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

(11) EP 2 302 114 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
30.03.2011 Bulletin 2011/13

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

(21) Application number: **10175754.0**

(22) Date of filing: **08.09.2010**

(84) Designated Contracting States:
AL 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:
BA ME RS

(30) Priority: **18.09.2009 JP 2009217023**
29.06.2010 JP 2010148330

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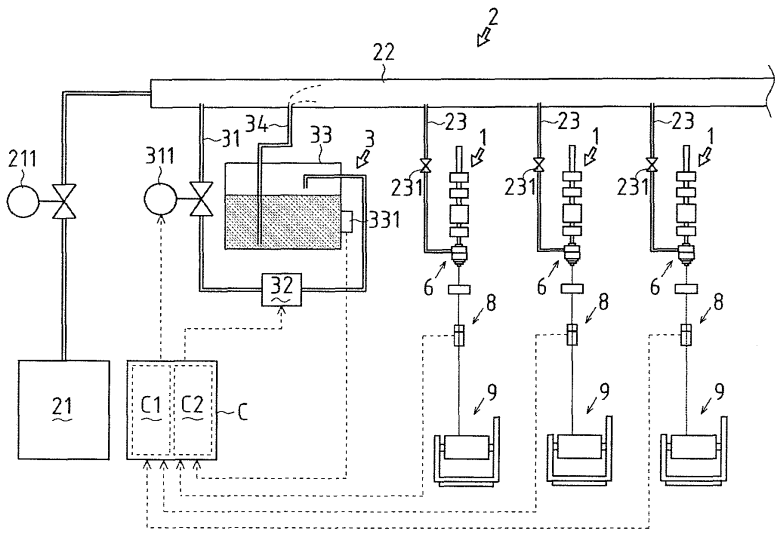
(54) Spinning machine

(57) A spinning machine includes a plurality of spinning units, each spinning unit having a pneumatic spinning device which twists a fiber bundle F by air. Each spinning unit includes a compressed air feeding device, a first air pipe, and a cleanser supplying device. The compressed air feeding device feeds compressed air. The first air pipe guides the air fed by the compressed air feeding device. The cleanser supplying device adds cleanser to the air flowing through the first pipe. The cleanser supplying device adds the cleanser at upstream of a branch point where the air flowing through the first air pipe branches off to each of the pneumatic spinning devices.

FIG. 7



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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to the technology of a spinning machine that produces spun yarn by a pneumatic spinning device, and relates more particularly to the technology for improving manufacturing quality and productive capacity of the spinning machine that produces spun yarn by the pneumatic spinning device.

2. Description of the Related Art

[0002] A pneumatic spinning device that twists a fiber bundle by whirling airflow to produce spun yarn is conventionally known. The pneumatic spinning device supplies air to a spinning chamber, to which a fiber bundle is fed, to generate whirling airflow , and whirls the fiber bundle in the spinning chamber to produce spun yarn (as disclosed in Patent Document 1, for example).

[0003] However, oiling agent is applied to some of synthetic fibers made of materials such as polyester in order to reduce withdrawal resistance of fibers. When the pneumatic spinning device is used for such a fiber bundle, there were cases where the oiling agent is adhered to and accumulated in the spinning chamber. Then, when a spinning operation is performed under a state in which the oiling agent is accumulated in the spinning chamber, the pneumatic spinning device produces so-called weak yarn, in which a yarn structure of the spun yarn is unstable. Accordingly, the spinning chamber had to be regularly cleaned, which reduced productivity of the spinning machine.

[0004] Therefore, in order to prevent oiling agent from being accumulated or remove the oiling agent, a pneumatic spinning device that supplies surfactant (surface-active agent) to a spinning chamber has been proposed (as disclosed in Patent Document 2, for example). However, when the oiling agent starts being adhered to and accumulated in the spinning chamber, it becomes relatively difficult to remove the oiling agent by applying surfactant. Therefore, there has been a demand for a technology that forms a film and resolves oil by supplying cleanser to the spinning chamber so as to prevent the oiling agent from being adhered in the spinning chamber or from being accumulated therein.

[0005] Further, in a spinning machine including a plurality of spinning units, wherein each of the spinning units has a pneumatic spinning device, a cleanser supplying device may be provided in the each of the spinning units. However, such structure may cause the spinning machine to become excessively large, the cost of the spinning machine to be increased, and unevenness to be generated among each of the spinning units. Accordingly, there has been a demand for a technology with a simple structure, capable of supplying the cleanser evenly and stably to each of the pneumatic spinning devices. Further, in order to be capable of producing spun yarn from all types of fiber bundles, there has also been a demand for a technology that changes supplying mode of the cleanser in accordance with characteristic of a fiber bundle.

[0006]

[Patent Document 1] Japanese Unexamined Patent Application Publication No. 2009-1935
[Patent Document 2] Japanese Unexamined Patent Application Publication No. 2008-95208

SUMMARY OF THE INVENTION

[0007] The present invention has been made to solve the above-described problems. It is an object of the present invention to provide a small and low-cost spinning machine capable of supplying cleanser evenly and stably to each of pneumatic spinning devices and capable of changing supplying mode of the cleanser in accordance with characteristic of a fiber bundle.

[0008] That is, the first invention relates to a spinning machine including a plurality of spinning units, wherein each spinning unit has a pneumatic spinning device which twists a fiber bundle by air. The spinning machine includes a compressed air feeding device, a first air pipe, and a cleanser supplying device. The cleanser supplying device adds cleanser to the air, which has been fed by the compressed air feeding device and is flowing through the first air pipe. The air added with the cleanser branches off and is fed to each of the pneumatic spinning devices.

[0009] According to the second invention, in the first invention, the spinning machine includes a second air pipe which guides the air fed by the compressed air feeding device and feeds the air to each of the pneumatic spinning devices. The second air pipe is an air passage where air not added with the cleanser is guided through.

[0010] According to the third invention, in the second invention, the spinning machine can switch the air to be fed to the pneumatic spinning device among the air flowing through the first air pipe and the air flowing through the second air pipe.

[0011] According to the fourth invention, in the second invention, the first air pipe and the second air pipe are arranged along a direction in which a plurality of pneumatic spinning units are arranged.

[0012] According to the fifth invention, in any one of the first invention through the fourth invention, the spinning machine includes an addition control section which controls the cleanser supplying device. The addition control section determines whether or not to add the cleanser to the air flowing through the first air pipe in accordance with characteristic of the fiber bundle. When oiling agent is applied to the fiber bundle, the addition control section controls the cleanser supplying device to add the cleanser.

[0013] According to the sixth invention, in the fifth in-

vention, the addition control section determines an additive amount of the cleanser to be added to the air flowing through the first air pipe in accordance with the characteristic of the fiber bundle. The addition control section controls the cleanser supplying device to add an amount of the cleanser that is appropriate according to the oiling agent added to the fiber bundle.

[0014] According to the seventh invention, in the fifth invention or the sixth invention, when at least one of the spinning units is producing spun yarn from the fiber bundle added with the oiling agent, the addition control section controls the cleanser supplying device to add cleanser to the air flowing through the first air pipe. When none of the spinning units is producing spun yarn from the fiber bundle added with the oiling agent, the addition control section controls the cleanser supplying device to stop adding cleanser to the air flowing through the first air pipe.

[0015] According to the eighth invention, in any one of the first invention through the seventh invention, the cleanser supplying device includes a cleanser tank which stores the cleanser and a detecting section which detects an accumulated amount of the cleanser in the cleanser tank. The spinning machine includes a spinning control section. The spinning control section can receive a detection signal from the detecting section and can control to activate or stop each of the spinning units. When the detecting section detects that the accumulated amount of the cleanser is less than a prescribed amount, the spinning control section controls all the spinning units to stop producing spun yarn.

[0016] According to the first invention, since the air added with the cleanser branches off and is fed to each of the pneumatic spinning devices, the cleanser can be evenly and stably supplied to the each of the pneumatic spinning devices. Accordingly, oiling agent applied to a fiber bundle is prevented from being adhered to and accumulated in a spinning chamber, and manufacturing quality and productivity of the spinning machine can be improved. Further, when compared with the conventional structure in which a cleanser supplying device is provided to each spinning unit, the structure of the above-described spinning machine is simple. As a result, the size and manufacturing costs of the spinning machine can be reduced.

[0017] According to the second invention, by providing the air passage where the cleanser is not added to air, the air not added with the cleanser can be fed to the pneumatic spinning device. Accordingly, the pneumatic spinning device can perform a spinning operation by the air not added with the cleanser.

[0018] According to the third invention, whether a spinning operation is performed by the air added with the cleanser or by the air not added with the cleanser can be reliably switched. Therefore, when producing spun yarn from a fiber bundle added with the oiling agent, the spinning operation can be performed by the air added with the cleanser. Accordingly, the oiling agent applied to the fiber bundle is prevented from being adhered to and accumulated in the spinning chamber, and manufacturing quality and productivity of the spinning machine can be improved.

[0019] According to the fourth invention, when compared with the conventional structure in which the cleanser supplying device is provided to each spinning unit, the structure of the above-described spinning machine can be made even more simple. As a result, the size and the manufacturing costs of the spinning machine can be reduced.

[0020] According to the fifth invention, when producing spun yarn from a fiber bundle added with the oiling agent, the spinning operation can be performed by the air added with the cleanser. Accordingly, the oiling agent applied to the fiber bundle is prevented from being adhered to and accumulated in the spinning chamber, and manufacturing quality and productivity of the spinning machine can be improved.

[0021] According to the sixth invention, the spinning operation can be performed by air added with an amount of the cleanser that is appropriate according to an amount of oiling agent applied to the fiber bundle. Accordingly, the oiling agent applied to the fiber bundle is prevented from being adhered to and accumulated in the spinning chamber, and manufacturing quality and productivity of the spinning machine can be improved. Further, the spinning machine can produce spun yarn from all types of fiber bundles.

[0022] According to the seventh invention, when at least one of the plurality of spinning units is producing spun yarn, the cleanser supplying device can supply the air added with the cleanser to the pneumatic spinning device of each of the spinning units through the first air pipe. Accordingly, the oiling agent applied to the fiber bundle is prevented from being adhered to and accumulated in the spinning chamber; consequently, manufacturing quality and productivity of the spinning machine can be improved. Further, when none of the spinning units is producing spun yarn, since the cleanser supplying device stops adding the cleanser to air, cleanser consumption can be reduced. Consequently, manufacturing costs of the spun yarn can be reduced.

[0023] According to the eighth invention, when the detecting section detects that the accumulated amount of the cleanser in the cleanser tank is less than the prescribed amount, production of the spun yarn can be stopped in all of the spinning units. Consequently, when producing spun yarn from the fiber bundle added with the oiling agent, the spinning operation can be prevented from being performed by the air not added with the cleanser. Accordingly, the oiling agent applied to the fiber bundle is prevented from being adhered to and accumulated in the spinning chamber, and manufacturing quality and productivity of the spinning machine can be improved.

BRIEF DESCRIPTION OF THE DRAWINGS

[0024]

Fig. 1 is a view illustrating an overall structure of a spinning machine 100.

Fig. 2 is a view illustrating a spinning unit 1 of the spinning machine 100.

Fig. 3 is a view illustrating a pneumatic spinning device 6 of the spinning unit 1.

Fig. 4 is a view illustrating an air distribution device 2 and a cleanser supplying device 3 of the spinning machine 100.

Fig. 5 is a view illustrating a state in which weak yarn is produced due to oiling agent being accumulated in a spinning chamber 65.

Fig. 6 is a table illustrating a control map for changing supplying mode of cleanser in accordance with characteristic of a fiber bundle F.

Fig. 7 is another view illustrating the air distribution device 2 and the cleanser supplying device 3 of the spinning machine 100.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0025] By referring to Fig. 1, a description will be made on an overall structure of a spinning machine 100 according to an embodiment of the present invention. As illustrated in Fig. 1, the spinning machine 100 includes a plurality of spinning units 1 which produce spun yarn Y from a fiber bundle (which will hereinafter be referred to as a "sliver") F. Further, the spinning machine 100 is provided with an air distribution device 2 (not illustrated in Fig. 1; refer to Fig. 4) and a cleanser supplying device 3 (not illustrated in Fig. 1; refer to Fig. 4). The air distribution device 2 can feed air to a pneumatic spinning device 6 provided in each of the spinning units 1. The cleanser supplying device 3 can add cleanser to the air to be fed to the pneumatic spinning device 6.

[0026] First, by referring to Fig. 2, each spinning unit 1 will be described in detail. The spinning unit 1 mainly includes a sliver feeding unit 4, a draft device 5, a pneumatic spinning device 6, a yarn feeding device 7, a yarn defect detecting and removing device 8, and a winding device 9, which are arranged in this order along a direction in which the sliver F and the spun yarn Y are fed.

[0027] The sliver feeding unit 4 includes a sliver case 41 where the sliver F, which is a material, is accumulated and a sliver guide that guides the sliver F to the draft device 5. The sliver feeding unit 4 feeds the sliver F accumulated in the sliver case 41 to the draft device 5.

[0028] The draft device 5 drafts the sliver F by a plurality of pairs of draft rollers and feeds out the sliver F to the pneumatic spinning device 6. The draft device 5 includes four pairs of draft rollers. The draft device 5 includes a pair of back draft rollers 51, a pair of third draft rollers 52, a pair of middle draft rollers 53, and a pair of front draft rollers 54, which are arranged in this order along a direction in which the sliver F is fed.

[0029] The four pairs of draft rollers include bottom rollers 51A, 52A, 53A, and 54A, which are rotated by driving sources (not illustrated in the drawings), and top rollers 51B, 52B, 53B, and 54B, which are arranged to make contact with the bottom rollers 51A, 52A, 53A, and 54A to be driven and rotated. Rotational speed of each pair of the draft rollers 51, 52, 53, and 54 is set to be increased sequentially along a direction in which the sliver F is fed.

[0030] In such a structure, the sliver F, which is nipped by each of the bottom rollers 51A, 52A, 53A, and 54A and each of the top rollers 51B, 52B, 53B, and 54B, is fed out following rotation of the pairs of draft rollers 51, 52, 53, and 54. Each time the sliver F passes through each pair of the draft rollers 51, 52, 53, and 54, the speed of the sliver F increases. Consequently, the sliver F is drafted between adjacent pairs of draft rollers 51, 52, 53, and 54.

[0031] The pneumatic spinning device 6 twists the sliver F drafted by the draft device 5 to produce the spun yarn Y. As illustrated in Fig. 3, the pneumatic spinning device 6 mainly includes a guide member 61, a spindle member 62, and a nozzle member 63. Further, the arrows in Fig. 3 indicate a direction in which the sliver F and the spun yarn Y are fed and also a direction in which the fed air flows.

[0032] The guide member 61 is a member which constitutes a portion of a spinning chamber 65. A yarn passage 61a is formed in the guide member 61 so as to be connected with the spinning chamber 65. The guide member 61 guides the sliver F drafted by the draft device 5 to the spinning chamber 65 through the yarn passage 61a. Further, according to the present embodiment, the guide member 61 is provided with a needle member 61b. The needle member 61b guides the spun yarn Y, which is twisted and produced in the spinning chamber 65, to a yarn passage 62a which will be described later. Further, instead of providing the guide member 61 with the needle member 61b, the function of the needle member 61b may be implemented by a downstream end edge of the guide member 61.

[0033] The spindle member 62 is a member which also constitutes a portion of the spinning chamber 65. The spindle member 62 is provided with a yarn passage 62a that is connected with the spinning chamber 65. The spindle member 62 feeds out the spun yarn Y, which is twisted and produced in the spinning chamber 65, through a yarn passage 62a. More specifically, the spun yarn Y, which is twisted and produced in the spinning chamber 65, is guided to the yarn passage 62a by the needle member 61b of the guide member 61, and is fed out through the yarn passage 62a to the yarn feeding device 7.

[0034] The nozzle member 63 is a member which also constitutes a portion of the spinning chamber 65. The nozzle member 63 is provided with a plurality of air passages 63a that are connected with the spinning chamber 65. The nozzle member 63 generates whirling airflow in

the spinning chamber 65 by feeding air to the spinning chamber 65 through the air passages 63a. More specifically, compressed air, which has been fed from a compressed air feeding device 21 which will be described later, is fed to the spinning chamber 65 through the air passages 63a, and becomes whirling airflow in the spinning chamber 65.

[0035] The nozzle member 63 will be described further in detail. The plurality of air passages 63a are arranged radially in the nozzle member 63 so as to be connected with the spinning chamber 65. In order to prevent a flow direction of air injected from the air passages 63a from intersecting with the central axis of the spinning chamber 65, the air passages 63a are formed in a manner that the flow direction of the air of the air passages 63a are displaced from the central axis in the same direction. The air injected through the air passages 63a flows along the internal surface of the nozzle member 63 and forms the whirling airflow.

[0036] In such a structure, the pneumatic spinning device 6 can twist the sliver F by having each of fibers of the sliver F reversed and whirled by the whirling airflow (refer to the alternate long and double-short dashed line in Fig. 5). As described above, the pneumatic spinning device 6 produces the spun yarn Y.

[0037] The yarn feeding device 7 feeds out the spun yarn Y produced by the pneumatic spinning device 6 to the winding device 9. The yarn feeding device 7 includes a delivery roller 71 and a nip roller 72. The spun yarn Y fed out from the pneumatic spinning device 6 is nipped between the delivery roller 71 and the nip roller 72, and is fed out following rotation of the delivery roller 71 and the nip roller 72.

[0038] The yarn defect detecting and removing device 8 detects and removes a yarn defect in the spun yarn Y (i.e., a failure portion in the spun yarn Y) before the spun yarn Y is fed to the winding device 9. The yarn defect detecting and removing device 8 is provided with a cutting device (not illustrated in the drawings) that cuts off and removes a yarn defect in the spun yarn Y. The spun yarn Y, which has been cut off and of which the yarn defect has been removed, is spliced together by a yarn splicing device (not illustrated in the drawings) provided in the spinning machine 100, and is wound into a package 91 which will be described later. As described above, the yarn defect detecting and removing device 8 prevents the spun yarn Y having a yarn defect from being wound into the package 91.

[0039] The yarn defect detecting and removing device 8 is electrically connected to a control device C (refer to Fig. 4). When the spun yarn Y passes through the yarn defect detecting and removing device 8, the yarn defect detecting and removing device 8 detects a yarn travelling signal. The yarn travelling signal is transmitted to the control device C from the yarn defect detecting and removing device 8. The control device C constantly monitors operational status of the spinning unit 1 by receiving the yarn travelling signal detected by the yarn defect detecting and removing device 8. When the yarn travelling signal cannot be received, the control device C determines that production of the spun yarn Y has been stopped due to some reason.

[0040] The winding device 9 forms the package 91 by winding the spun yarn Y while traversing the spun yarn Y in an axial direction of a bobbin 92. The package 91 or the bobbin 92 is driven and rotated by receiving driving force of a driving drum 93, and the spun yarn Y is wound around the package 91. Further, although a cheese-shaped package P is illustrated in Fig. 2, the winding device 9 can also wind the spun yarn Y into a cone-shaped package P.

[0041] As described above, the spinning unit 1 drafts the sliver F by the draft device 5, and twists the drafted sliver F by the pneumatic spinning device 6 to produce the spun yarn Y. Further, the spinning unit 1 cuts off and removes a yarn defect by the yarn defect detecting and removing device 8, and winds the spun yarn Y, of which yarn quality has been improved, by the winding device 9 in order to produce the package 91.

[0042] Further, the spinning unit 1 may include a yarn accumulating roller between the yarn feeding device 7 and the yarn defect detecting and removing device 8. The yarn accumulating roller winds the spun yarn Y around an outer peripheral surface of the rotating yarn accumulating roller to temporarily accumulate the spun yarn Y. Consequently, even during a yarn splicing operation, for example, the yarn accumulating roller can prevent the spun yarn Y, which is continuously fed out from the pneumatic spinning device 6, from slackening. Further, since the yarn accumulating roller winds the spun yarn Y around an outer peripheral surface thereof to temporarily accumulate the spun yarn Y, even when fluctuations in tension in the winding device 9 are generated, for example, the fluctuations can be prevented from being propagated to the pneumatic spinning device 6.

[0043] Further, the spinning unit 1 may include the above-described yarn accumulating roller in place of the yarn feeding device 7. The yarn accumulating roller winds the spun yarn Y around the rotating yarn accumulating roller, and unwinds the spun yarn Y to feed out the spun yarn Y. Therefore, to the yarn accumulating roller can pull out the spun yarn Y from the pneumatic spinning device 6 while applying a prescribed tension to the spun yarn Y, and feed out the spun yarn Y to the winding device 9.

[0044] Next, by referring to Fig. 4, the air distribution device 2 and the cleanser supplying device 3 will be described in detail. Further, the arrows in the Fig. 4 indicate a direction of airflow.

[0045] The air distribution device 2 includes the compressed air feeding device 21, a first air pipe 22, a first distribution pipe 23, a second air pipe 24, a second distribution pipe 25.

[0046] The compressed air feeding device 21 is a device that compresses air in order to feed the compressed air to the pneumatic spinning device 6 of each of the

spinning units 1. The compressed air feeding device 21 mainly includes an electric compressor, which drives an electric motor to compress air, or the like. Pressure of the compressed air fed by the compressed air feeding device 21 is adjusted by a pressure adjusting valve 211. Consequently, an airflow rate of the air, which is fed to the first air pipe 22 and the second air pipe 24, is adjusted.

[0047] The first air pipe 22 is an air passage where the air compressed by the compressed air feeding device 21 is guided through. In the spinning machine 100 in which the plurality of spinning units 1 are arranged next to one another, the first air pipe 22 is arranged parallel to a direction in which the spinning units 1 are arranged next to one another.

[0048] The first distribution pipe 23 is an air passage where air flowing through the first air pipe 22 branches off and is guided through to the pneumatic spinning device 6. One end of the first distribution pipe 23 is connected to the pneumatic spinning device 6. The other end of the first distribution pipe 23 is connected to the intermediate portion of the first air pipe 22. Accordingly, the first distribution pipe 23 can feed the air flowing through the first air pipe 22 to the pneumatic spinning device 6. Further, the air to be guided through the first distribution pipe 23 to the pneumatic spinning device 6 is controlled by an open/close valve 231 arranged at the intermediate portion of the first distribution pipe 23.

[0049] The second air pipe 24 is an air passage where the air compressed by the compressed air feeding device 21 is guided through. In the spinning machine 100 in which the plurality of spinning units 1 are arranged next to one another, the second air pipe 24 is arranged parallel to the direction in which the spinning units 1 are arranged next to one another.

[0050] The second distribution pipe 25 is an air passage where air flowing through the second air pipe 24 branches off and is guided through to the pneumatic spinning device 6. One end of the second distribution pipe 25 is connected to the pneumatic spinning device 6. The other end of the second distribution pipe 25 is connected to the intermediate portion of the second air pipe 24. Accordingly, the second distribution pipe 25 can feed the air flowing through the second air pipe 24 to the pneumatic spinning device 6. Further, the air to be guided through the second distribution pipe 25 to the pneumatic spinning device 6 is controlled by an open/close valve 251 arranged at the intermediate portion of the second distribution pipe 25.

[0051] The cleanser supplying device 3 mainly includes a branching pipe 31, an air compressing device 32, a cleanser tank 33, and a cleanser supplying pipe 34.

[0052] The branching pipe 31 is an air passage where the air flowing through the first air pipe 22 branches off and is fed through to the cleanser tank 33. One end of the branching pipe 31 is connected to the cleanser tank 33. The other end of the branching pipe 31 is connected to the intermediate portion of the first air pipe 22. Accordingly, the branching pipe 31 can feed the air flowing through the first air pipe 22 to the cleanser tank 33. Further, a supplying amount of air to be guided through the branching pipe 31 to the cleanser tank 33 is appropriately adjusted by a valve 311 arranged at the intermediate portion of the branching pipe 31.

[0053] The air compressing device 32 is a device that compresses the air which has branched off from the first air pipe 22 by the branching pipe 31. The air compressing device 32 mainly includes an electric compressor, which drives an electric motor to compress air. Further, the air compressing device 32 is electrically connected to the control device C. The air compressing device 32 can appropriately change an operational state thereof by receiving a control signal from the control device C.

[0054] The cleanser tank 33 is a tank that stores the cleanser. The cleanser tank 33 is provided with a level sensor 331. The level sensor 331 is a detection section that detects an accumulated amount of the cleanser in the cleanser tank 33. The level sensor 331 is electrically connected to the control device C. A detection signal detected by the level sensor 331 is transmitted from the level sensor 331 to the control device C. The control device C monitors the accumulated amount of the cleanser by receiving the detection signal detected by the level sensor 331. When receiving a detection signal indicating a prescribed amount, the control device C determines that the accumulated amount of cleanser is low.

[0055] For example, the cleanser, which is stored in the cleanser tank 33, is hydrocarbon system cleanser, alcohol system cleanser, or the like. The cleanser forms a film or resolves oil in the spinning chamber 65 to prevent the oiling agent from being adhered to the spinning chamber 65 or from being accumulated therein. Further, the cleanser cannot be limited to a certain type of cleanser or a cleanser with a specific product name. This is because according to a type, an amount, or the like of oiling agent applied to the sliver F, it is necessary to appropriately use the most suitable cleanser for the sliver F.

[0056] The cleanser supplying pipe 34 is a cleanser passage for adding the cleanser to the air flowing through the first air pipe 22. One end of the cleanser supplying pipe 34 is arranged to be opened at the bottom of the cleanser tank 33 or in the vicinity thereof. The other end of the cleanser supplying pipe 34 is connected to upstream of a branch point where the air flowing through the first air pipe 22 branches off to the pneumatic spinning device 6. Accordingly, the air added with the cleanser can be fed to each of the pneumatic spinning devices 6.

[0057] By such a structure, the cleanser supplying device 3 branches off portion of the air flowing through the first air pipe 22, and compresses such the air. Accordingly, internal pressure of the cleanser tank 33 can be increased by the compressed air. Since the internal pressure of the cleanser tank 33 has been increased, the cleanser supplying device 3 can push the cleanser into the first air pipe 22 through the cleanser supplying pipe 34. Accordingly, the cleanser supplying device 3 can add the cleanser to the air flowing through the first air pipe

22. The cleanser added to the air flowing through the first air pipe 22 is evenly and stably supplied to each of the pneumatic spinning devices 6 such that the cleanser is sprayed in the form of a mist.

[0058] The spinning machine 100 of the present embodiment is formed such that the air added with the cleanser is branched off and fed to all the pneumatic spinning devices 6. However, when the plurality of spinning units 1 are divided into a plurality of groups, the cleanser supplying device 3 and the compressed air feeding device 21 may be provided in each group.

[0059] Further, the cleanser supplying device 3 of the present embodiment increases internal pressure of the cleanser tank 33 by the compressed air and adds the cleanser to the air flowing through the first air pipe 22. However, the cleanser supplying device 3 may use an electric pump or the like to push the cleanser out of the cleanser tank 33 to add the cleanser to the air flowing through the first air pipe 22.

[0060] Next, by referring to Fig. 5, a description will be made on reasons why weak yarn is produced due to accumulation of the oiling agent in the spinning chamber 65. Specifically, a description will be made on reasons why weak yarn is produced due to the accumulation of the oiling agent in the spinning chamber 65 when the spun yarn Y is produced from the sliver F added with the oiling agent such as polyester. Further, the arrows in Fig. 5 indicate a direction in which the sliver F and the spun yarn Y are fed and also a direction in which the fed air flows.

[0061] As described above, the sliver F added with the oiling agent is guided through the yarn passage 61a of the guide member 61 to the spinning chamber 65. Each of fibers of the sliver F is reversed and whirled in the spinning chamber 65 by whirling airflow (refer to the alternate long and double-short dashed line in Fig. 5) . At this point of time, the oiling agent, which has been added to each fiber, is removed from the whirling fibers by the whirling airflow, and adheres to a peripheral surface of the spindle member 62. Adhesion of the oiling agent from each fiber is continuously repeated, and the oiling agent is thickly accumulated on the peripheral surface of the spindle member 62.

[0062] As described above, the oiling agent accumulated on the peripheral surface of the spindle member 62 becomes resistance to the fibers (refer to the alternate long and double-short dashed line in Fig. 5) which whirls while being wound around the peripheral surface of the spindle member 62. That is, the accumulated oiling agent consequently causes so-called weak yarn, which has unstable yarn structure, to be produced.

[0063] Accordingly, in order to prevent the weak yarn from being produced, it is necessary to prevent the oiling agent applied to the sliver F from being adhered to and accumulated in the spinning chamber 65. Particularly, it is necessary to prevent the oiling agent applied to the sliver F from being adhered to and accumulated on the spindle member 62 which constitutes a portion of the spinning chamber 65. Accordingly, it becomes important to add an appropriate amount of cleanser to air and to evenly and stably feed the air added with the cleanser to each of the pneumatic spinning devices 6.

[0064] As described above, in the spinning machine 100, the cleanser supplying device 3 adds the cleanser to the air for preventing the oiling agent from being adhered or from being accumulated, and the air is branched off and fed to each of the pneumatic spinning devices 6. Consequently, the spinning machine 100 can supply the cleanser evenly and stably to the each of the pneumatic spinning devices 6. Accordingly, the oiling agent applied to the sliver F can be prevented from being adhered to and accumulated in the spinning chamber 65. Consequently, manufacturing quality of the spun yarn Y produced by the spinning machine 100 can be improved. Further, since the oiling agent is not adhered to and accumulated in the spinning chamber 65, it becomes unnecessary to perform regular cleaning. Consequently, productivity of the spinning machine 100 producing the spun yarn Y can be improved.

[0065] Furthermore, since the air added with the cleanser is branched off and fed to each of the pneumatic spinning devices 6 in the spinning machine 100, the structure of the spinning machine 100 can be made simple in which one air distribution device 2 and one cleanser supplying device 3 are arranged. Accordingly, the size and the costs of the spinning machine 100 can be reduced. Particularly, since the first air pipe 22 and the second air pipe 24 are provided along a direction in which the plurality of spinning units 1 are arranged in the spinning machine 100, the structure of the spinning machine 100 can be even more simplified. Consequently, the size and the costs of the spinning machine 100 can be reduced.

[0066] Next, a description will be made on a structure in which supplying mode of the cleanser is changed in accordance with characteristic of the sliver F.

[0067] As described above, among slivers of synthetic fibers made of materials such as polyester, there are slivers F added with the oiling agent. However, among slivers of plant fibers such as cotton or flax, there is no sliver F added with the oiling agent. Accordingly, when producing the spun yarn Y from the sliver F not added with the oiling agent, the spinning machine 100 stops adding the cleanser to air to be fed to the pneumatic spinning device 6. Further, when producing the spun yarn Y from the sliver F added with the oiling agent, the spinning machine 100 changes an additive amount of cleanser to be added to the air to be fed to the pneumatic spinning device 6 in accordance with the characteristic of the sliver F.

[0068] Stopping of addition of the cleanser and changing of the additive amount of the cleanser are performed by the control device C controlling an operating state of the air compressing device 32. Specifically, the control device C includes an addition control section C1. The addition control section C1 retrieves from a control map M, the additive amount of the cleanser according to the characteristic of the sliver F. The addition control section

C1 transmits a control signal, which corresponds to the retrieved additive amount of the cleanser, to the air compressing device 32. Further, the control map M is data storing an appropriate amount of the cleanser to be added that has been previously found through experiments in order to prevent the oiling agent from being adhered to and accumulated the spinning chamber 65 (refer to Fig. 6).

[0069] As illustrated in Fig. 6, when producing the spun yarn Y from a sliver F1 not added with the oiling agent, the addition control section C1 controls the air compressing device 32 not to add the cleanser to the air flowing through the first air pipe 22. Further, in the spinning machine 100 according to the present embodiment, a valve 221 arranged upstream of the first air pipe 22 is closed, and a valve 241 arranged upstream of the second air pipe 24 is opened. Accordingly, the spinning machine 100 can supply air flowing through the second air pipe 24 to the pneumatic spinning devices 6, and the spinning operation can be performed only by air not added with the cleanser.

[0070] Meanwhile, as illustrated in Fig. 6, when producing the spun yarn Y from slivers F2, F3, or F4 added with the oiling agent, the addition control section C1 controls the air compressing device 32 to add the cleanser to the air flowing through the first air pipe 22. Further, in the spinning machine 100 according to the present embodiment, the valve 221 arranged upstream of the first air pipe 22 is opened, and the valve 241 arranged upstream of the second air pipe 24 is closed. Accordingly, the spinning machine 100 can supply the air flowing through the first air pipe 22 to the pneumatic spinning devices 6, and the spinning operation can be performed by air added with the cleanser.

[0071] The spinning machine 100 includes the first air pipe 22 where the cleanser is added to air and the second air pipe 24 where the cleanser is not added to air. Therefore, the spinning machine 100 can reliably switch as to whether to perform the spinning operation by the air added with the cleanser or by the air not added with the cleanser. Further, as illustrated in Fig. 7, even when the second air pipe 24 is not provided, the spinning machine 100 can switch whether or not to add the cleanser to air just by controlling the operational state of the air compressing device 32. In this case, it is possible to further simplify the structure of the spinning machine 100.

[0072] For example, when producing the spun yarn Y from the sliver F4 added with a large amount of oiling agent, if a large amount of cleanser is not added to the air, the oiling agent cannot be prevented from being accumulated. Therefore, the spinning machine 100 adjusts an amount of the cleanser to be added to air to an appropriate amount in accordance with characteristic of the sliver F4. In this case, the addition control section C1 controls the air compressing device 32 to increase pressure of the air.

[0073] As described above, the spinning machine 100 can change the additive amount of the cleanser in accordance with the characteristic of the sliver F. That is, when producing the spun yarn Y from the sliver F added with the oiling agent, the spinning machine 100 can add an appropriate amount of the cleanser to the air to be supplied to the pneumatic spinning devices 6 in accordance with the characteristic of the sliver F. Accordingly, the oiling agent applied to the sliver F is prevented from being adhered to the spinning chamber 65 and from being accumulated therein, and manufacturing quality and productivity of the spinning machine 100 can be improved. Furthermore, the spinning machine 100 can produce the spun yarn Y from various types of slivers F.

[0074] Next, a description will be made on a structure in which when at least one of the plurality of spinning units 1 is producing the spun yarn Y, the cleanser is added to air, and when none of the spinning units 1 is producing the spun yarn Y, the cleanser is stopped being added to the air.

[0075] Such a structure can be accomplished by the control device C monitoring operational status of each of the spinning units 1. Specifically, a spinning control section C2 of the control device C can receive a yarn travelling signal from the yarn defect detecting and removing device 8 of each of the spinning units 1. When receiving the yarn travelling signal from at least one of the yarn defect detecting and removing devices 8, the spinning control section C2 controls the air compressing device 32 to add the cleanser.

[0076] Meanwhile, when the spinning control section C2 cannot receive a yarn travelling signal from all of the yarn defect detecting and removing devices 8, the spinning control section C2 determines that none of the spinning units 1 is producing the spun yarn Y. Then, the spinning control section C2 controls the air compressing device 32 not to add the cleanser.

[0077] In such a structure, when at least one of the spinning units 1 is producing the spun yarn Y, the spinning machine 100 can supply the air added with the cleanser to the pneumatic spinning devices 6 in the spinning units 1. Accordingly, the oiling agent applied to the sliver F is prevented from being adhered to the spinning chamber 65 and from being accumulated therein, and manufacturing quality and productivity of the spinning machine 100 can be improved. When none of the spinning units 1 is producing the spun yarn Y, the cleanser supplying device 3 stops adding the cleanser to the air. Consequently, cleanser consumption in the spinning machine 100 can be reduced, and manufacturing costs of the spun yarn Y can be reduced.

[0078] Furthermore, when none of the spinning units 1 is producing the spun yarn Y and cannot restart producing the spun yarn Y promptly, the spinning machine 100 stops driving of the compressed air feeding device 21 in addition to stopping the addition of the cleanser. Accordingly, the spinning machine 100 can further reduce manufacturing costs of the spun yarn Y.

[0079] Next, a description will be made on a structure in which when an accumulated amount of the cleanser

in the cleanser tank 33 is less than a prescribed amount, all of the spinning units 1 stop producing the spun yarn Y.

[0080] Such a structure is accomplished by having the accumulated amount of the cleanser in the cleanser tank 33 monitored by the control device C. Specifically, the spinning control section C2 receives a detection signal from the level sensor 331 provided at the cleanser tank 33 and monitors the accumulated amount of the cleanser. When the detection signal from the level sensor 331 becomes less than a prescribed amount, the spinning control section C2 controls all the spinning units 1 to stop producing the spun yarn Y. Specifically, the spinning control section C2 stops driving sources of the draft device 5, the yarn feeding device 7, and the winding device 9 or the like in the spinning units 1. Furthermore, the spinning control section C2 controls the air compressing device 32 to stop adding the cleanser.

[0081] In such a structure, when the level sensor 331 of the cleanser tank 33 detects that the accumulated amount of the cleanser is less than the prescribed amount, all the spinning units 1 are controlled to stop producing the spun yarn Y in the spinning machine 100. Therefore, when producing the spun yarn Y from the sliver F added with the oiling agent, the spinning operation can be prevented from being performed by air not added with the cleanser. Accordingly, the oiling agent added to the sliver F is prevented from being adhered to the spinning chamber 65 and from being accumulated therein. Consequently, manufacturing quality and productivity of the spinning machine 100 can be improved.

[0082] Further, in the spinning machine 100 according to the present embodiment, the sliver F is fed from top to bottom. However, the present invention is not limited to such an embodiment. For example, a can storing the sliver F may be arranged in a lower portion of the spinning machine 100 and the winding device 9 may be arranged in an upper portion of the spinning machine 100.

Claims

1. A spinning machine including a plurality of spinning units (1), each spinning unit (1) having a pneumatic spinning device (6) which twists a fiber bundle by air, the spinning machine **characterized by** comprising:

a compressed air feeding device (21) which feeds compressed air,
a first air pipe (22) which guides the air fed by the compressed air feeding device (21), and
a cleanser supplying device (3) which adds cleanser to the air flowing through the first air pipe (22), the cleanser supplying device (3) adds the cleanser at upstream of a branch point where the air flowing through the first air pipe (22) branches off to each of the pneumatic spinning devices (6).

2. The spinning machine according to claim 1, **characterized by** further comprising a second air pipe (24) which guides the air fed by the compressed air feeding device (21) and feeds the air to each of the pneumatic spinning devices (6), wherein the second air pipe (24) is an air passage where air not added with the cleanser is guided through.

3. The spinning machine according to claim 2, **characterized in that** the air to be fed to the pneumatic spinning devices (6) can be switched among the air flowing through the first air pipe (22) and the air flowing through the second air pipe (24).

4. The spinning machine according to claim 2, **characterized in that** the first air pipe (22) and the second air pipe (24) are arranged along a direction in which the plurality of the pneumatic spinning units (1) are arranged.

5. The spinning machine according to any one of claim 1 through claim 4, **characterized by** further comprising an addition control section (C1) which controls the cleanser supplying device (3),
wherein the addition control section (C1) determines whether or not to add the cleanser to the air flowing through the first air pipe (22) in accordance with characteristic of the fiber bundle, and
when oiling agent is applied to the fiber bundle, the addition control section (C1) controls the cleanser supplying device (3) to add the cleanser.

6. The spinning machine according to claim 5, wherein the addition control section (C1) determines an additive amount of the cleanser to be added to the air flowing through the first air pipe (22) in accordance with the characteristic of the fiber bundle, and controls the cleanser supplying device (3) to add an amount of the cleanser that is appropriate according to the oiling agent added to the fiber bundle.

7. The spinning machine according to claim 5 or claim 6, **characterized in that** when at least one of the spinning units (1) is producing spun yarn from the fiber bundle added with the oiling agent, the addition control section (C1) controls the cleanser supplying device (3) to add cleanser to the air flowing through the first air pipe (22), and
when none of the spinning units (1) is producing spun yarn from fiber bundle added with the oiling agent, the addition control section (C1) controls the cleanser supplying device (3) to stop adding cleanser to the air flowing through the first air pipe (22) .

8. The spinning machine according to any one of claim 1 through claim 7, **characterized in that** the cleanser supplying device (3) includes:

a cleanser tank (33) which stores the cleanser, and

a detecting section (331) which detects an accumulated amount of the cleanser in the cleanser tank (33),

characterized in that the spinning machine further comprises a spinning control section (C2) which can receive a detection signal from the detecting section (331) and controls to activate or stop the spinning units (1),

wherein when the detecting section (331) detects that the accumulated amount of the cleanser is less than a prescribed amount, the spinning control section (C2) controls all the spinning units (1) to stop producing spun yarn.

FIG. 1

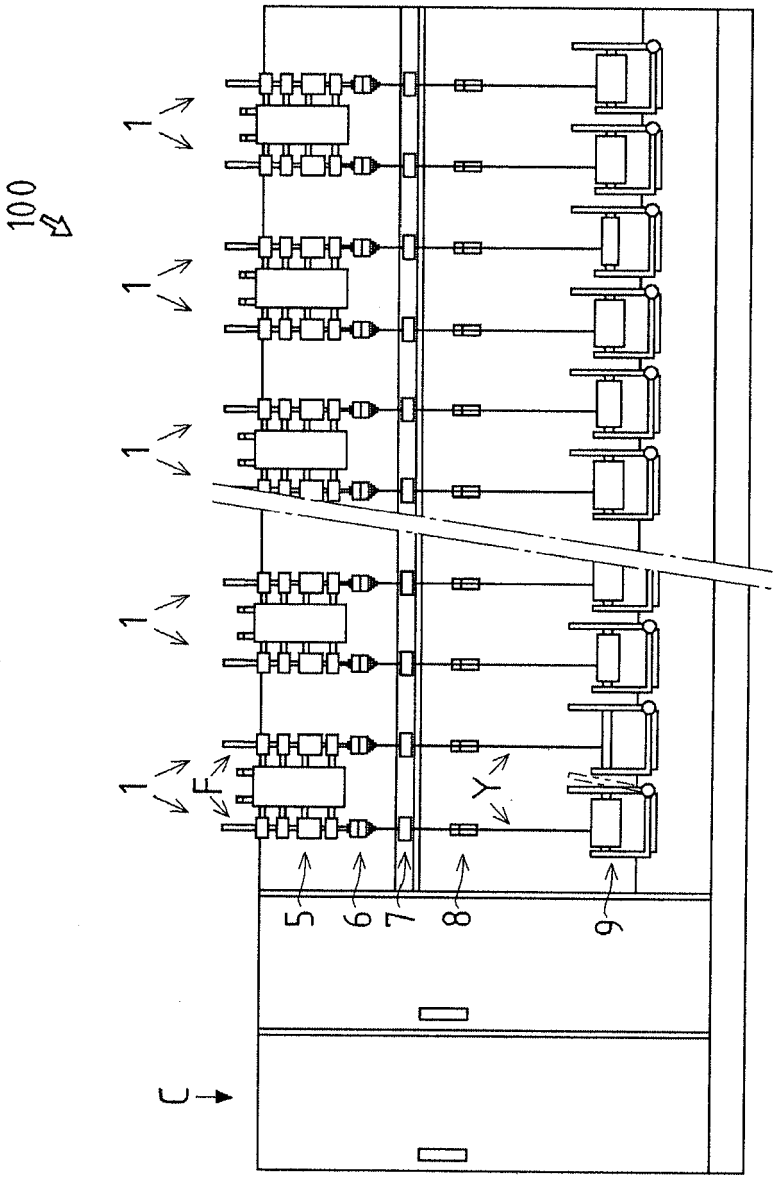

FIG. 2

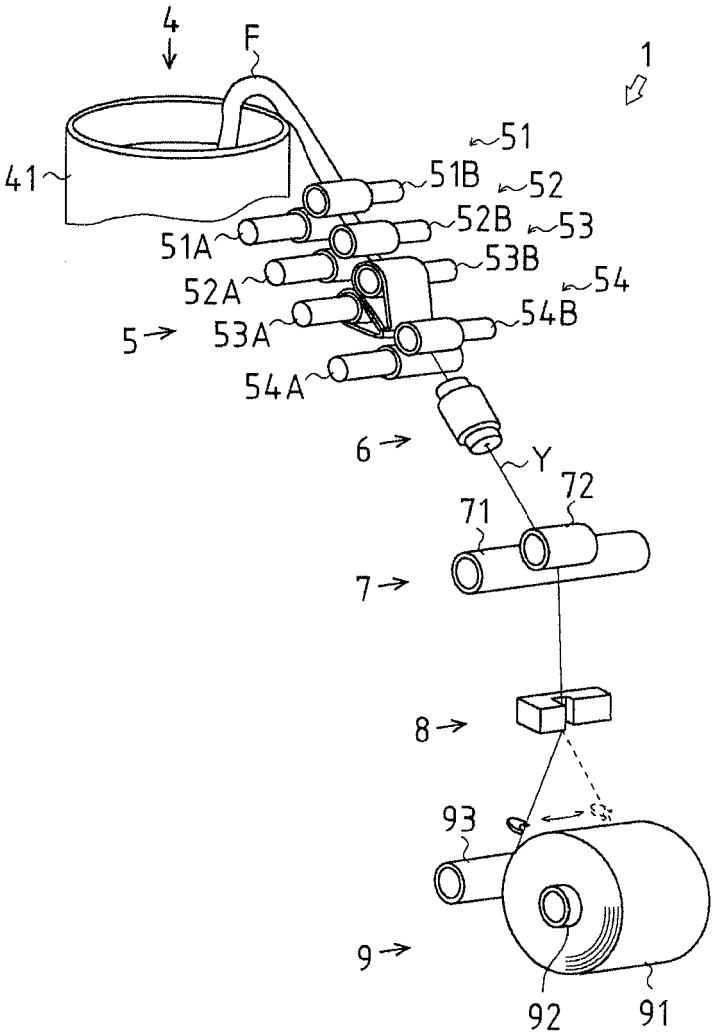
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FIG. 3

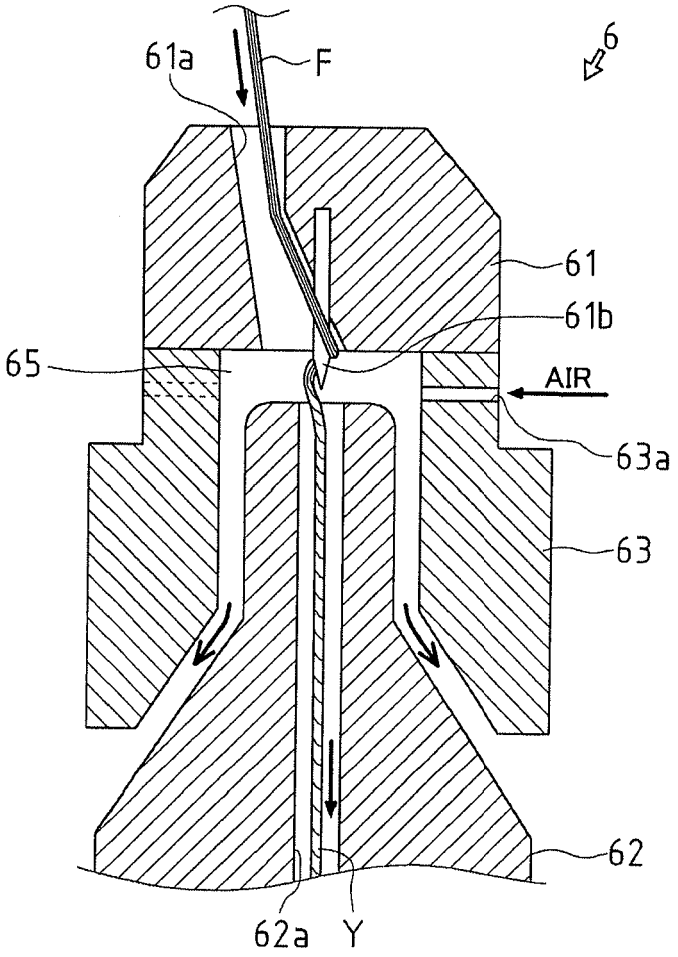
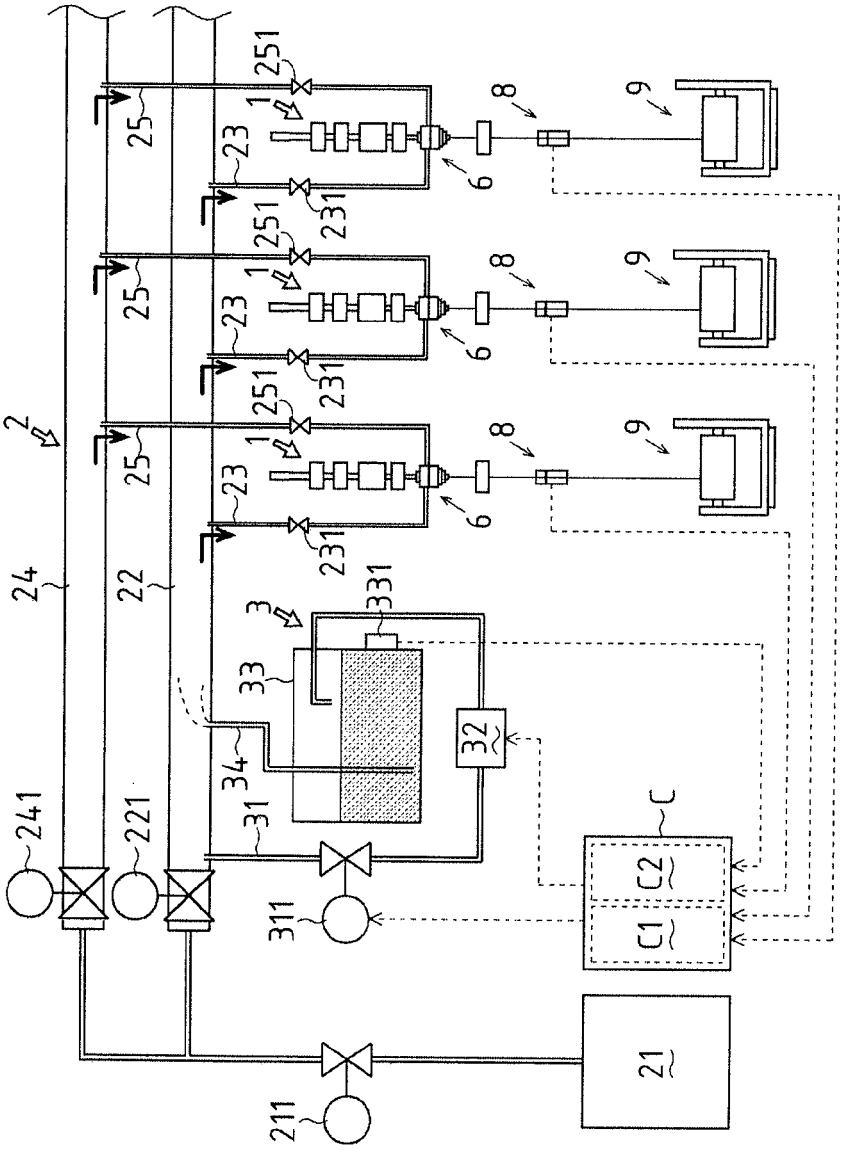


FIG. 4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221
211
311
251
231
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31
32
C
C2
C1
21

FIG. 5

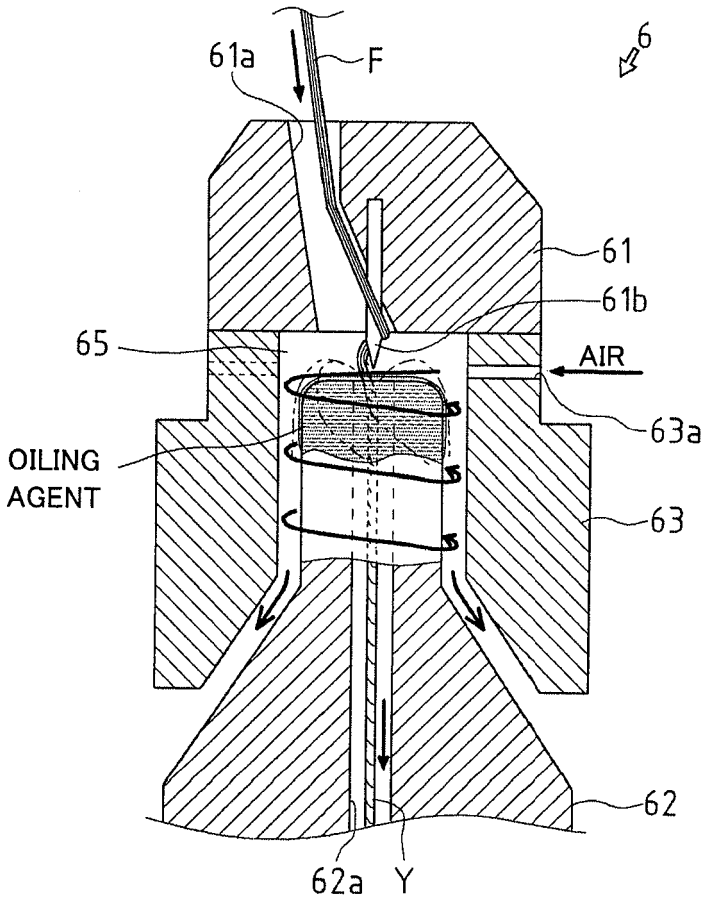


FIG. 6

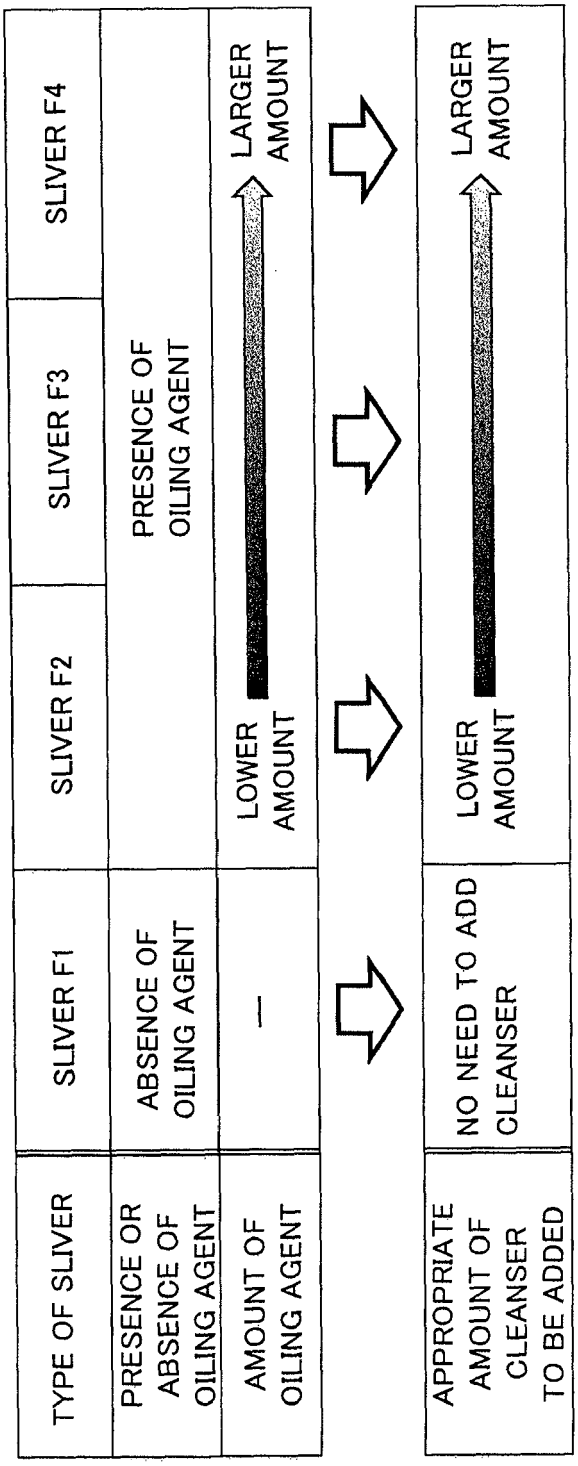
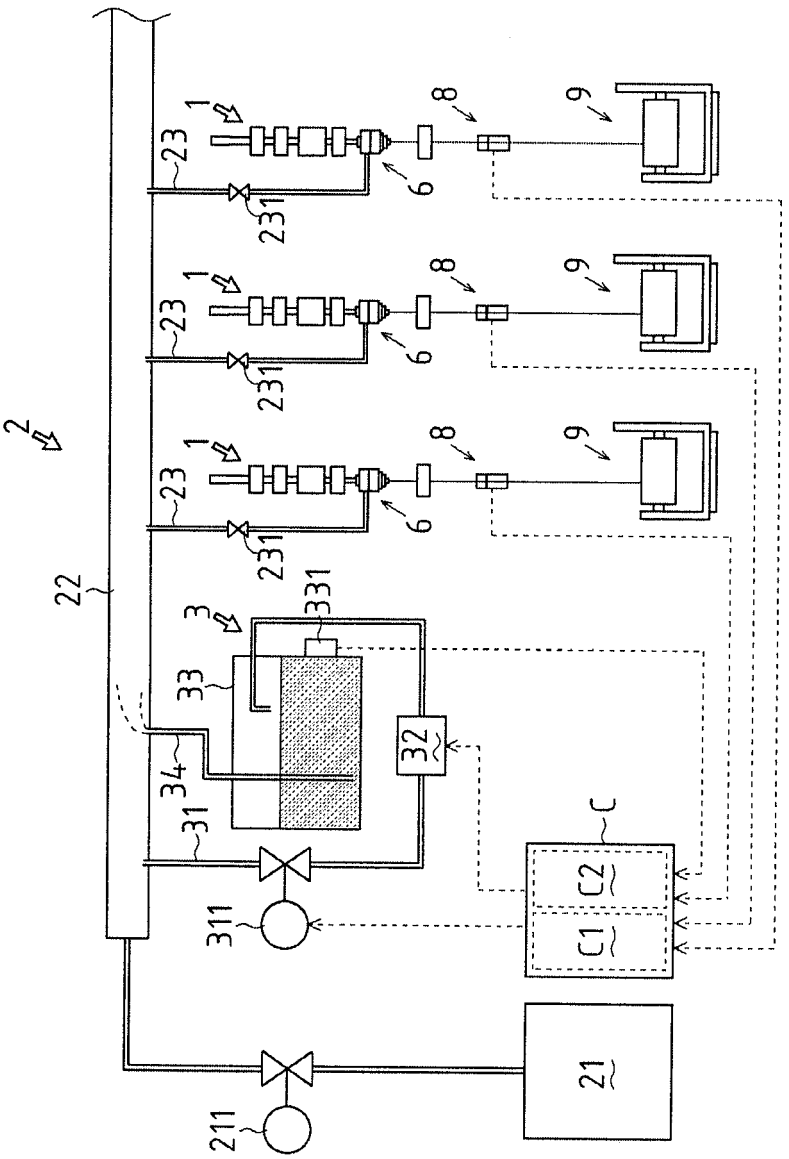

TYPE OF SLIVER
SLIVER F1
SLIVER F2
SLIVER F3
SLIVER F4
PRESENCE OR ABSENCE OF OILING AGENT
ABSENCE OF OILING AGENT
PRESENCE OF OILING AGENT
AMOUNT OF OILING AGENT
—
LOWER AMOUNT
LARGER AMOUNT
APPROPRIATE AMOUNT OF CLEANSER TO BE ADDED
NO NEED TO ADD CLEANSER
LOWER AMOUNT
LARGER AMOUNT

FIG. 7



REFERENCES CITED IN THE DESCRIPTION

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- JP 2009001935 A **[0006]**
- JP 2008095208 A **[0006]**