(19) Europäisches Patentamt / European Patent Office / Office européen des brevets

(11) EP 2 199 438 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
**23.06.2010 Bulletin 2010/25**

(51) Int Cl.:
***D01H 1/115*** (2006.01) ***D01H 4/02*** (2006.01)

(21) Application number: **09175487.9**

(22) Date of filing: **10.11.2009**

(84) Designated Contracting States:
**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO SE SI SK SM TR**
Designated Extension States:
**AL BA RS**

(30) Priority: **19.12.2008 JP 2008324266**

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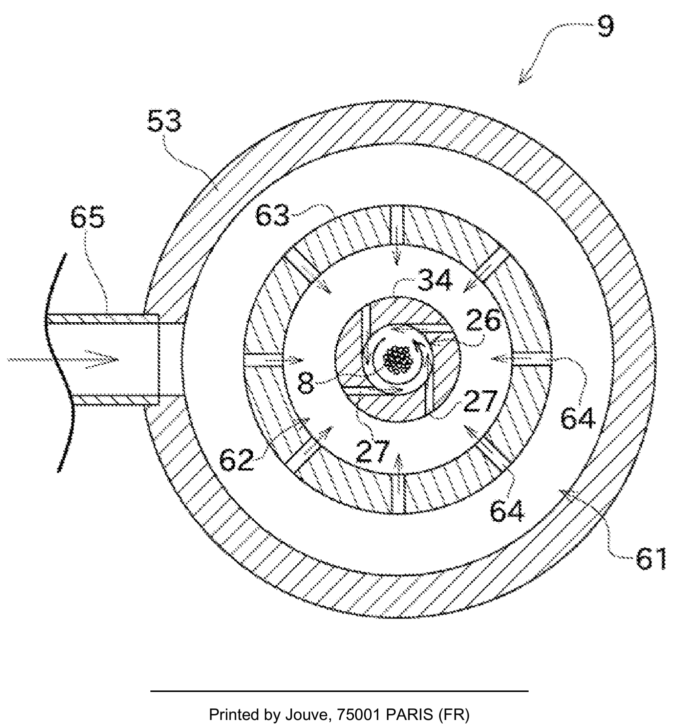
(54) **Air spinning machine**

(57) A spinning machine includes a spinning chamber 26, a hollow guide spindle 20, a first air chamber 61, a second air chamber 62, a plurality of air channels 64, and a plurality of whirling flow generation nozzles 27. Compressed air is supplied to the first air chamber 61. The air channels 64 connect the first air chamber 61 and the second air chamber 62. The whirling flow generation nozzles 27 connect the second air chamber 62 and the spinning chamber 26. The spinning chamber 26 is formed in a substantially round shape in cross section. The second air chamber 62 is formed in a ring shape around the spinning chamber 26. The air channels 64 are arranged at equal interval in a peripheral direction of the second air chamber 62. A total cross-sectional area of the plurality of the air channels 64 is greater than a total cross-sectional area of the plurality of the whirling flow generation nozzles 27 (Fig. 3)

FIG. 5




EP 2 199 438 A1

## Description

### BACKGROUND OF THE INVENTION

#### 1. Field of the Invention

**[0001]** The present invention relates to an air spinning machine. More specifically, the present invention relates to a structure for supplying compressed air to air injection holes of the air spinning machine.

#### 2. Description of the Related Art

**[0002]** Patent Document 1 (Japanese Unexamined Patent Application Publication No. 2005-220483) discloses an air spinning machine that includes a spinning chamber, which is formed in a substantially circular shape in cross section, and that injects compressed air from a plurality of whirling flow generation nozzles (air injection holes) to the spinning chamber, in a tangential direction of the spinning chamber in order to generate whirling airflow in the spinning chamber to apply twists to a fiber bundle.

**[0003]** Fig. 6 is a schematic cross-sectional plan view of a spinning device of a conventional air spinning machine. A spinning device 93 includes a spinning chamber 94 formed in a substantially circular shape in cross section. A fiber bundle 98 can be inserted into the spinning chamber 94 in a direction perpendicular to the plane of Fig. 6. An air chamber 95 is formed in a ring shape in cross section around the spinning chamber 94. The spinning chamber 94 and the air chamber 95 are connected by a plurality of elongate whirling flow generation nozzles (air injection holes) 96. The whirling flow generation nozzle 96 is formed in a tangential direction of the spinning chamber 94 in planar view. A compressed air supplying pipe 97 is connected to the ring-shaped air chamber 95 so as to supply compressed air from a not-illustrated compressed air source to the air chamber 95.

**[0004]** In the above-described structure, when the compressed air is supplied from the compressed air supplying pipe 97 to the air chamber 95, the compressed air is divided and supplied from the air chamber 95 to the plurality of whirling flow generation nozzles 96, and then, the compressed air is injected from each of the whirling flow generation nozzles 96 towards the spinning chamber 94. Thus, for example, counterclockwise whirling airflow is generated in the spinning chamber 94 as indicated by an arrow of the drawing. The spinning device 93 can produce spun yarn by applying twists to the fiber bundle 98 by the whirling airflow.

**[0005]** The whirling flow generation nozzle 96 is slanted towards the inner side of the plane of Fig. 6. Accordingly, when the compressed air is injected from the whirling flow generation nozzles 96 to the spinning chamber 94, airflow directed to the inner side of the plane of Fig. 6 is generated in the spinning chamber 94. Thus, the spinning chamber 94 is decompressed, i.e. the pressure inside the spinning chamber 94 is decreased (Bernoulli's theory), and the fiber bundle 98 can be sucked and guided into the spinning chamber 94.

**[0006]** However, in such an air spinning machine, when an amount (i.e. quantity or volume) of the compressed air supplied from the compressed air supplying pipe increases due to an increase in a spinning speed, or the like, an amount of the airflow injected from the plurality of whirling flow generation nozzles to the spinning chamber may be unequalized. As a result, the whirling flow may become turbulent in the spinning chamber, decreasing stability of a spinning operation. Moreover, since the spinning chamber is not sufficiently decompressed, a stable suction operation may become difficult.

### SUMMARY OF THE INVENTION

**[0007]** In order to overcome the problems described above, preferred embodiments of the present invention provide an air spinning machine that can perform a spinning operation and a suction operation stably and in good condition even when an amount of airflow increases.

**[0008]** According to an aspect of the present invention, an air spinning machine includes a spinning chamber, a hollow guide spindle, a first air chamber, a second air chamber, a plurality of air channels, and a plurality of air injection holes. Compressed air is supplied to the first air chamber. The air channels connect the first air chamber and the second air chamber. The air injection holes connect the second air chamber and the spinning chamber.

**[0009]** Thus, since the compressed air can be supplied from the plurality of air channels to the second air chamber, an amount (i.e. quantity or volume) of the airflow injected from the plurality of air injection holes to the spinning chamber can be equalized, and even when the amount of airflow increases, the spinning operation and the suction operation can be performed stably and in good condition. As a result, the quality of a spun yarn produced by spinning a fiber bundle in the spinning chamber can be maintained in good condition.

**[0010]** In the air spinning machine, a total cross-sectional area of the plurality of the air channels is preferably greater than a total cross-sectional area of the plurality of the air injection holes. Thus, the pressure inside the second air chamber can be equalized in good condition, and the amount of the airflow injected from the plurality of the air injection holes can be further equalized.

**[0011]** In the air spinning machine, the second air chamber is preferably formed in a ring shape around the spinning chamber. The air channels are preferably arranged at equal interval in a peripheral direction of the second air chamber. Thus, since the compressed air can be equally supplied to the second air chamber in a peripheral direction of the second air chamber, the air pressure inside the second air chamber can be equalized in good condition, and the amount of the airflow injected from the plurality of air injection holes can be equalized.

**[0012]** In the air spinning machine, the first air chamber is preferably formed in a ring shape outside the second air chamber in a radial direction of the second air chamber. Accordingly, a device that is compact in a traveling direction of a fiber bundle or of a spun yarn can be provided.

## BRIEF DESCRIPTION OF THE DRAWINGS

**[0013]** Fig. 1 is a front view of an entire structure of a spinning machine according to an embodiment of the present invention.

**[0014]** Fig. 2 is a longitudinal cross-sectional view of the spinning machine.

**[0015]** Fig. 3 is a longitudinally-cross-sectional front view of a spinning section.

**[0016]** Fig. 4 is a longitudinally-cross-sectional front view illustrating a state of the spinning section during a spinning operation.

**[0017]** Fig. 5 is a schematic cross-sectional plan view of the spinning section.

**[0018]** Fig. 6 is a schematic cross-sectional plan view of a spinning section of a conventional air spinning machine.

## DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

**[0019]** Next, an embodiment of the present invention will be described with reference to the drawings. A spinning machine 1 as an air spinning machine illustrated in Fig. 1 includes a plurality of aligned spinning units (air spinning units) 2. The spinning machine 1 further includes a yarn splicing cart 3, a blower box 4, and a motor box 5. The yarn splicing cart 3 can travel in a direction in which the spinning units 2 are aligned.

**[0020]** As illustrated in Fig. 1, each of the spinning units 2 primarily includes a draft device 7, a spinning section 9, a yarn feeding device 11, and a winding device 12. The draft device 7 is provided at an upper portion of a frame 6 of the spinning machine 1. The spinning section 9 spins a fiber bundle 8 fed from the draft device 7. A spun yarn 10 fed from the spinning section 9 is further fed by the yarn feeding device 11, and then wound by the winding device 12 into a package 45.

**[0021]** The draft device 7 drafts a sliver 13 into the fiber bundle 8. As illustrated in Fig. 2, the draft device 7 includes a back roller 14, a third roller 15, a middle roller 17, and a front roller 18. Further, an apron belt 16 is wound around the middle roller 17.

**[0022]** A draft motor 31 formed of an electric motor is provided at an appropriate position of the frame 6. The back roller 14 and the third roller 15 are connected to the draft motor 31 via a belt. A unit controller 32 of the spinning unit 2 controls to drive and stop the draft motor 31. In the spinning machine 1 according to the present embodiment, although an electric motor for driving the middle roller 17 and the front roller 18 is also provided on the frame 6, illustration thereof is omitted.

**[0023]** The yarn feeding device 11 includes a delivery roller 39 and a nip roller 40. The delivery roller 39 is supported on the frame 6 of the spinning machine 1. The nip roller 40 is in contact with the delivery roller 39. While the spun yarn 10 discharged from the spinning section 9 is nipped between the delivery roller 39 and the nip roller 40, the delivery roller 39 is rotationally driven by a not-illustrated electric motor. Accordingly, the spun yarn 10 can be fed to the winding device 12.

**[0024]** As illustrated in Figs. 1 and 2, the yarn splicing cart 3 includes a splicer (yarn splicing device) 43, a suction pipe 44, and a suction mouth 46. The yarn splicing cart 3 travels on a rail 41 provided on the frame 6 of a main body of the spinning machine 1. When a yarn cutting or a yarn breakage occurs in a certain spinning unit 2, the yarn splicing cart 3 travels to and stops at such a spinning unit 2. While vertically swinging around a shaft, the suction pipe 44 sucks and catches a yarn end discharged from the spinning section 9, and then guides the caught yarn end to the splicer 43. While vertically swinging around a shaft, the suction mouth 46 sucks and catches a yarn end from the package 45, which is rotationally supported by the winding device 12, and then the suction mouth 46 guides the caught yarn end to the splicer 43. The splicer 43 splices the guided yarn ends.

**[0025]** As illustrated in Fig. 2, the spinning section 9 is divided into two blocks, that is, a first block 91 and a second block 92. The second block 92 is provided downstream of the first block 91 in a direction in which the fiber bundle 8 is fed.

**[0026]** A pneumatic cylinder 80 is connected to the second block 92. By driving the pneumatic cylinder 80, the second block 92 can be moved away from the first block 91. When fibers or the like clog a later-described air discharging space 55, whirling flow generation chamber 25, or spinning chamber 26, which are formed between the first block 91 and the second block 92, by moving the second block 92 away from the first block 91, maintenance work such as a cleaning operation etc. can be easily performed. The pneumatic cylinder 80 is controlled by the unit controller 32 and can be operated in accordance with a proper drive signal.

**[0027]** Next, with reference to Figs. 3 through 5, a structure of the spinning section 9 will be described further in detail. As illustrated in Fig. 3, the first block 91 includes an air spinning nozzle 19, a nozzle casing 53, and a ring member 63. The second block 92 includes a hollow guide spindle 20 and a spindle holding member 59.

**[0028]** The air spinning nozzle 19 includes a needle holder 23 and a nozzle block 34. The air spinning nozzle 19 is supported by the nozzle casing 53. A guide hole 21 is formed in the needle holder 23. The fiber bundle 8, which has been drafted by the draft device 7 arranged upstream, is introduced into the guide hole 21. The needle holder 23 holds a needle 22 arranged on a path of the fiber bundle 8 introduced from the guide hole 21.

**[0029]** A taper hole 54 is formed in the nozzle block 34 at a position located downstream of the path of the fiber bundle 8 than the needle holder 23. A tip end portion 24 of the hollow guide spindle 20 is coaxially inserted into the taper hole 54. The tip end portion 24 is formed in a taper shape, and its taper angle is substantially similar to a taper angle of the taper hole 54. The round-shaped (circular) spinning chamber 26 is formed between a tip end surface of the hollow guide spindle 20 and the needle holder 23. A tip end of the needle 22 protrudes into the spinning chamber 26. The tip end of the needle 22 faces the tip end surface of the hollow guide spindle 20.

**[0030]** The tip end portion 24 of the hollow guide spindle 20 is arranged such that prescribed space is formed between the hollow guide spindle 20 and the taper hole 54. Accordingly, the whirling flow generation chamber (hollow chamber) 25 is formed and connected to the spinning chamber 26. The air discharging space 55 is formed in the nozzle casing 53. The air discharging space 55 is connected to the whirling flow generation chamber 25. The air discharging space 55 is connected via a pipe 60 to a not-illustrated negative-pressure source (suction mechanism) provided in the blower box 4.

**[0031]** The hollow guide spindle 20 includes a tubular body 56. The taper-shaped tip end portion 24 is formed at one end of the tubular body 56. A yarn path 29 is formed at the shaft center of the hollow guide spindle 20. After passing through the yarn path 29, the yarn is discharged through a not-illustrated outlet hole arranged downstream. The tubular body 56 includes a large radial portion 58 having an enlarged radius at a downstream side than the tip end portion 24. The large radial portion 58 is exposed to the air discharging space 55. Under a state in which the large radial portion 58 is inserted into the spindle holding member 59, the hollow guide spindle 20 is fixed relative to the spindle holding member 59.

**[0032]** The ring member 63 is formed in a ring shape in cross section in a plane perpendicular to the traveling direction of the fiber bundle 8, and can be engaged with the nozzle casing 53. A plurality of holes (air channels) 64, which are elongate in a radial direction of the ring member 63, are formed (drilled) in the ring member 63 so as to connect an inner periphery and an outer periphery of the ring member 63. More specifically, as illustrated in Fig. 5, eight air channels 64 are arranged at equal interval in a peripheral direction of the ring member 63. Each of the eight air channels 64 has a similar channel cross-sectional area and a similar length. Further, the channel cross-sectional area and the length of each of the eight air channels 64 may be identical.

**[0033]** As illustrated in Figs. 3 and 5, when the ring member 63 is engaged with the nozzle casing 53, a ring-shaped first air chamber 61 is formed between the ring member 63 and the nozzle casing 53, and a ring-shaped second air chamber 62 is formed between the nozzle block 34 and the ring member 63. A compressed air supplying pipe 65, which is connected to a not-illustrated compressed air source, is connected with the nozzle casing 53. Accordingly, compressed air can be supplied from the compressed air source to the first air chamber 61.

**[0034]** A plurality of whirling flow generation nozzles (air injection holes) 27 are formed in the nozzle block 34 to connect the spinning chamber 26 and the second air chamber 62. The whirling flow generation nozzles 27 are an elongate hole formed (drilled) in the nozzle block 34. As illustrated in Fig. 3, a longitudinal direction of the whirling flow generation nozzles 27 is slightly slanted towards a downstream side of a yarn feeding direction, and as illustrated in Fig. 5, the whirling flow generation nozzles 27 are formed in a tangential direction of the round-shaped spinning chamber 26.

**[0035]** The whirling flow generation nozzles 27 inject the compressed air supplied from the compressed air source to the spinning chamber 26, and, for example, the whirling flow generation nozzles 27 generate whirling flow directed in a counterclockwise direction in planar view in the spinning chamber 26 (refer to Figs. 4 and 5). After spirally flowing downstream along the whirling flow generation chamber 25, the whirling flow is discharged from the air discharging space 55 formed in the nozzle casing 53. Further, the spinning chamber 26 is decompressed by the airflow directed downstream, and suction flow is generated in the guide hole 21.

**[0036]** Focusing on the arrangement of the spinning chamber 26, the first air chamber 61, and the second air chamber 62, the spinning section 9 is configured as follows. That is, the ring-shaped second air chamber 62 is formed around the round-shaped spinning chamber 26, and the spinning chamber 26 and the second air chamber 62 are connected via the plurality of whirling flow generation nozzles 27. Moreover, the ring-shaped first air chamber 61 is formed around the second air chamber 62, and the first air chamber 61 and the second air chamber 62 are connected via the plurality of air channels 64.

**[0037]** When the compressed air is supplied from the compressed air source via the compressed air supplying pipe 65 to the first air chamber 61, the compressed air supplied to the first air chamber 61 is supplied to the second air chamber 62 via the plurality of air channels 64. Then, the compressed air can be injected from the second air chamber 62 to the spinning chamber 26 through the plurality of whirling flow generation nozzles 27.

**[0038]** A description will now be made of advantages of the structure in which the compressed air is supplied to the spinning chamber via the two air chambers as described above.

**[0039]** As illustrated in Fig. 6, a conventional air spinning machine includes only one air chamber 95, and the compressed air is supplied through one compressed air supplying pipe 97 to the air chamber 95. However, in the air chamber 95 having such a structure, a pressure difference is generated between a position located near a connection portion of the compressed air supplying pipe 97 and a position located away from such a connection portion. As a result, an amount (i.e. quantity or volume) of the airflow injected from each of a plurality of whirling flow generation nozzles 96 varies and, in particular, when a large amount of compressed air is supplied, the varying in the amount of the airflow becomes significant, causing unstable whirling flow and suction flow.

**[0040]** On this point, in the present embodiment, as illustrated in Fig. 5, the compressed air is once supplied to the first air chamber 61, and then supplied from the first air chamber 61 to the second air chamber 62 via the plurality of air channels 64 provided as an orifice (flow adjusting section). Accordingly, after distributing the compressed air to some degree in the peripheral direction in the ring-shaped first air chamber 61 (i.e., after moderating a pressure difference to some degree in the peripheral direction), the compressed air can be supplied to the second air chamber 62. In particular, in the present embodiment, the plurality of air channels 64 are arranged at equal interval in the peripheral direction of the ring-shaped second air chamber 62. Thus, since the compressed air can be supplied to the second air chamber 62 equally in the peripheral direction, disproportion or unevenness of the air pressure in the second air chamber 62 can be eliminated. As a result, the amount of the compressed air injected from the whirling flow generation nozzles 27 can be equalized.

**[0041]** In the present embodiment, a total cross-sectional area of the plurality of air channels 64 is greater than a total cross-sectional area of the plurality of whirling flow generation nozzles 27. Accordingly, when the compressed air is introduced into the whirling flow generation nozzles 27, the amount of the airflow is squeezed. Thus, the air pressure inside the second air chamber 62 located upstream can be further equalized. As a result, the amount of the compressed air injected from the whirling flow generation nozzles 27 can be further equalized.

**[0042]** Next, an operation of spinning the fiber bundle 8 by the above-described spinning section 9 will be described.

**[0043]** First, under a state in which a fiber bundle 8 has not been introduced into the spinning section 9 (illustrated in Fig. 3), the compressed air is supplied from the not-illustrated compressed air source, and further injected to the spinning chamber 26 by the whirling flow generation nozzles 27. Thus, the whirling airflow is generated in the spinning chamber 26, and airflow flowing downward in the drawing of Fig. 3 is generated. Accordingly, the spinning chamber 26 is decompressed by Bernoulli's theory, and suction flow is generated in the guide hole 21. In this state, when the fiber bundle 8 is fed from the draft device 7 to the spinning section 9, the fiber bundle 8 is sucked into the guide hole 21 and guided to the spinning chamber 26. The fiber bundle 8 introduced into the spinning chamber 26 passes through the yarn path 29, and is eventually discharged from the not-illustrated outlet hole to the outside of the spinning section 9.

**[0044]** A yarn end discharged from the outlet hole of the spinning section 9 is caught by the suction pipe 44 of the yarn splicing cart 3, and spliced with a yarn end of the package 45 by the splicer 43. Accordingly, the fiber bundle 8 or the spun yarn 10 is connected from the front roller 18 to the yarn feeding device 11 via the guide hole 21, the spinning chamber 26, and the yarn path 29. In this state, by applying a feeding force to the spun yarn 10 by the yarn feeding device 11 towards the downstream side, tension is applied to the spun yarn 10, and the spun yarn 10 is sequentially fed from the spinning section 9.

**[0045]** As illustrated in Fig. 4, the fiber bundle 8 fed from the front roller 18 of the draft device 7 towards the downstream side enters the spinning chamber 26 through the guide hole 21, and the whirling flow generated by the whirling flow generation nozzles 27 acts upon the fiber bundle 8. Accordingly, one end of each of short fibers is separated and opened relative to long fibers defined as core fibers of the fiber bundle 8. The short fibers are swung around in the whirling flow generation chamber 25, and twists are applied to the fibers. Such twists tend to be propagated towards the front roller 18, however, the propagation is prevented by the needle 22. Therefore, the fiber bundle 8 fed from the front roller 18 is not twisted in by such twists. As described above, the needle 22 has a twist propagation preventing function. However, such a twist propagation preventing function is not limited to the needle 22, and may be achieved by other structures.

**[0046]** Such twisted fibers are sequentially produced into a truly-twisted yarn, in which most of the fibers are wound fibers. Such a truly-twisted yarn passes through the yarn path 29 as the spun yarn 10, and then, the spun yarn 10 is discharged from the not-illustrated outlet hole to the downstream side. After passing through the yarn feeding device 11 of Fig. 1, the spun yarn 10 is wound by the winding device 12 and eventually formed into the package 45. Further, there are fibers that are not twisted into the spun yarn 10 due to breakage or the like that occurs when the short fibers are opened or when the twists are applied. Such fibers are fed from the whirling flow generation chamber 25 to the air discharging space 55 by the whirling flow generated by the whirling flow generation nozzles 27, and then, discharged via the pipe 60 by the suction of the negative-pressure source.

**[0047]** As described above, the spinning machine 1 according to the present embodiment includes the spinning chamber 26, the hollow guide spindle 20, the first air chamber 61, the second air chamber 62, the plurality of air channels 64, and the plurality of whirling flow generation nozzles 27. The compressed air is supplied to the first air chamber 61. Each of the plurality of air channels 64 connects the first air chamber 61 and the second air chamber 62. Each of the plurality of whirling flow generation nozzles 27 connects the second air chamber 62 and the spinning chamber 26.

**[0048]** As described above, the compressed air can be supplied from the plurality of air channels 64 to the second air chamber 62. Thus, the amount of the airflow injected from the plurality of whirling flow generation nozzles 27 into the spinning chamber 26 can be equalized, and even if the amount of the airflow increases, the spinning operation and the suction operation can be stably performed. As a result, the quality of the spun yarn 10 produced by spinning the fiber bundle 8 in the spinning chamber 26 can be maintained in good condition.

**[0049]** In the spinning machine 1 according to the present embodiment, the total cross-sectional area of the plurality of air channels 64 is greater than the total cross-sectional area of the plurality of whirling flow generation nozzles 27. Therefore, the pressure inside the second air chamber 62 can be equalized in good condition, and the amount of the airflow injected from the plurality of whirling flow generation nozzles 27 can be further equalized.

**[0050]** In the spinning machine 1 according to the present embodiment, the spinning chamber 26 is formed in a substantially round shape in cross section. The second air chamber 62 is formed in a ring shape around the spinning chamber 26. The air channels 64 are arranged at equal interval in the peripheral direction of the second air chamber 62. Thus, the compressed air can be supplied to the second air chamber 26 equally in the peripheral direction. As a result, the air pressure inside the second air chamber 62 can be equalized in good condition, and the amount of the airflow injected from the plurality of whirling flow generation nozzles 27 into the second air chamber 26 can be equalized.

**[0051]** In the spinning machine 1 according to the present embodiment, the first air chamber 61 is formed in a ring shape outside the second air chamber 62 in the radial direction of the second air chamber 62. Accordingly, a device that is compact in the traveling direction of the fiber bundle or of the spun yarn can be provided.

**[0052]** The preferred embodiment of the present invention has been described above, however, for example, the above-described structures may be modified as follows.

**[0053]** The number of the whirling flow generation nozzles 27 and the number of air channels 64 are not limited to those in the above-described embodiment, but may be appropriately changed.

**[0054]** The air channels, which connect the first air chamber and the second air chamber, are not necessarily required to be arranged at equal interval as long as a plurality of air channels are provided. However, from the standpoint of equally supplying the compressed air to the second air chamber, it is preferable to arrange the air channels at equal interval in the peripheral direction of the second air chamber as described in the above embodiment.

**[0055]** Instead of forming the first air chamber around the second air chamber, for example, the first air chamber may be formed downstream in the yarn traveling direction (lower side in the drawing of Fig. 3) relative to the second air chamber, and the first air chamber and the second air chamber may be connected by a plurality of air channels formed parallel to the yarn traveling direction. However, from the standpoint of downsizing the spinning section in the yarn traveling direction and the standpoint of having the airflow to smoothly flow from the compressed air supplying pipe to the whirling flow generation nozzles, the first air chamber is preferably arranged around the second air chamber.

**[0056]** In the above-described embodiment, the position of the ring member 63 is not fixed in the peripheral direction. Accordingly, a positional relationship of the air channels 64 and the whirling flow generation nozzles 27 is not limited to the positional relationship illustrated in Fig. 5. However, when fixing the position of the ring member 63 in the peripheral direction, it is preferable that an opening end of the air channel 64 and an opening end of the whirling flow generation nozzle 27 do not face one another as illustrated in Fig. 5. Accordingly, the airflow from the air channels 64 does not directly flow into the whirling flow generation nozzles 27. As a result, the amount of the compressed air injected from the whirling flow generation nozzles 27 can be further equalized.

## Claims

1. An air spinning machine comprising:

   a spinning chamber (26);
   a hollow guide spindle (20);
   a first air chamber (61) to which compressed air is supplied;
   a second air chamber (62);
   a plurality of air channels (64) that connect the first air chamber (61) and the second air chamber (62); and
   a plurality of air injection holes (27) that connect the second air chamber (62) and the spinning chamber (26).

2. The air spinning machine according to claim 1, **characterized in that** a total cross-sectional area of the plurality of the air channels (64) is greater than a total cross-sectional area of the plurality of the air injection holes (27).

3. The air spinning machine according to claim 1 or 2, **characterized in that** the second air chamber (62) is formed in a ring-shape around the spinning chamber (26), and the air channels (64) are arranged at equal interval in a peripheral direction of the second air chamber (62).

4. The air spinning machine according to claim 3, **characterized in that** the first air chamber (61) is formed in a ring-shape outside the second air chamber (62) in a radial direction of the second air chamber (62).

FIG. 1

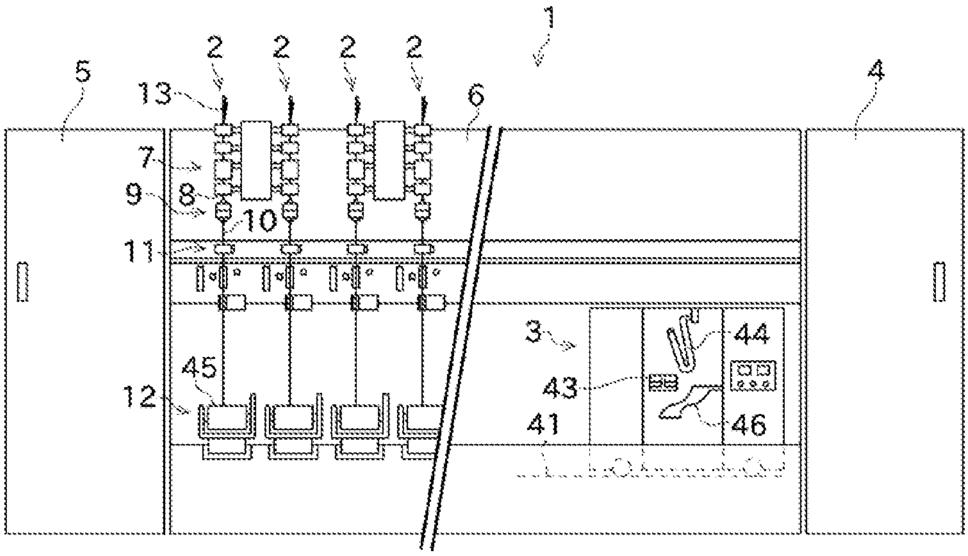


FIG. 2

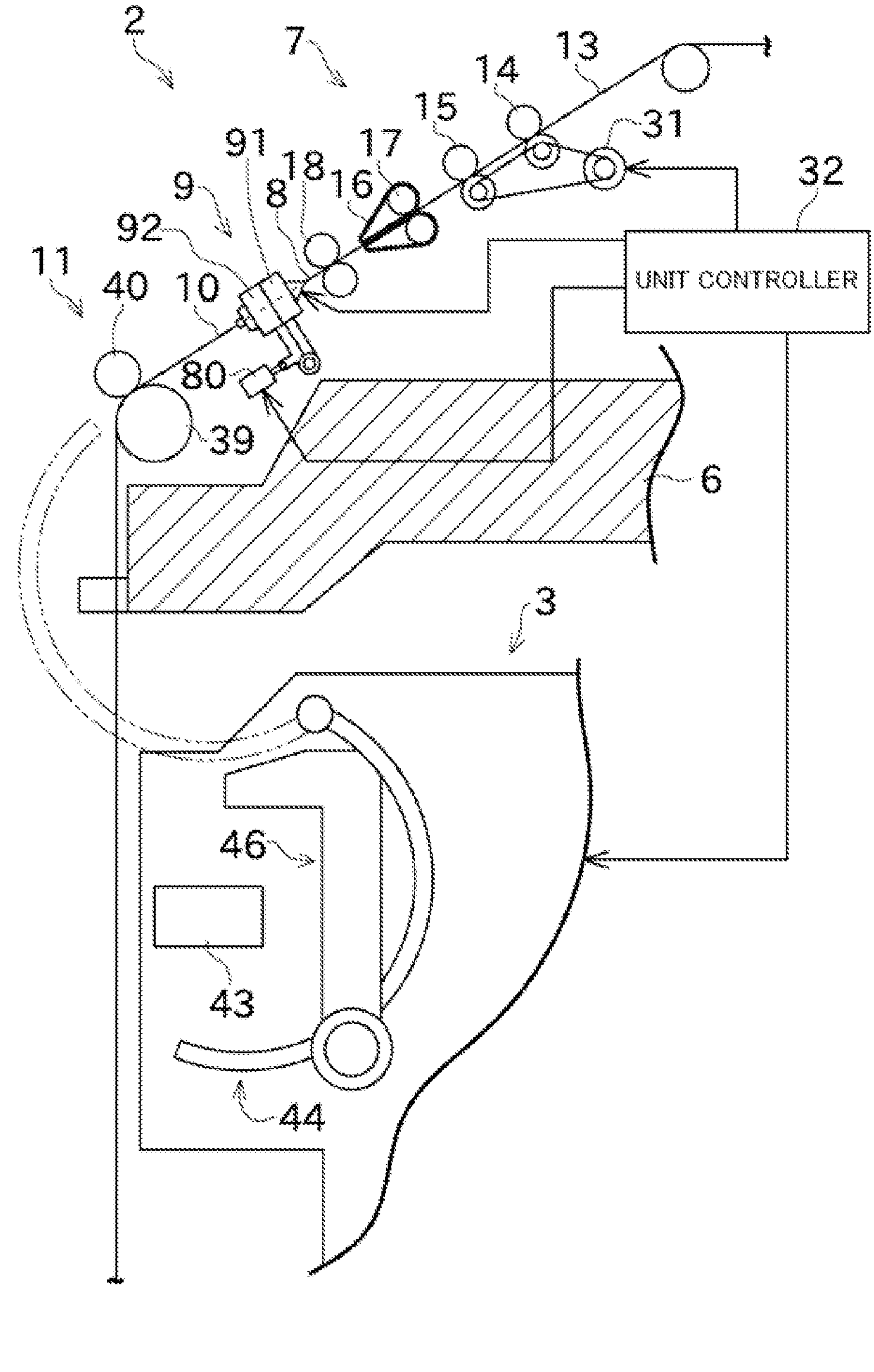

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FIG. 3

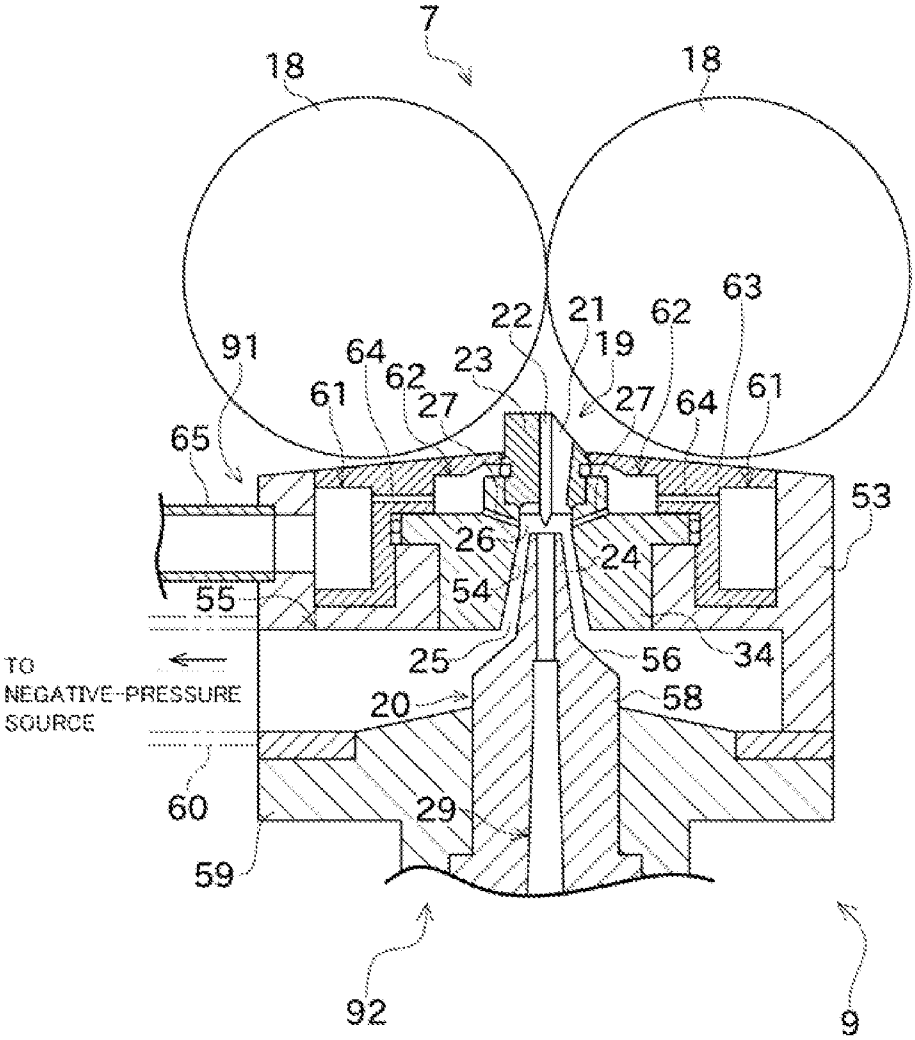
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FIG. 4

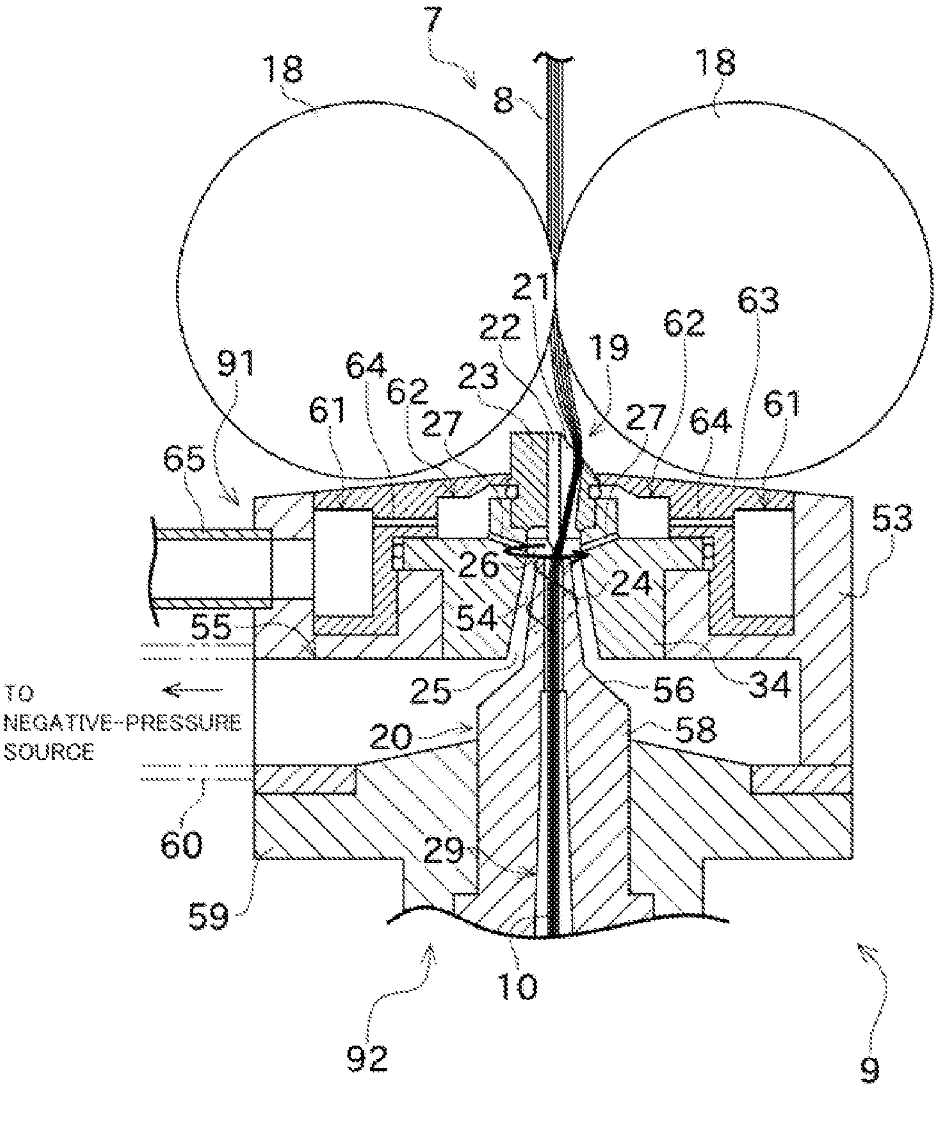
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FIG. 5

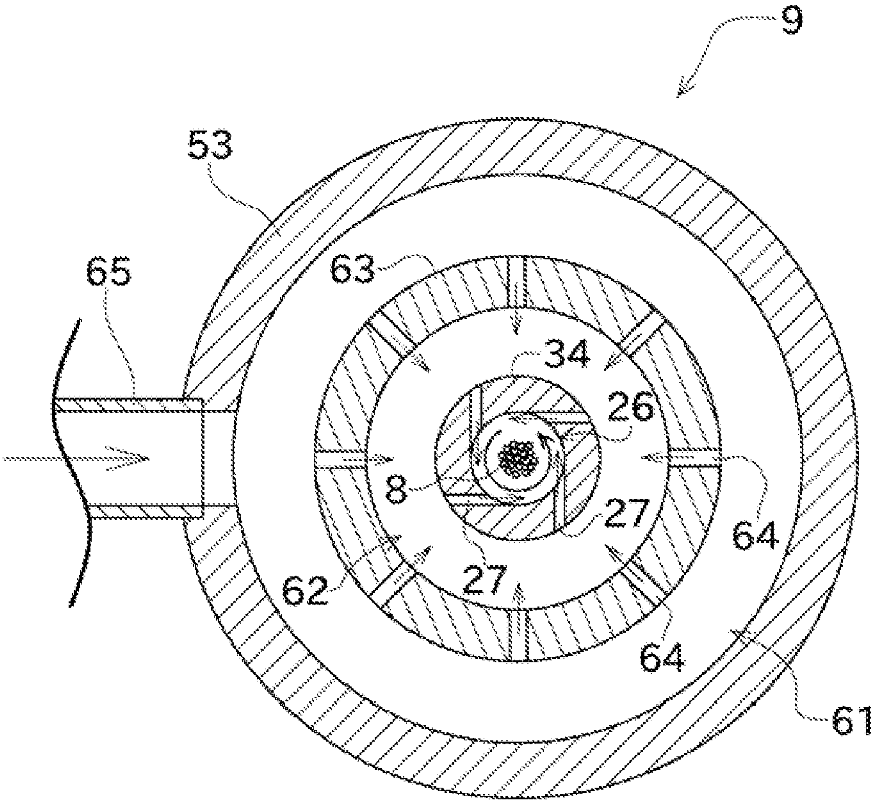
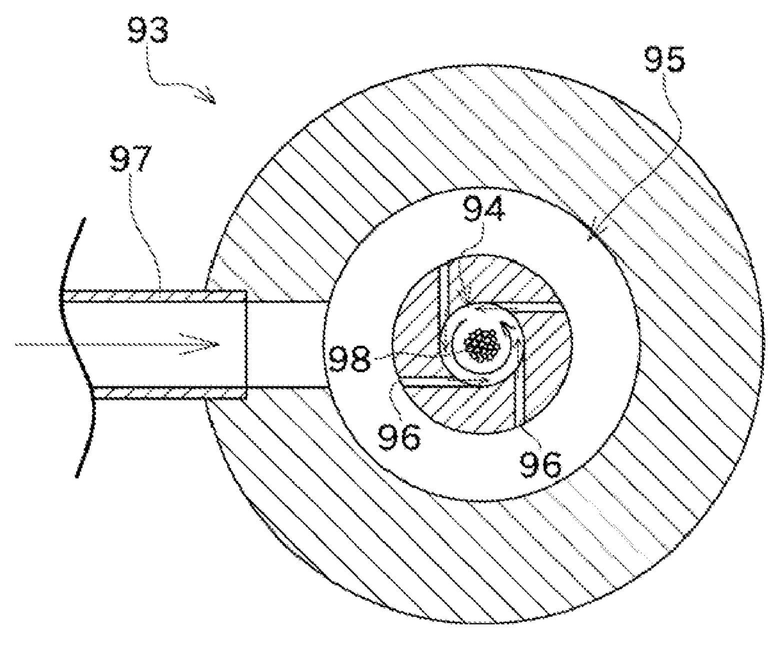


FIG. 6



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# EUROPEAN SEARCH REPORT

Application Number
EP 09 17 5487

## DOCUMENTS CONSIDERED TO BE RELEVANT

| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | CLASSIFICATION OF THE APPLICATION (IPC) |
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