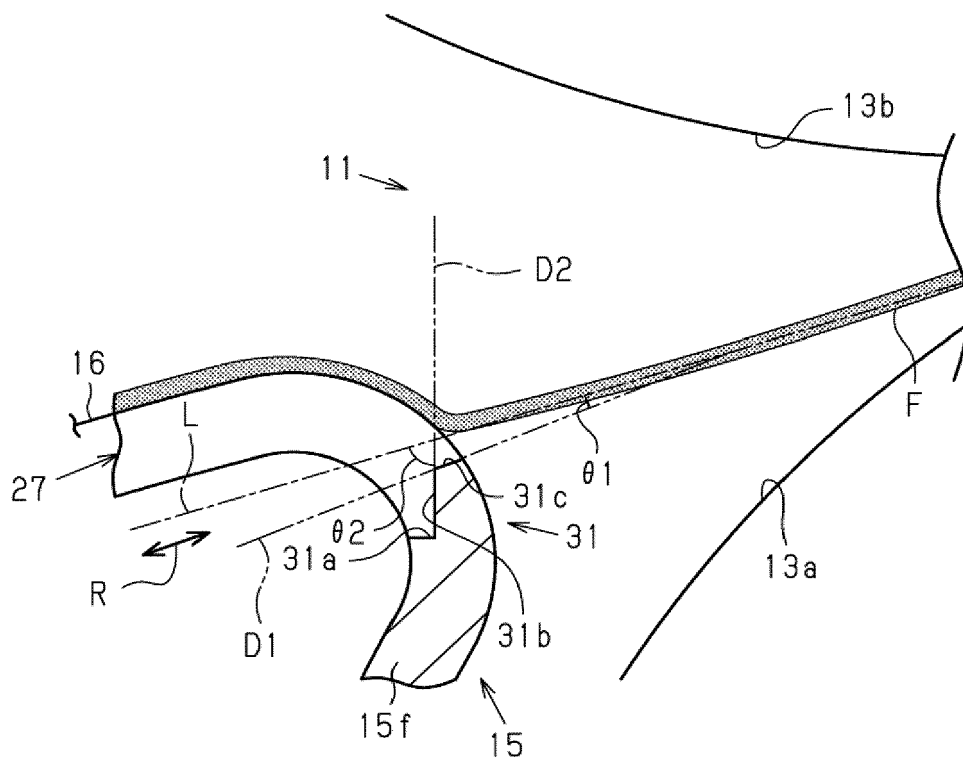


FIG. 9





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Place of search Munich		Date of completion of the search 6 September 2024	Examiner Humbert, Thomas
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