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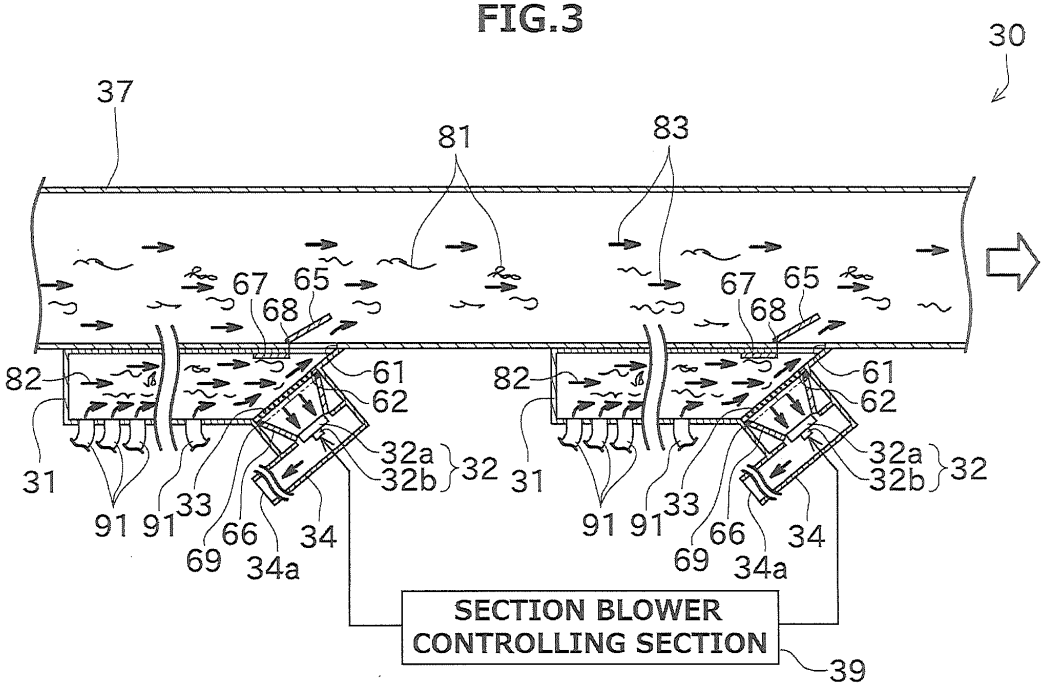
(54) YARN WINDING MACHINE

(57) In a spinning frame (1), opening / closing members (a first opening / closing member (65) and a second opening / closing member (66)) are arranged in a flow path in which a suction current (82, 83) generated by at least one of a section blower (32) and a main blower acts in each of section ducts (31). Supporting members openably / closably support the opening / closing members (65, 66) to change an open / closed state of the flow path according to difference between a pressure at an upstream side and a pressure at a downstream side of the opening / closing members.

FIG.3



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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention mainly relates to a yarn winding machine having a configuration to remove fly-waste, yarn waste, and the like.

2. Description of the Related Art

[0002] When a textile machine, such as the yarn winding machine, processes a fiber bundle and / or a yarn and the like, unnecessary fly-waste, yarn waste, and the like (rejection material) is generated during its operation. Supposing that the rejection material is left unattended, not only it can cause a degradation of the quality of a package if the rejection material adheres to the package and the like, but can lead to malfunctioning of the textile machine in itself. A textile machine that generates a suction current at an appropriate point to suck and remove the rejection material is known in the art. Japanese Patent Application Laid-Open No. 2012-132112 and Japanese Examined Utility Model Application Publication No. S61-26381 disclose this kind of textile machines.

[0003] The Japanese Patent Application Laid-Open No. 2012-132112 discloses a textile machine including a section duct and a section blower that are provided for each of a predetermined number of spinning units, and a main duct and a main blower that collectively transport the fly-waste and the like accumulated in the section duct. A filter member is arranged between the section blower and the section duct. A blocking member capable of blocking a flow path is arranged between the filter member and the section blower. By blocking the flow path with the blocking member, the fly-waste deposited on the filter member can be transported to the main duct by the action of a suction current generated by the main blower. The Japanese Patent Application Laid-Open No. 2012-132112 discloses, as the methods to operate the blocking member, a manual operation by the operator, and an automatic operation depending on the circumstances (amount of deposited fly-waste or time).

[0004] The Japanese Examined Utility Model Application Publication No. S61-26381 discloses a device including a plurality of pneumatic boxes that collects the fly-waste, and a collecting device that collects the fly-waste accumulated in the pneumatic boxes. The pneumatic boxes and the collecting devices are connected with a main duct. An automatic opening / closing valve that can open / close a flow path is arranged between the pneumatic boxes and the main duct. Normally, the automatic opening / closing valve is positioned such that the flow path is closed. The automatic opening / closing valve opens the flow path by the influence of the pressure difference generated when the operation of a suction fan of the pneumatic box is stopped while a blower of the main duct is operating, thus connecting the pneumatic boxes and the main duct. The Japanese Examined Utility Model Application Publication No. S61-26381 discloses that, if the plurality of the pneumatic boxes is simultaneously connected to the main duct, the fly-waste cannot be collected in one collecting device.

[0005] In the Japanese Patent Application Laid-Open No. 2012-132112, in the method in which the operator operates the blocking member, the amount of work to be done by the operator increases. Moreover, even if the blocking member is operated automatically, a driving source to operate the blocking member and a sensor and the like to detect the amount of deposited fly-waste become necessary, resulting in increased cost.

[0006] The configuration disclosed in the Japanese Examined Utility Model Application Publication No. S61-26381 does not allow simultaneous connection of the plurality of the pneumatic boxes to the main duct.

SUMMARY OF THE INVENTION

[0007] An object of the present invention is, in a yarn winding machine in which a plurality of section ducts is connected to a main duct, to provide a configuration that can remove the fly-waste that is deposited on a filter member.

[0008] A yarn winding machine according to one aspect of the present invention includes a plurality of winding units; a plurality of section ducts through which rejection material generated in at least one of the winding units flows; a section suction device arranged in each of the section ducts that moves the rejection material from the winding units by generating a suction current in the section duct; a filter member arranged between the section duct and the section suction device; a main duct connected to the section ducts and through which the rejection material from the section ducts flows; a main suction device that generates a suction current in the main duct for moving the rejection material from the section duct; an opening / closing member arranged in a flow path in which the suction current generated by at least one of the section suction device and the main suction device acts in each of the section ducts; and a supporting member that openably / closably supports the opening / closing member to change an open / closed state of the flow path according to difference between pressures at an upstream side and a downstream side of the opening / closing member, in a flow direction of the suction current.

[0009] The above and other objects, features, advantages and technical and industrial significance of this invention will be better understood by reading the following detailed description of presently preferred embodiments of the invention, when considered in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010]

FIG. 1 is a front view of a spinning frame according to one embodiment of the present invention.

FIG. 2 is a longitudinal cross-sectional view of the spinning frame.

FIG. 3 is a front cross-sectional view indicating a configuration of a fly-waste removing section.

FIG. 4 is an enlarged cross-sectional view of a state (normal state) of the fly-waste removing section when a section blower and a main blower are being operated.

FIG. 5 is an enlarged cross-sectional view of a state of the fly-waste removing section when the section blower is operated, and the operation of the main blower is stopped.

FIG. 6 is an enlarged cross-sectional view of a state of the fly-waste removing section when the section blower and the main blower are operated and in which a large amount of fly-waste is deposited on a filter member.

FIG. 7 is an enlarged cross-sectional view of a state of the fly-waste removing section when the operation of the section blower is stopped while the main blower continues to operate and in which the fly-waste removing section is removing the fly-waste deposited on the filter member.

FIG. 8 is an enlarged view of the fly-waste removing section in a state in which a first connection opening is closed by using a slide opening / closing member.

DETAILED DESCRIPTION

[0011] Exemplary embodiments of a spinning frame (a yarn winding machine) according to the present invention are explained in detail below with reference to the accompanying drawings. A spinning frame 1 as a yarn winding machine shown in FIG. 1 includes a large number of spinning units (winding units) 2 arranged side-by-side, a yarn joining cart 3, a blower box 4, and a motor box 5.

[0012] As shown in FIGS. 1 and 2, each of the spinning units 2 includes, sequentially arranged from upstream to downstream, a drafting device 7, a spinning device 9, a fly-waste removing section 30, a yarn accumulating device 12, and a winding device 13. The terms "upstream" and "downstream" in the explanation of FIGS. 1 and 2 refer to upstream and downstream, respectively, in a running (transportation) direction of a sliver 15, a fiber bundle 8, and a spun yarn 10 during spinning.

[0013] The drafting device 7 is arranged near an upper end of a frame 6 of the spinning frame 1. The drafting device 7 includes four roller pairs of a back roller pair 16, a third roller pair 17, a middle roller pair 19, and a front roller pair 20 sequentially from upstream. An apron belt 18 is stretched over each of the rollers of the middle roller pair 19. The drafting device 7 drafts the sliver 15 supplied from a not-shown sliver case until the fiber bundle 8 attains a predetermined thickness. The fiber bundle 8 drafted by the drafting device 7 is supplied to the spinning device 9.

[0014] The spinning device 9 includes a swirling current generating chamber (not-shown) through which the fiber bundle 8 can be passed. The spinning device 9 generates a swirling current in the swirling current generating chamber by jetting compressed air from not-shown nozzles inside of the swirling current generating chamber. The spinning device 9 generates the spun yarn 10 by applying twists to the fiber bundle 8 by using the swirling current.

[0015] In the spinning device 9, fibers (fly-waste) that could not be twisted into the spun yarn 10 in the spinning are generated. The fly-waste removing section 30 includes suction pipes 91, section ducts 31, and a main duct 37. The fly-waste is transported through the suction pipes 91, the section ducts 31, and the main duct 37 of the fly-waste removing section 30 to a not-shown cotton accumulation box. With this arrangement, because the fly-waste does not stay in the swirling current generating chamber, generation of the swirling current is not interfered. A detailed configuration of the fly-waste removing section 30 will be explained later.

[0016] The yarn accumulating device 12 is arranged downstream of the spinning device 9. As shown in FIG. 2, the yarn accumulating device 12 includes a yarn accumulating roller 21 and a motor 25 that rotationally drives the yarn accumulating roller 21.

[0017] The yarn accumulating roller 21 temporarily accumulates the spun yarn 10 by winding a certain amount of the spun yarn 10 on an outer peripheral surface thereof. The spun yarn 10 is pulled from the spinning device 9 and transported to the downstream side at a predetermined speed by causing the yarn accumulating roller 21 to rotate at a predetermined rotational speed with the spun yarn 10 wound on the outer peripheral surface thereof. Because the spun yarn 10 can be temporarily accumulated on the outer peripheral surface of the yarn accumulating roller 21, the yarn accumulating device 12 can function as a kind of buffer. The buffering function of the yarn accumulating device 12 avoids troubles (for example, slackening and the like of the spun yarn 10) caused by a mismatch in a spinning speed of the spinning device 9 and a winding speed (the speed of the spun yarn 10 being wound into a package 45) due to some reason.

[0018] An upstream guide 23 is arranged little upstream of the yarn accumulating roller 21. The upstream guide 23 guides the spun yarn 10 to the outer peripheral surface of the yarn accumulating roller 21.

[0019] A yarn clearer 52 is arranged between the spinning device 9 and the yarn accumulating device 12. The spun yarn 10 generated in the spinning device 9 passes the yarn clearer 52 before it is wound on the yarn accumulating device 12. The yarn clearer 52 monitors a thickness of the running spun yarn 10. Upon detecting a yarn defect in the spun yarn 10, the yarn clearer 52 transmits a yarn-defect detection signal to a not-shown unit controller.

[0020] Upon receiving the yarn-defect detection signal

from the yarn clearer 52, the unit controller cuts the spun yarn 10 by stopping driving of the spinning device 9, and stops winding and the like by the winding device 13. The unit controller sends a control signal to the yarn joining cart 3 to cause the yarn joining cart 3 to travel to the spinning unit 2. After completion of yarn joining by the yarn joining cart 3, the unit controller drives the spinning device 9 again to cause the winding device 13 to restart the winding.

[0021] As shown in FIGS. 1 and 2, the yarn joining cart 3 includes a yarn joining device 43, a suction pipe 44, and a suction mouth 46. When a yarn breakage or a yarn discontinuation occurs in a certain spinning unit 2, the yarn joining cart 3 travels on a rail 41 and stops at a work position corresponding to that spinning unit 2. The suction pipe 44 swings upward about a shaft to catch a spun yarn 10 from the spinning device 9, and then swings downward about the shaft to guide the spun yarn 10 to the yarn joining device 43. The suction mouth 46 swings downward about a shaft to catch a spun yarn 10 from the package 45, and then swings upward about the shaft to guide the spun yarn 10 to the yarn joining device 43. The yarn joining device 43 joins the spun yarns 10 guided thereto.

[0022] The winding device 13 includes a cradle arm 71, a winding drum 72, and a traversing device 75. The cradle arm 71 is supported so as to be pivotable around a support shaft 70. The cradle arm 71 rotatably supports a bobbin 48 on which the spun yarn 10 is to be wound. The winding drum 72 rotates in a state of being in contact with an outer peripheral surface of the bobbin 48 or the package 45. The traversing device 75 includes a traversing guide 76 that guides the spun yarn 10. The winding device 13 drives the winding drum 72 with a not-shown electric motor while causing the traversing guide 76 to perform a reciprocating movement with a not-shown driving member. As a result, the spun yarn 10 is wound into the package 45 while traversing the spun yarn 10.

[0023] A configuration of the fly-waste removing section 30 is explained below while referring to FIG. 3. The terms "upstream" and "downstream" in the explanation of the fly-waste removing section 30 refer to upstream and downstream, respectively, in a direction in which suction currents 82 and 83 flow.

[0024] The fly-waste removing section 30 includes, the section ducts 31, section blowers (section suction devices) 32, filter members 33, the main duct 37, and a main blower (a main suction device) 38 (See FIG. 1).

[0025] In the spinning frame 1 according to the present embodiment, one suction pipe 91 shown in FIG. 2 is provided for each of the spinning units 2. The section duct 31 is connected to the downstream side of the suction pipe 91. As shown in FIG. 3, the suction pipes 91 of a predetermined number (20 in the present embodiment) of the spinning units 2 are connected to one section duct 31. In the present embodiment, because one suction pipe 91 is arranged per spinning unit 2, 20 units of the suction pipes 91 are connected to one section duct 31. The fly-waste removing section 30 includes a plurality of such section ducts 31. The downstream side of each of the section ducts 31 is connected to the main duct 37 and an exhaust duct 34. The section duct 31 is connected to the main duct 37 via a first connection opening 61. The main duct 37 and the section ducts 31 are directly connected. The first connection opening 61 is arranged in a downstream end of the section duct 31. The section duct 31 is connected to the exhaust duct 34 via a second connection opening 62. When the first connection opening 61 is open, a suction current generated by the main blower 38 also acts inside the section duct 31.

[0026] The section blower 32 is arranged near the filter member 33 but inside the exhaust duct 34. The second connection opening 62 is an opening arranged between the section duct 31 and the section blower 32. By operating the section blower 32, a state of negative pressure can be created inside the section duct 31. The section blower 32 has blades 32a that generate a suction current by rotating, and a section blower driving section 32b that drives the blades 32a. The section blower driving section 32b is an electric motor. The operation of the section blower driving section 32b is controlled by a section blower controlling section 39 (a controlling section). One section blower controlling section 39 can be arranged in a controlling device that controls the entire spinning frame 1, or can be arranged per section. A section is a group of a predetermined number of the spinning units 2. The number of the spinning units 2 can be the same or can be different in different sections. Accordingly, the number of the suction pipes 91 and the number of the spinning units 2 connected to one section duct 31 can be the same or can be different in different section ducts 31. The section blower controlling section 39 (the controlling section) also controls the rotation of blades of the main blower 38. A controlling section other than the section blower controlling section 39 can be arranged to control the main blower 38. The controlling section controls the blades 32a of the section blower 32 so that they keep rotating during winding.

[0027] As shown in FIG. 3, the filter member 33 is arranged between the section duct 31 and the exhaust duct 34. The filter member 33 is a net. The mesh of the net of the filter member 33 is set such that rejection material 81 cannot but air (the later-explained suction current 82) can pass through it.

[0028] A second opening / closing member (an opening / closing member) 66 is arranged between the filter member 33 and the section blower 32. The second opening / closing member 66 includes two rectangular plate members. One end of each of the plate members is pivotably (openably / closably) supported by a second pivoting shaft member (a supporting member) 69. The supporting member is not limited to a shaft member. That is, a hinge and the like that is arranged on the inner wall of the exhaust duct 34 can be used as the supporting member. With such a configuration, the second opening / closing member 66 can change the open / closed state of the

second connection opening 62 (open state or closed state). A position of the second opening / closing member 66 when the second connection opening 62 is in the open state is considered as an open position, and a position of the second opening / closing member 66 when the second connection opening 62 is in the closed state is considered as a closed position. In the present embodiment, no biasing member and the like is attached to the second opening / closing member 66. Consequently, the second opening / closing member 66 opens / closes by the influence of the difference between the pressure inside the section duct 31 and the pressure inside the exhaust duct 34 (in other words, the pressure difference between the upstream and downstream sides of the second opening / closing member 66) (explained in detail later). It is allowable to arrange a biasing member for the second opening / closing member 66 so that the second opening / closing member is biased to the open position or the closed position when no force is applied on the second opening / closing member 66. The second opening / closing member 66 can be of any shape. Moreover, the second opening / closing member 66 of an appropriate shape can be used according to the shape of the filter member 33.

[0029] The section blower 32 sucks air from the section duct 31 via the filter member 33 thereby generating the suction current 82 inside the section duct 31, inside the suction pipe 91, and the like. The suction current 82 is used mainly to move the rejection material 81, which is generated in the spinning device 9, via the suction pipe 91 to a downstream end of the section duct 31. If the section blower 32 can generate a suction current inside the section duct 31, a suction device other than a blower can be used.

[0030] A part of the suction current 82 is exhausted to the outside of the spinning frame 1 via an outlet 34a of the exhaust duct 34. The remaining suction current 82 along with the rejection material 81 flows into the main duct 37 via the first connection opening 61. A first opening / closing member (an opening / closing member) 65 and a slide opening / closing member (an auxiliary opening / closing member) 67 are arranged between the section duct 31 and the main duct 37.

[0031] The first opening / closing member 65 is arranged near the first connection opening 61. The first opening / closing member 65 is a rectangular plate member. One end of the plate member (the upstream end in the flow direction of the suction current 83) is pivotably (openably / closably) supported by a first pivoting shaft member (a supporting member) 68. The supporting member is not limited to a shaft member, and a hinge and the like arranged on the inner wall of the main duct 37 can be used as the supporting member. In the present embodiment, no biasing member and the like is attached to the first opening / closing member 65. Consequently, the first opening / closing member 65 opens / closes by the influence of the difference between the pressure inside the section duct 31 and the pressure inside the main duct 37 (in other words, the pressure difference between the upstream and downstream sides of the first opening / closing member 65) (explained in detail later). The open / closed state of the first connection opening 61 is switchable by opening / closing the first opening / closing member 65, in other words, the first connection opening 61 can be switched to the closed state by positioning the first opening / closing member 65 to a closed position, and the first connection opening 61 can be switched to the open state by positioning the first opening / closing member 65 to an open position. It is allowable to arrange a biasing member that biases the first opening / closing member 65 to the open position or the closed position when no force is applied on the first opening / closing member 65. The first opening / closing member 65 can be of any shape. Moreover, the first opening / closing member 65 of an appropriate shape can be used according to the shape of the first connection opening 61.

[0032] The slide opening / closing member 67 is arranged near the first connection opening 61. The slide opening / closing member 67 is a rectangular plate member that is slidable along the longitudinal direction of the main duct 37 by the power of a not shown driving source that operates in accordance with the instructions from the operator. The open / closed state of the first connection opening 61 is switchable by sliding the slide opening / closing member 67, in other words, the first connection opening 61 can be switched to the closed state by positioning the slide opening / closing member 67 to a closed position, and the first connection opening 61 can be switched to the open state by positioning the slide opening / closing member 67 to an open position. As an alternative to the configuration having the driving source, an operating member can be arranged in the slide opening / closing member 67 so that the slide opening / closing member 67 is slidable when the operator operates the operating member. In such a configuration, the operating member can be a part of the slide opening / closing member 67, or can be a member arranged separately from the slide opening / closing member 67.

[0033] The main blower 38 is arranged near one end of the main duct 37 but inside the blower box 4 (See FIG. 1). By operating the main blower 38 to generate a negative pressure downstream of the main duct 37, the suction current 83 flows inside the main duct 37. If the main blower 38 can generate a suction current inside the main duct 37, it is allowable to use a suction device other than a blower. Basically, the main blower 38 is always operated (during the winding of the spun yarn 10). The rejection material 81 is taken by this suction current 83 to the cotton accumulation box along the main duct 37. A main duct opening is formed in the main duct 37. As shown in FIG. 1, an opening / closing door 4a that changes the open / closed state of the main duct opening is arranged in the blower box 4. The operator, by opening the opening / closing door (an opening / closing member of main duct opening) 4a (by opening the main duct opening) at a predetermined timing, removes the fly-waste accumulated

in the cotton accumulation box. When the opening / closing door 4a is opened, the suction current 83 generated by the main blower 38 leaks outside causing increase in the pressure inside the main duct 37 (closer to the atmospheric pressure) and decrease in the suction force of the main blower 38. The main duct opening and the opening / closing door 4a can be arranged at any desired positions. As long as the main duct opening and the opening / closing door 4a are arranged nearer to the main blower 38 than the first connection opening 61, their positions can be upstream of the blower box 4.

[0034] In the present embodiment, the fly-waste removing section 30 is configured so that a flow rate of the suction current 82 exhausted from the exhaust duct 34 is higher than a flow rate of the suction current 82 introduced into the main duct 37. As a result, a power consumption of the main blower 38 can be reduced because the flow rate of the suction current 83 sucked by the main blower 38 can be set low. However, the flow rate of the suction current 82 exhausted from the exhaust duct 34 can be set lower than the flow rate of the suction current 82 introduced into the main duct 37.

[0035] In this manner, in the present embodiment, the rejection material 81 is sucked and removed by the action of the suction current 82 and the suction current 83. Thus, basically the first connection openings 61 in all the sections are in the open state. Accordingly, the process of moving the rejection material 81 from the section duct 31 to the main duct 37 can be performed simultaneously in the plurality of the sections.

[0036] Opening / closing mechanisms of the first opening / closing member 65, the second opening / closing member 66, and the slide opening / closing member 67 are explained below while referring to FIGS. 4 to 8.

[0037] A state of the fly-waste removing section 30 during the winding of the spun yarn 10 (a normal state) is shown in FIG. 4. In the normal state, the section blower 32 and the main blower 38 are in an operating state. When the section blower 32 is operated, the pressure inside the exhaust duct 34 (more specifically, in the region between the filter member 33 and the section blower 32 inside the exhaust duct 34) decreases to a lower level compared to the pressure inside the section duct 31, causing the influence of this pressure difference to set the second opening / closing member 66 to the open position. As a result, the suction current 82 can be generated inside the section duct 31.

[0038] When the main blower 38 is operated, the pressure inside the main duct 37 is reduced (the suction current 83 is generated inside the main duct 37). Because the pressure inside the main duct 37 is lower than the pressure inside the section duct 31, the first opening / closing member 65 is set to the open position by the influence of the pressure difference. As a result, the first connection opening 61 is set to the open state, and the suction current 83 generated by the main blower 38 can be generated in the section duct 31 as well.

[0039] Accordingly, in the normal state, when the first connection opening 61 and the first opening / closing member 65 are automatically set to the open position by the influence of the pressure difference, the rejection material 81 can be sucked and collected in the blower box 4 by the action of the suction current 82 generated by the section blower 32 and the suction current 83 generated by the main blower 38.

[0040] A state in which the operation of the main blower 38 is stopped while the operation of the section blower 32 continues in the normal state is explained below while referring to FIG. 5. The operation of the main blower 38 is stopped in cases such as when performing maintenance of the main blower 38, or when the main blower 38 is damaged.

[0041] Because the operation of the section blower 32 is continued, as shown in FIG. 5, the second opening / closing member 66 remains in the open position. On the other hand, when the operation of the main blower 38 is stopped, the pressure inside the main duct 37 increases (generation of the suction current 83 stops). Consequently, the pressure inside the main duct 37 increases to a higher level than the pressure inside the section duct 31 (inverting the relation of pressure difference), causing the first opening / closing member 65 to be switched to the closed position. As a result, the first connection opening 61 is set to the closed state.

[0042] Because the suction current 83 ceases to exist when the operation of the main blower 38 is stopped, the suction current 82 can be effectively applied to the section duct 31 when the first connection opening 61 is switched to the closed state. Accordingly, by configuring the first opening / closing member 65 so as to be openable / closable by the means of pressure difference, the reduction of the suction force inside the section duct 31 can be automatically kept to a minimum, even if the operation of the main blower 38 is stopped.

[0043] In the above explanation, it is assumed that the operation of the main blower 38 has stopped completely. However, even if the operation of the main blower 38 has not stopped completely, the first opening / closing member 65 is switched to the closed state when the suction force inside the main duct 37 decreases to a lower level than a predetermined value. For example, the first opening / closing member 65 can be switched to the closed state when the operator opens the opening / closing door 4a to remove the fly-waste collected in the blower box 4.

[0044] When the operation of the main blower 38 is restarted after completion of the maintenance and the like, the pressure difference between the inside of the section duct 31 and the inside of the main duct 37 returns to its original state whereby the first opening / closing member 65 moves to the open position. Accordingly, by configuring the first opening / closing member 65 so as to be openable / closable by the means of pressure difference, the suction force inside the section duct 31 can be prevented from decreasing when under maintenance of the main blower 38, without using the driving source. Similarly, even when the opening / closing door 4a is

opened and then closed, the pressure difference between inside of the section duct 31 and inside of the main duct 37 returns to its original state, whereby the first opening / closing member 65 moves to the open position.

[0045] A state in which the operation of the section blower 32 is stopped while the operation of the main blower 38 continues in the normal state is explained below while referring to FIGS. 6 and 7.

[0046] Inside the section duct 31, a part of the suction current 82 flows through the filter member 33 in a direction perpendicular to the filter member 33 (the section blower 32 side). Therefore, the rejection material 81 receives the force such that the rejection material 81 is pushed toward the filter member 33. Consequently, the rejection material 81 can be easily caught in the filter member 33, and the rejection material 81 can be easily deposited on the filter member 33. As a result, if the operation of the section blower 32 is continued in the normal state, the rejection material 81 is deposited on the filter member 33, as shown in FIG. 6.

[0047] To remove this deposited rejection material 81, the operation of the section blower 32 is temporarily stopped in the present embodiment. A similar effect can be obtained by adjusting a rotational speed of the blades 32a to a predetermined speed or lower, without completely stopping the operation of the section blower 32. When the operation of the section blower 32 is stopped, the pressure inside the section duct 31 decreases to a lower level than the pressure inside the exhaust duct 34 (more specifically, in the region between the filter member 33 and the section blower 32 (the blades 32a) inside the exhaust duct 34) causing the second opening / closing member 66 to move to the closed position. As a result, the second connection opening 62 is switched to the closed state.

[0048] When the second connection opening 62 is switched to the closed state, the force that pushes the rejection material 81 toward the filter member 33 stops acting. Because the suction current 83 generated by the main blower 38 acts even inside the section duct 31, the rejection material 81 can be moved to the main duct 37 by the action of the suction current 83 (See FIG. 7). Accordingly, by stopping the operation of the section blower 32, or by reducing the rotational speed of the blades 32a, the rejection material 81 deposited on the filter member 33 can be effectively removed.

[0049] After the rejection material 81 deposited on the filter member 33 is removed, because the difference between the pressure inside the section duct 31 and the pressure inside the exhaust duct 34 (more specifically, the region between the filter member 33 and the section blower 32 inside the exhaust duct 34) returns to the original state when the rotational speed of the blades 32a of the section blower 32 is increased, the second opening / closing member 66 can be moved to the open position. Accordingly, by configuring the second opening / closing member 66 so as to be openable / closable by the means of the pressure difference, the rejection material 81 deposited on the filter member 33 can be removed without using the driving source.

[0050] The rejection material 81 keeps on depositing on the filter member 33 when formation and / or winding of the spun yarn 10 are performed. Therefore, it is preferable to stop the operation of the section blower 32, or reduce the rotational speed of the blades 32a at a predetermined timing. These processes can be executed after every predetermined time, or their execution timing can be determined according to a detection result of a not shown pressure sensor. When using the pressure sensor, the pressure sensor can be arranged, for example, between the filter member 33 and the section blower 32. In such a case, a negative pressure inside the exhaust duct 34 (more specifically, the region between the filter member 33 and the section blower 32 inside the exhaust duct 34) becomes stronger due to the deposition of the rejection material 81, so that the amount of the deposited rejection material 81 can be estimated based on a detected pressure value. The pressure sensor can be arranged inside the section duct 31 and / or inside the suction pipe 91. In such a case, the value of the detected pressure increases in accordance with the deposition of the rejection material 81 (in other words, the negative pressure becomes weak), so that the amount of the deposited rejection material 81 can be estimated based on the detected pressure value.

[0051] A state in which the slide opening / closing member 67 is being operated is explained below while referring to FIG. 8.

[0052] Because the first opening / closing member 65 opens / closes by the influence of the pressure difference, for example, when the section duct 31 or the exhaust duct 34 (the section blower 32), and the like are removed, the first opening / closing member 65 moves to the open position and remains in that position. In such a case, the suction force inside the main duct 37 becomes weak.

[0053] When removing the section duct 31, the exhaust duct 34, and the like, the slide opening / closing member 67 is first moved to the closed position to avoid a decrease in the suction force inside the main duct 37 as explained above. The position of the slide opening / closing member 67 is switched by an operating force applied by the operator or by the power of the driving source. Therefore, even if a pressure difference capable of moving the first opening / closing member 65 to the open position is generated, the slide opening / closing member 67 remains in the closed position (the open / closed state of the first connection opening 61 is retained). Consequently, the suction force inside the main duct 37 does not become weak even if the section duct 31, the exhaust duct 34, and the like is removed. As a result, maintenance of the section duct 31, the exhaust duct 34, and the like can be performed during the formation and / or winding of the spun yarn 10.

[0054] The present embodiment relates to a configuration having the slide opening / closing member 67 in addition to the first opening / closing member 65. Alter-

natively, spinning frame 1 can include a configuration that locks the first opening / closing member 65 in at least the closed position. By locking the first opening / closing member 65 in the closed position, the maintenance of the section duct 31, the exhaust duct 34, and the like can be performed for each section while the formation and / or winding of the spun yarn 10 is being performed, even if spinning frame 1 is not equipped with the slide opening / closing member 67. It is allowable to arrange a switching section that can simultaneously switch the open / closed state of the slide opening / closing members 67 of the sections.

[0055] As explained above, the spinning frame 1 includes the spinning units 2, the section ducts 31, the section blowers 32, the filter members 33, the main duct 37, the main blower 38, at least one opening / closing member (the first opening / closing member 65 and the second opening / closing member 66), and the supporting member (the first pivoting shaft member 68 and the second pivoting shaft member 69). Each of the section ducts 31 is arranged in at least one spinning unit 2, and the rejection material 81 generated in the corresponding spinning units 2 flows into the section ducts 31. The section blower 32 is arranged in each of the section ducts 31 to move the rejection material 81 by generating the suction current 82 in the corresponding section duct 31. The filter member 33 is arranged between the section duct 31 and the section blower 32. The main duct 37 is connected to the section ducts 31. The suction current 82 and the rejection material 81 from the section ducts 31 flow into the main duct 37. The main blower 38 generates in the main duct 37 the suction current 83 for moving the rejection material 81. The opening / closing member is arranged in a flow path in which the suction current 82 generated by the section blower 32 and / or the suction current 83 generated by the main blower 38 acts in each of the section ducts 31. The supporting member openably / closably supports the opening / closing member to change the open / closed state of the flow path according to the difference between the pressure at the upstream side and the pressure at the downstream side of the opening / closing member.

[0056] Accordingly, in the spinning frame 1 in which the plurality of the section blowers 32 are simultaneously connected to the main blower 38, the rejection material 81 deposited on the filter member 33 can be automatically removed by the pressure difference inside the flow path (in other words, without using the driving source that drives the opening / closing member and the like).

[0057] In the spinning frame 1, the main duct 37 has the main duct opening formed nearer to the main blower 38 than the first connection opening 61, and the opening / closing door 4a that changes the open / closed state of the main duct opening. When the section blower 32 is generating the suction current 82, and the main duct opening is open, the first opening / closing member 65 closes the first connection opening 61 by the influence of the pressure difference.

[0058] Accordingly, when the main duct opening is open, the pressure inside the main duct 37 increases causing a change in the pressure difference. This change in the pressure difference causes the first connection opening 61 to close. As a result, the suction current 82 generated by the section blower 32 can be effectively utilized, and the operation of the spinning units 2 can be continued even if, for example, the section ducts 31 and the main duct 37 are not connected.

[0059] In the spinning frame 1, in a state in which the section blower 32 is generating the suction current 82 and the first opening / closing member 65 has closed the first connection opening 61, when the main duct opening is closed by the opening / closing door 4a, the first opening / closing member 65 opens the first connection opening 61 by the influence of the pressure difference.

[0060] With the above configuration, when the main duct opening closes, the pressure inside the main duct 37 decreases and the pressure difference changes causing the first connection opening 61 to open. With this action, by configuring the first connection opening 61 to automatically open at a timing when the suction force inside the main duct 37 is increased, the suction current 83 generated by the main blower 38 can be utilized.

[0061] In the spinning frame 1, in a state in which the section blower 32 is generating the suction current 82 and the main blower 38 is generating the suction current 83, if the operation of the main blower 38 is stopped, the first opening / closing member 65 closes the first connection opening 61 by the influence of the pressure difference.

[0062] With this configuration, by configuring the first connection opening 61 to automatically close at a timing when the suction force inside the main duct 37 is decreased, the suction current 82 generated by the section blower 32 can be utilized.

[0063] In the spinning frame 1, in a state in which the section blower 32 is generating the suction current 82 and the operation of the main blower 38 is stopped, when the operation of the main blower 38 is started, the first opening / closing member 65 opens the first connection opening 61 by the influence of the pressure difference.

[0064] With this configuration, when the operation of the main blower 38 is started, the pressure inside the main duct 37 decreases and the pressure difference changes causing the first connection opening 61 to open. Therefore, by configuring the first connection opening 61 to automatically open at a timing when the suction force inside the main duct 37 is increased, the suction current 83 generated by the main blower 38 can be utilized.

[0065] In the spinning frame 1, when the rotational speed of the blades 32a of the section blower 32 is reduced, the second opening / closing member 66 closes the second connection opening 62 by the influence of the pressure difference.

[0066] With this configuration, because the pressure at the downstream side of the filter member 33 increases and the pressure difference changes when the rotational

speed of the blades 32a of the section blower 32 is reduced, the second connection opening 62 closes. When the second connection opening 62 closes, the rejection material 81 stops getting sucked into the filter member 33. Therefore, the rejection material 81 can be removed by using the suction current 83 generated by the main blower 38.

[0067] In the spinning frame 1, when the rotational speed of the blades 32a of the section blower 32 is increased, the second opening / closing member 66 opens the second connection opening 62 by the influence of the pressure difference.

[0068] With this configuration, because the pressure at the downstream side of the filter member 33 decreases and the pressure difference changes when the rotational speed of the blades 32a of the section blower 32 is increased, the second connection opening 62 opens. Therefore, by configuring the second connection opening 62 to open at a timing when the suction force inside the section duct 31 is increased, the suction current 82 can be utilized.

[0069] The spinning frame 1 includes the slide opening / closing member 67 that changes the open / closed state of the first connection opening 61 independently from the first opening / closing member 65. The slide opening / closing member 67 retains the open / closed state of the first connection opening 61 even if there is a difference between the pressure at the upstream side and the pressure at the downstream side.

[0070] Accordingly, because the first connection opening 61 can be kept closed during maintenance and the like, leakage of the suction current 83 generated by the main blower 38 can be prevented. Consequently, a section-wise maintenance can be performed.

[0071] Exemplary embodiments and variations of the present invention are explained above. The configuration explained above can, however, be modified as explained below.

[0072] In the above embodiments, when the pressure inside the main duct 37 is lower than the pressure inside the section duct 31, the first opening / closing member 65 is set to the open position. If the first opening / closing member 65 is, however, receiving power because of being biased by a biasing member or due to its own weight to position itself to the closed position, the first opening / closing member 65 may position itself to the open position even if the pressure inside the main duct 37 is higher than the pressure inside the section duct 31. Consequently, the magnitude relationship between the pressures explained in the above embodiments is just an example. Moreover, the magnitude relationship between the pressures explained in the above embodiments in states where the first opening / closing member 65 is positioned at the closed position, and where the second opening / closing member 66 is positioned at the open position or the closed position, in addition to the state where the first opening / closing member 65 is positioned at the open position is just examples.

[0073] In the embodiments explained above, the first opening / closing member 65 includes one plate member, and the second opening / closing member 66 includes two plate members. This configuration is just an example. The first opening / closing member 65 can include two plate members. The second opening / closing member 66 can include one plate member. In the embodiments explained above, when in the closed state, the first connection opening 61 and the second connection opening 62 are completely closed. However, even if some gap remains, the state is considered as the "closed state".

[0074] The number of the spinning units 2 connected to one section duct 31 is not limited to 20. That is, any number of the spinning units 2 between 1 and 20, or 21 or more can be connected to one section duct 31.

[0075] In the embodiments explained above, the first opening / closing member 65, the second opening / closing member 66, and the slide opening / closing member 67 are arranged in each of the sections, but it is allowable if at least one opening / closing member among the three opening / closing members is not arranged in one or more of the sections.

[0076] The location and the orientation of the filter member 33 are not particularly limited. In the present embodiments, the filter member 33 is arranged in an inclined manner (specifically, so that it approaches toward the first connection opening 61 as one goes downstream with the direction of the flow of the suction current). For example, in FIG. 3, however, it is allowable to arrange the filter member 33 so that the longitudinal direction of the filter member 33 matches with the longitudinal direction of the section duct 31.

[0077] In addition to connecting the suction pipe 91 to the section duct 31, a suction pipe through which fly-waste stuck to a drafting roller of the drafting device 7 is transported after sucking can be connected to the section duct 31. In the spinning unit 2, a suction port that sucks the yarn waste and the like can be arranged downstream of the spinning device 9. Moreover, a suction pipe having such a suction port can be connected to the section duct 31. In addition, in a spinning frame that includes one yarn joining device for each of the spinning units 2, a pipe that sucks and transports the yarn waste generated during the yarn joining and the like can be connected to the section duct 31.

[0078] In the spinning unit 2, the yarn accumulating device 12 pulls the spun yarn 10 from the spinning device 9; however, the configuration is not limited to this configuration. For example, in the spinning unit, the spun yarn 10 can be pulled from the spinning device 9 by using a delivery roller and a nip roller, thereafter, the spun yarn 10 can be accumulated by using the yarn accumulating device 12 or a slack tube provided downstream. When a configuration in which the spun yarn 10 is pulled from the spinning device 9 by using the delivery roller and the nip roller is employed, the yarn accumulating device 12 can be omitted.

[0079] The application of the present invention is not

limited to the spinning frame explained above. That is, the present invention can be applied, for example, to an open-end spinning frame, an automatic winder, a twisting frame, a doubling machine, and the like. When applying the present invention to, for example, the automatic winder, the present invention can be applied to a configuration for removing the yarn waste occurring during the yarn joining.

[0080] A yarn winding machine according to one aspect of the present invention includes a plurality of winding units, a plurality of section ducts, a section suction device, a filter member, a main duct, a main suction device, an opening / closing member, and a supporting member. Rejection material generated in at least one of the winding units flows through the section ducts. The section suction device is arranged in each of the section ducts and moves the rejection material from the winding units by generating a suction current in the section duct. The filter member is arranged between the section duct and the section suction device. The main duct is connected to the section ducts and the rejection material from the section ducts flows through it. The main suction device generates a suction current in the main duct for moving the rejection material from the section duct. The opening / closing member is arranged in a flow path in which the suction current generated by at least one of the section suction device and the main suction device acts in each of the section ducts. The supporting member openably / closably supports the opening / closing member to change an open / closed state of the flow path according to difference between pressures at an upstream side and a downstream side of the opening / closing member, in a flow direction of the suction current.

[0081] With the above configuration, in the yarn winding machine, in which a plurality of the section suction devices is connected to the main suction device, the rejection material deposited on the filter member can be automatically removed by the pressure difference inside the flow path.

[0082] In the above yarn winding machine, the opening / closing member is a first opening / closing member that changes an open / closed state of a first connection opening between the section duct and the main duct.

[0083] With the above configuration, the open / closed state of the section duct and the main duct can be changed.

[0084] In the above yarn winding machine, the first connection opening is arranged in a downstream end of the section duct.

[0085] With the above configuration, the rejection material can be smoothly moved inside the main duct via the first connection opening.

[0086] In the above yarn winding machine, the main duct includes a main duct opening that is formed nearer to the main suction device than the first connection opening, and an opening / closing member of duct opening that changes an open / closed state of the main duct opening. In a state in which the section suction device is generating the suction current, if the main duct opening is opened by the opening / closing member of duct opening, the first opening / closing member closes the first connection opening.

[0087] With the above configuration, when the main duct opening is open, pressure inside the main duct (downstream side of the first connection opening) increases and the pressure difference changes causing the first connection opening to close. As a result, the suction current generated by the section suction device can be effectively utilized, and the operation of the spinning unit can be continued even if, for example, the section duct and the main duct are not connected.

[0088] In the above yarn winding machine, in a state in which the section suction device is generating the suction current and the first opening / closing member has closed the first connection opening, if the main duct opening is closed by the opening / closing member of duct opening, the first opening / closing member opens the first connection opening.

[0089] With the above configuration, when the main duct opening closes, the pressure inside the main duct decreases and the pressure difference changes causing the first connection opening to open. Therefore, by configuring the first connection opening to automatically open at a timing when the suction force inside the main duct is increased, the suction current generated by the main suction device can be utilized.

[0090] In the above yarn winding machine, in a state in which the section suction device and the main suction device are generating the suction currents and the operation of the main suction device is stopped, the first opening / closing member closes the first connection opening.

[0091] With the above configuration, when the operation of the main suction device is stopped, the pressure inside the main duct increases and the pressure difference changes causing the first connection opening to close. With this action, by configuring the first connection opening to automatically close at a timing when the suction force inside the main duct is decreased, the suction current generated by the section suction device can be utilized. As a result, the operation of the spinning unit can be continued even if, for example, the section duct and the main duct are not connected.

[0092] In the above yarn winding machine, in a state in which the section suction device is generating the suction current and the operation of the main suction device is stopped, if the operation of the main suction device is started, the first opening / closing member opens the first connection opening.

[0093] With the above configuration, because the pressure inside the main duct decreases and the pressure difference changes when the operation of the main suction device is started, the first connection opening opens. Therefore, by configuring the first connection opening to automatically open at a timing when the suction force inside the main duct is increased, the suction current generated by the main suction device can be utilized.

[0094] The above yarn winding machine includes an auxiliary opening / closing member that changes the open / closed state of the first connection opening independently from the first opening / closing member. Even if there is a difference between a pressure at an upstream side and a pressure at a downstream side of the auxiliary opening / closing member in the flow direction of the suction current, the auxiliary opening / closing member retains the open / closed state of the first connection opening.

[0095] With the above configuration, because the first connection opening can be kept closed during maintenance and the like, a section-wise maintenance can be performed.

[0096] In the above yarn winding machine, the opening / closing member is a second opening / closing member that changes an open / closed state of a second connection opening arranged between the filter member and the section suction device.

[0097] With the above configuration, the open / closed state between the filter member and the section suction device can be changed according to difference in pressure between two regions on each side of the filter member.

[0098] In the above yarn winding machine, when a rotational speed of blades of the section suction device is reduced, the second opening / closing member closes the second connection opening.

[0099] With the above configuration, because pressure at a downstream side of the filter member increases and the pressure difference changes when the rotational speed of the blades of the section suction device is reduced, the second connection opening closes. When the second connection opening closes, the rejection material stops getting sucked into the filter member. Thus, the rejection material can be removed by using the suction current generated by the main suction device.

[0100] In the above yarn winding machine, when the rotational speed of the blades of the section suction device is increased, the second opening / closing member opens the second connection opening.

[0101] With the above configuration, because the pressure at the downstream side of the filter member decreases and the pressure difference changes when the rotational speed of the blades of the section suction device is increased, the second connection opening opens. Therefore, by opening the second connection opening at a timing when the suction force inside the section duct is increased, the suction current can be utilized.

[0102] The above yarn winding machine includes an exhaust duct arranged for each of the section ducts and having an outlet for exhausting to outside the suction current that has passed through the filter member. Moreover, it is preferable that the filter member is arranged between the section duct and the exhaust duct, and the section suction device is arranged in the exhaust duct but between the filter member and the outlet.

[0103] With the above configuration, the suction current generated by the section suction device can be caused to effectively act in the section duct.

[0104] In the above yarn winding machine, blades of the main suction device are kept rotating during winding.

[0105] With this configuration, size of the section suction device can be reduced.

[0106] In the above explanation, the meaning of "a plurality of" also includes "a predetermined number of".

[0107] Although the invention has been explained with respect to specific embodiments for a complete and clear disclosure, the appended claims are not to be thus limited but are to be construed as embodying all modifications and alternative constructions that may occur to one skilled in the art that fairly fall within the scope of the claims.

Claims

1. A yarn winding machine (1) comprising:

a plurality of winding units (2);
a plurality of section ducts (31) through which rejection material generated in at least one of the winding units (2) flows;
a section suction device (32) arranged in each of the section ducts (31) that moves the rejection material from the winding units (2) by generating a suction current in the section duct (31);
a filter member (33) arranged between the section duct (31) and the section suction device (32);
a main duct (37) connected to the section ducts (31) and through which the rejection material from the section ducts (31) flows;
a main suction device (38) that generates a suction current in the main duct (37) for moving the rejection material from the section duct (31);
characterized by
an opening / closing member (65, 66) arranged in a flow path in which the suction current generated by at least one of the section suction device (32) and the main suction device (38) acts in each of the section ducts (31); and
a supporting member (68, 69) that openably / closably supports the opening / closing member (65, 66) to change an open / closed state of the flow path according to a difference between pressures at an upstream side and a downstream side of the opening / closing member (65, 66), in a flow direction of the suction current.

2. The yarn winding machine (1) as claimed in Claim 1, **characterized in that** the opening / closing member (65, 66) includes a first opening / closing member (65) that changes an open / closed state of a first connection opening (61) between the section duct (31) and the main duct (37).

3. The yarn winding machine (1) as claimed in Claim 2, **characterized in that** the first connection opening (61) is arranged in a downstream end of the section duct (31).

4. The yarn winding machine (1) as claimed in Claim 2 or 3, **characterized in that**
the main duct (37) includes a main duct opening that is formed nearer to the main suction device (38) than the first connection opening (61), and an opening / closing member of duct opening (4a) that changes an open / closed state of the main duct opening, and in a state in which the section suction device (32) is generating the suction current, if the main duct opening is opened by the opening / closing member of duct opening (4a), the first opening / closing member (65) closes the first connection opening (61).

5. The yarn winding machine (1) as claimed in Claim 4, **characterized in that**, in a state in which the section suction device (32) is generating the suction current and the first opening / closing member (65) has closed the first connection opening (61), if the main duct opening is closed by the opening / closing member of duct opening (4a), the first opening / closing member (65) opens the first connection opening (61).

6. The yarn winding machine (1) as claimed in any one of Claims 2 to 5, **characterized in that**, in a state in which the section suction device (32) and the main suction device (38) are generating the suction currents and the operation of the main suction device (38) is stopped, the first opening / closing member (65) closes the first connection opening (61).

7. The yarn winding machine (1) as claimed in any one of Claims 2 to 6, **characterized in that**, in a state in which the section suction device (32) is generating the suction current and the operation of the main suction device (38) is stopped, when the operation of the main suction device (38) is started, the first opening / closing member (65) opens the first connection opening (61).

8. The yarn winding machine (1) as claimed in any one of Claims 2 to 7, includes an auxiliary opening / closing member (67) that changes the open / closed state of the first connection opening (61) independently from the first opening / closing member (65), **characterized in that**
even if there is a difference between a pressure at an upstream side and a pressure at a downstream side of the auxiliary opening / closing member (67) in the flow direction of the suction current, the auxiliary opening / closing member (67) retains the open / closed state of the first connection opening (61).

9. The yarn winding machine (1) as claimed in any one of Claims 1 to 8, **characterized in that** the opening / closing member (65) includes a second opening / closing member (66) that changes an open / closed state of a second connection opening (62) arranged between the filter member (33) and the section suction device (32).

10. The yarn winding machine (1) as claimed in Claim 9, **characterized in that**, when a rotational speed of blades (32a) of the section suction device (32) is reduced, the second opening / closing member (66) closes the second connection opening (62).

11. The yarn winding machine (1) as claimed in Claim 10, **characterized in that**, when the rotational speed of the blades (32a) of the section suction device (32) is increased, the second opening / closing member (66) opens the second connection opening (62).

12. The yarn winding machine (1) as claimed in any one of Claims 1 to 11, further **characterized by** an exhaust duct (34) arranged for each of the section ducts (31) and having an outlet (34a) for exhausting to outside the suction current that has passed through the filter member (33), and
wherein the filter member (33) is arranged between the section duct (31) and the exhaust duct (34), and the section suction device (32) is arranged in the exhaust duct (34) but between the filter member (33) and the outlet (34a).

13. The yarn winding machine (1) as claimed in any one of Claims 1 to 12, **characterized in that** blades of the main suction device (32) are kept rotating during winding.

FIG.1

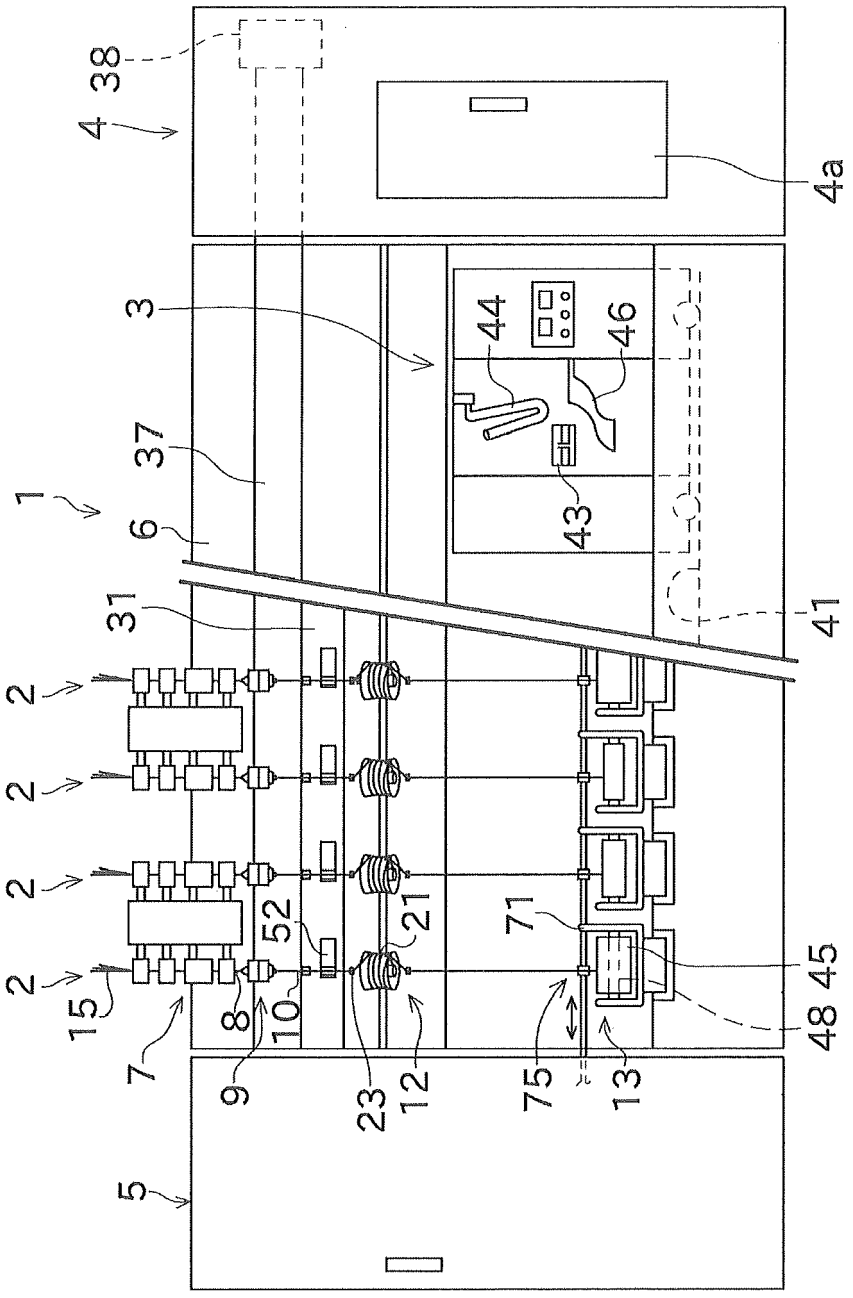
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FIG.2

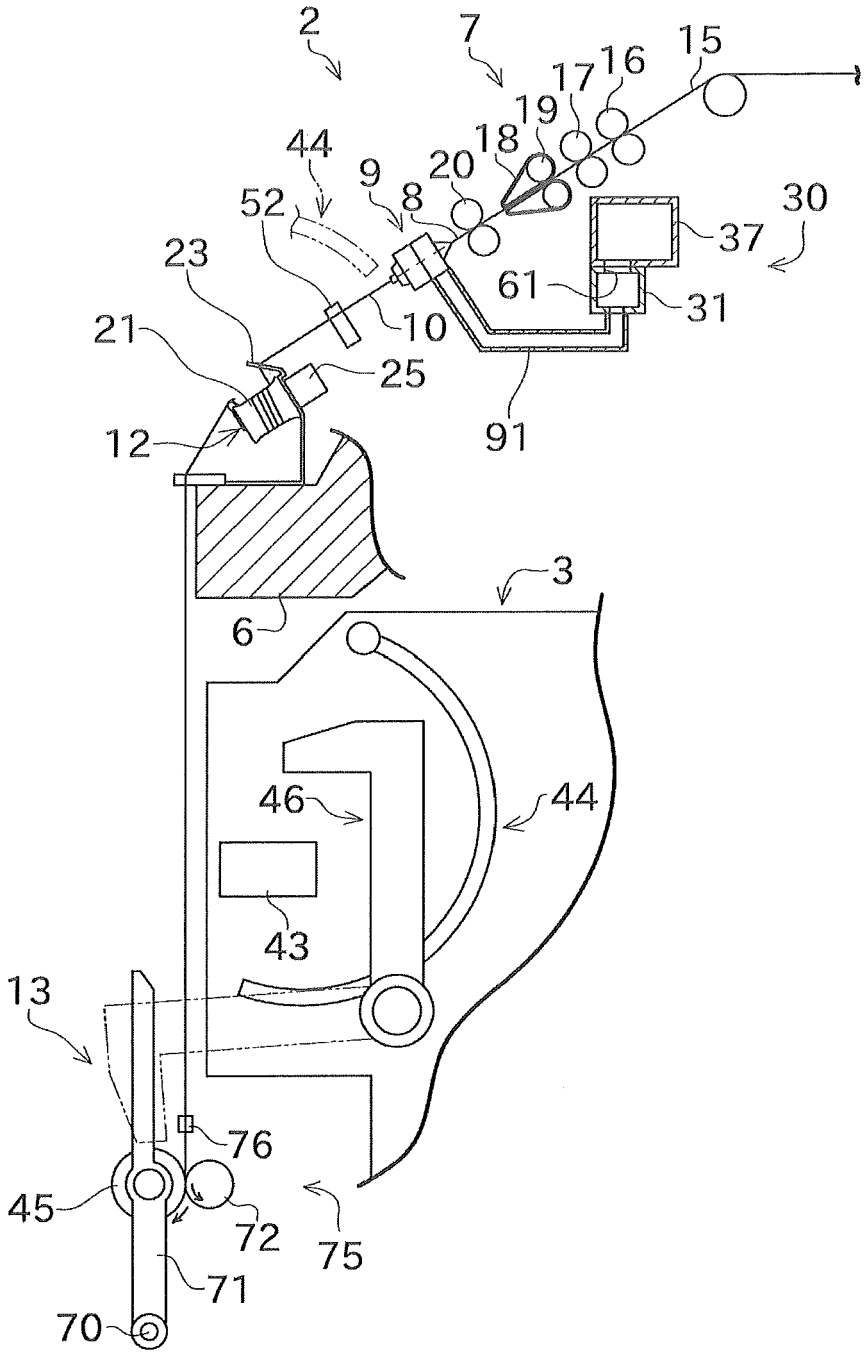
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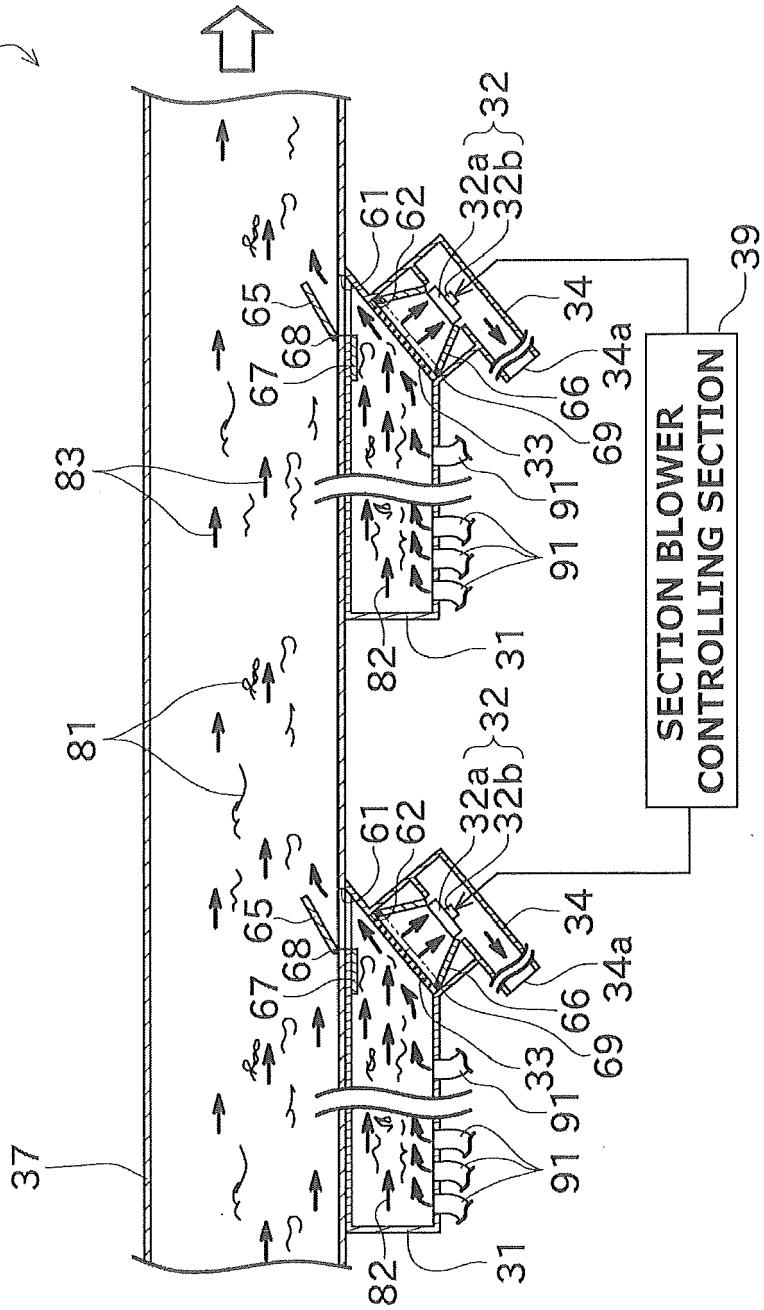
FIG.3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32a
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SECTION BLOWER CONTROLLING SECTION

FIG.4

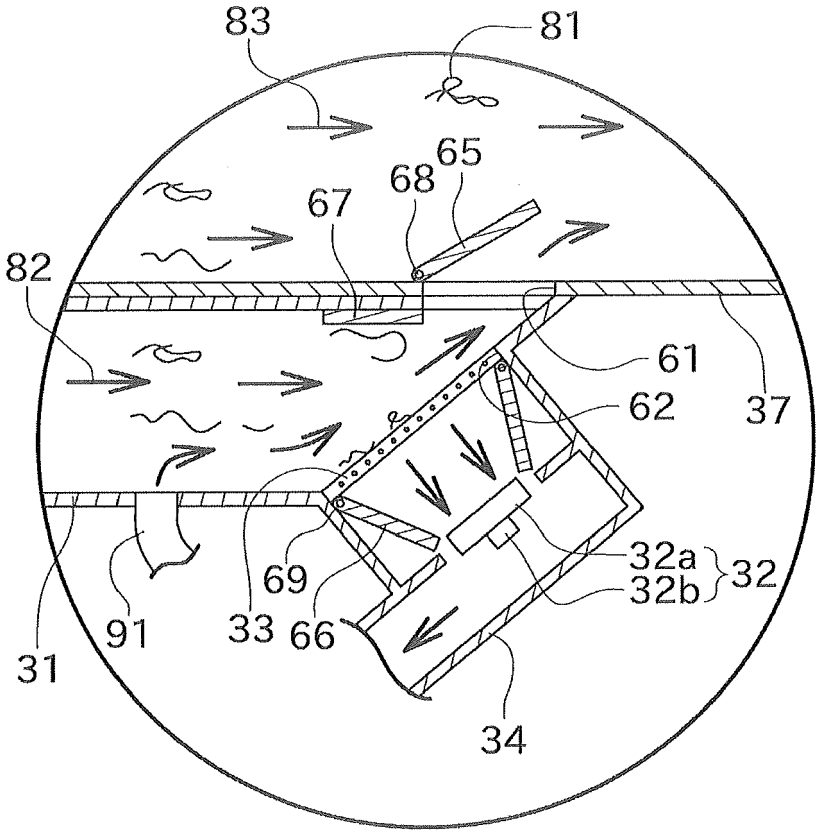


FIG.5

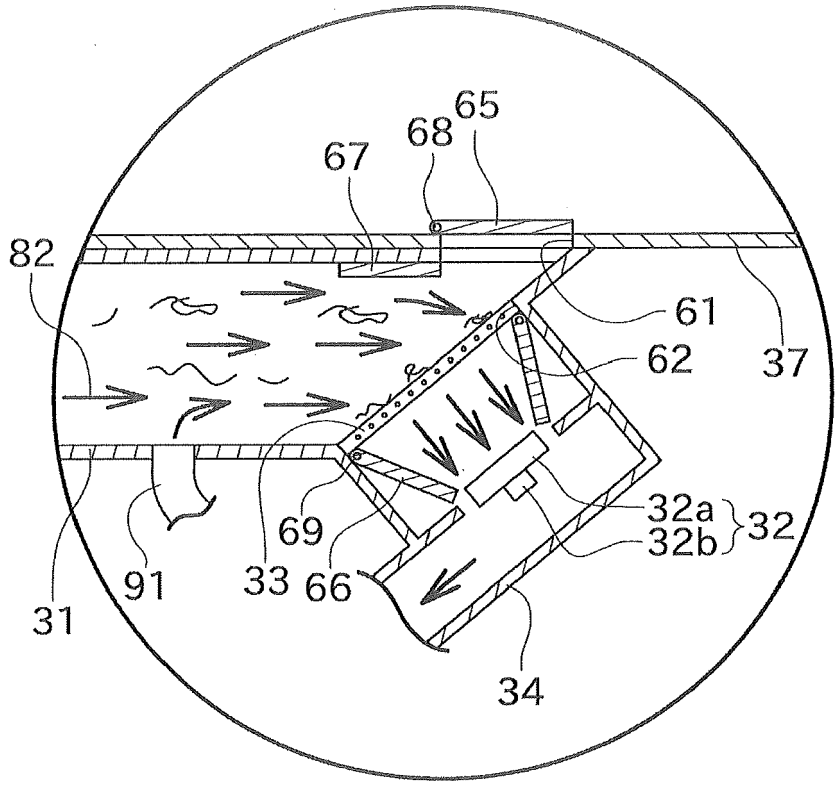


FIG.6

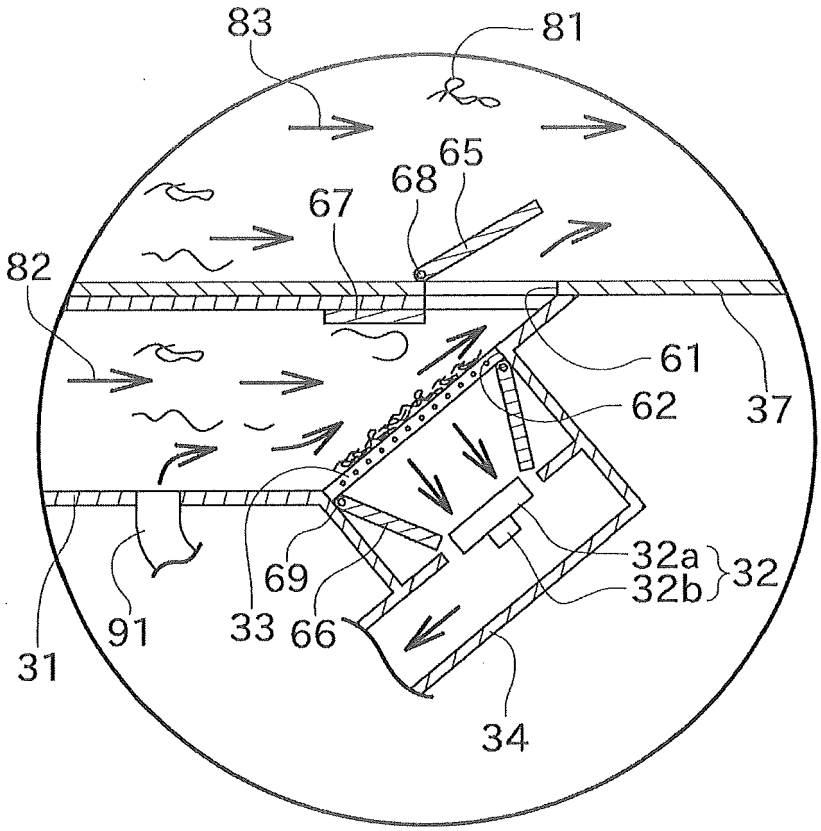


FIG.7

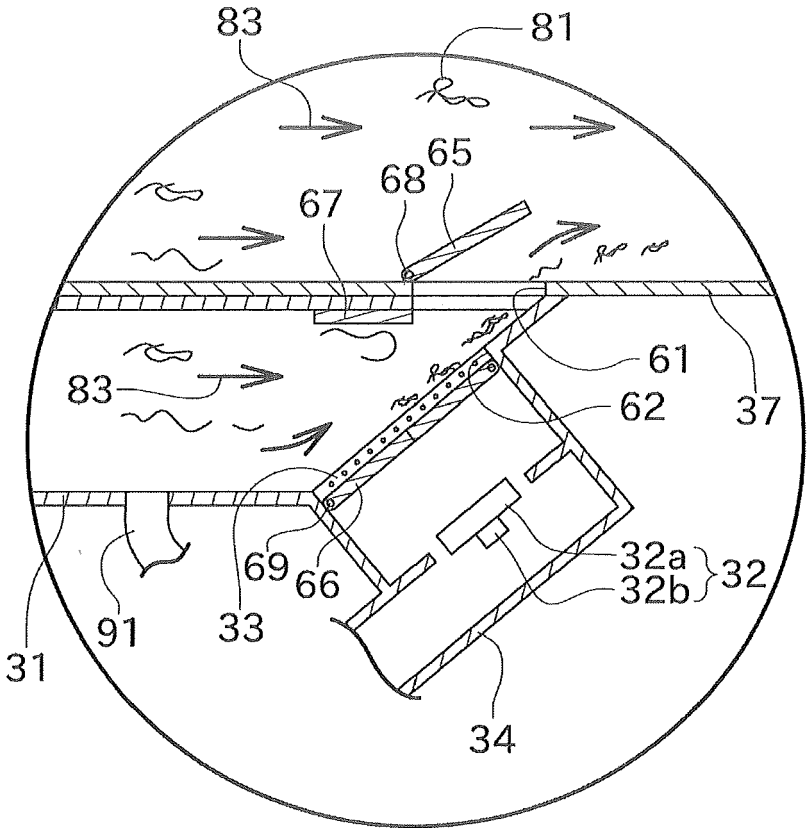
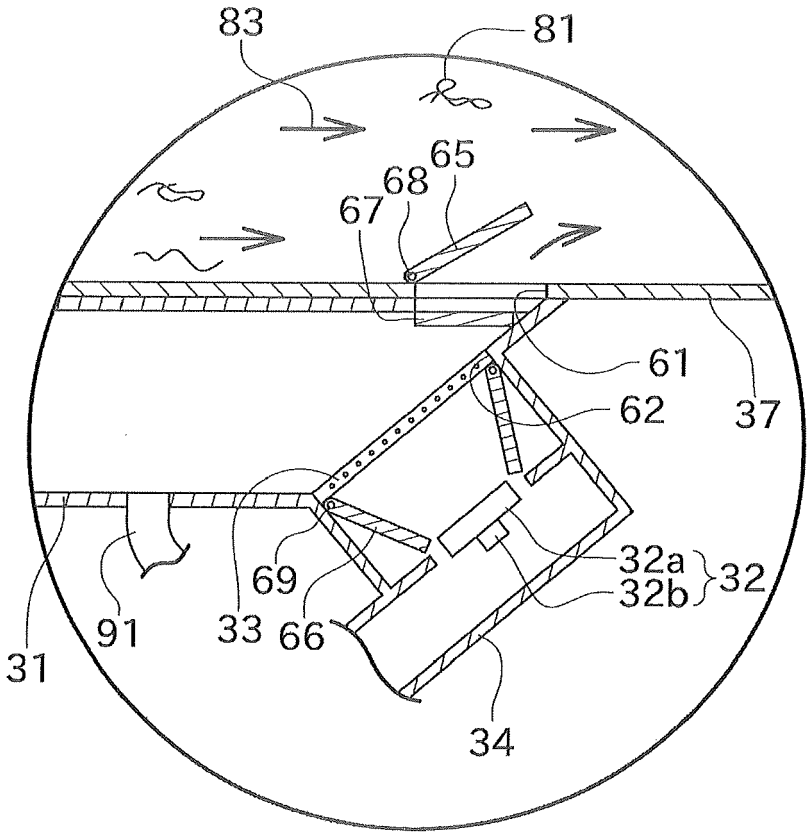


FIG.8



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EUROPEAN SEARCH REPORT

Application Number
EP 16 18 7506

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
Y	EP 2 657 381 A1 (MURATA MACHINERY LTD [JP]) 30 October 2013 (2013-10-30) * paragraphs [0041], [0056] - [0061], [0082] - [0085]; figures * & JP 2012 132112 A (MURATA MACHINERY LTD) 12 July 2012 (2012-07-12) * figures *	1,9,12, 13	INV. B65H54/70 D01H11/00
Y	EP 2 322 458 A1 (SAVIO MACCHINE TESSILI SPA [IT]) 18 May 2011 (2011-05-18) * paragraphs [0024], [0036] - [0038] *	1,9,12, 13	
X,D A	JP S61 26381 A (HITACHI LTD; HITACHI ELECTRONICS) 5 February 1986 (1986-02-05) * figures *	1-4,6,7, 12,13 5,8-11	
A	EP 1 488 841 A1 (RIETER CZ AS [CZ]) 22 December 2004 (2004-12-22) * the whole document *	1-13	
A	US 3 762 143 A (STEWART R) 2 October 1973 (1973-10-02) * column 3, lines 38-60; figures *	1-13	TECHNICAL FIELDS SEARCHED (IPC) B65H D01H
A	EP 2 543 757 A2 (MURATA MACHINERY LTD [JP]) 9 January 2013 (2013-01-09) * paragraphs [0002], [0006], [0052], [0064] - [0068], [0074] - [0076], [0080]; figures *	1-13	
A	EP 2 626 453 A1 (MURATA MACHINERY LTD [JP]) 14 August 2013 (2013-08-14) * paragraph [0043]; figures *	1-13	
A	US 4 353 721 A (MOLLSTAETTER WALTER) 12 October 1982 (1982-10-12) * column 3, lines 54-67; figures *	1-13	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	25 January 2017	Lemmen, René

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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D : document cited in the application
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